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The Relation Among Sleep, Routines, and Behavior in Children With an Autism Spectrum Disorder

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THE RELATION AMONG SLEEP, ROUTINES, AND BEHAVIOR IN CHILDREN WITH AN AUTISM SPECTRUM DISORDER

by

Jill Angelique Henderson

A Dissertation
Submitted to the Graduate Studies Office
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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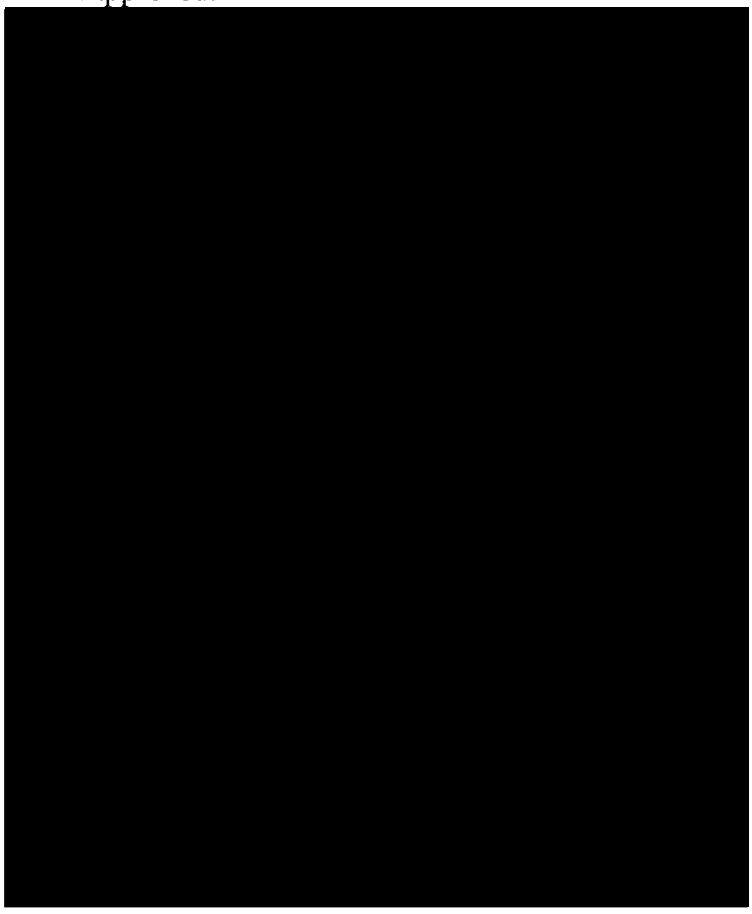

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ABSTRACT

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Children with an ASD have a propensity for routines and reportedly have a greater incidence of sleep disturbance and externalizing behaviors than typical children. In addition, significant relations have been identified among routines, sleep behavior, and externalizing behavior in a community sample of children, suggesting that a lack of routines may be related to sleep disturbance and externalizing behaviors. However, to date, no known studies have thoroughly examined the relation between these variables in children with an ASD. The primary purpose of the present investigation was to examine relations among routines, sleep, and behavior in children with an ASD. Primary caregivers of 58 children with an ASD and 57 non-ASD children ages 6 – 12 participated in the study (ASD $M = 9.0$, $SD = 2.09$; Non-ASD $M = 8.25$, $SD = 1.98$). Most participants were recruited and completed the surveys on-line. Several significant relations were found, including correlations between bedtime routines and general routines, sleep hygiene, and sleep quality; general routines and sleep hygiene; and all pairings of sleep hygiene, sleep quality, and externalizing behavior. Other predicted relations were not supported. Diagnostic status significantly moderated the relation between general routines and externalizing behavior, but not between bedtime routines and either sleep quality or externalizing behavior. These results support relations between the variables of interest and indicate a need for additional research to further clarify the

exact nature of the relations. Further research may be most pertinent within children with ASD who experience less consistent routines and children with ASD who exhibit sleep disturbance. In addition, the observed relation between bedtime routines and sleep behavior indicates implementation of consistent bedtime routines may be an appropriate intervention strategy for children with an ASD who experience sleep disturbance.

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CHAPTER I

INTRODUCTION

Children with an autism spectrum disorder (ASD), including Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), often display a preference for routines (APA, 2000) and benefit from a structured environment (Hendriks, 1998). Based on the apparent preference for consistency, routines may be advantageous for children with an ASD, possibly relating to daily behaviors. Specifically, lack of routines may be related to sleep disturbance (Richdale, 2001) and externalizing behavior problems (Bradley, Summers, Wood, & Bryson, 2004), both of which are more frequent and severe in children with an ASD than in typically developing children.

Bedtime routines are related to sleep in both a community sample of children (Henderson & Jordan, 2008) and children with an ASD (Patzold, Richdale, & Tonge, 1998), though comprehensive relations have not been examined in children with an ASD. This may be due to a lack of methods to evaluate bedtime routines. Prior to the recent development of the Bedtime Routines Questionnaire (BRQ; Henderson & Jordan), a parent report, paper-and-pencil measure of bedtime routines, evaluation of use of a bedtime routine frequently consisted of a single question on a questionnaire (e.g., Williams, Sears, & Allard, 2004a). A single question does not allow for assessment of different components of a bedtime routine or consistency of using each component of the bedtime routine. Previous known studies have not examined the relation between consistency of a bedtime routine and sleep in a large number of children with an ASD; the present study explores these relations. Furthermore, general routines are related to

externalizing behavior in children (Henderson & Jordan, 2008; Jordan, 2003; Sytsma, Kelley, & Wymer, 2001), though no known studies have examined this relation in children with an ASD. Given the preference for routines exhibited in children with an ASD (APA, 2000), as well as the greater frequency and severity of disruptive behavior possibly displayed by children with an ASD than by typical children (Bradley et al., 2004), the relation between general routines and externalizing behavior in children with an ASD is in need of exploration.

The present study is the first known study to examine the relations between routines and externalizing problems associated with ASDs, as well as to determine if the relation between routines and externalizing problems varies between children with an ASD and non-ASD children. Specifically, the relation between bedtime routines and both sleep behavior and externalizing behavior, as well as between general routines and externalizing behavior, were examined in a sample of children diagnosed with an ASD. In addition, diagnostic group status (ASD or non-ASD) was examined as a moderator in the relation between routines and sleep and routines and externalizing behavior.

Routines

Recently, Fiese et al. (2002) reviewed 32 publications from the previous 50 years on family routines. The authors found various definitions for routines, as well as inconsistencies in assessment methods, making comparison of study results difficult. In recent years, there has been an effort to remedy these flaws. Several parent-report, paper-and-pencil assessment tools have been developed to measure routines in children and families, including the Family Routines Inventory (Boyce, Jensen, James, & Peacock, 1983), the Child Routines Questionnaire (CRQ; Sytsma et al., 2001), and the Child

Routines Questionnaire-Preschool (CRQ-P; Murphy, 2005). Routines are defined as "observable, repetitive behaviors which directly involve the child and at least one adult acting in an interactive or supervisory role, and which occur with predictable regularity in the daily or weekly life of the child" (p. 243, Sytsma et al.). Furthermore, "routines may occur at a regular time, in the presence of a regular adult, in a regular place, in a regular sequence, or a combination of these" (p. 243).

Routines and ASD

Children with an ASD have "apparently inflexible adherence to specific, nonfunctional routines or rituals" (p. 75, APA, 2000) and function best when in a structured environment (Hendriks, 1998). Relations have been identified between repetitive behaviors and clinical features of autism. However, some results are contradictory. For example, one study reported individuals with autism and a low intellectual level have been found more likely to insist on sameness than individuals with autism and an average intellectual level (Bartak & Rutter, 1976). However, a similar study reported individuals with autism and a higher intellectual level were more likely to exhibit insistence on sameness than individuals with autism and a lower intellectual level (Turner, 1999). Based on the contradictory findings, a definitive relation is not known between routines and intelligence in children with an ASD, indicating routines should be studied among children with an ASD at all intellectual levels.

Routines are important to study in children with an ASD not only because these children exhibit a preference for and benefit from a structured environment, but also because routines may relate to problems that are not definitive of an ASD but that are often associated with the disorder. For example, sleep disturbance is correlated with

severity of restrictive, repetitive, and stereotyped behaviors in individuals with an ASD based on parental report of 55 children with an ASD, aged 5 to 12 years, using the Behavior Evaluation of Disorders of Sleep (BEDS) and the Gilliam Autism Rating Scale (GARS; Schreck, Mulick, & Smith, 2004). Parent report of 14 children, with a mean age of 10 years, 7 months and diagnosed with PDD-NOS, yielded similar results (Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005). Specifically, higher levels of restrictive, repetitive, and stereotyped behavior on the Repetitive Behavior Scales-Revised were significantly related to the Hyperactivity subscale of the Aberrant Behavior Checklist after controlling for related factors. Thus, ritualistic behavior is related to both sleep disturbance and overactive behavior in children with an ASD. Although these studies examined symptoms of an ASD that tap into these individuals' often inflexible preference for frequently nonfunctional routines, such findings suggest it may be important to further understand the intricate connection between routines and related behavioral outcomes in children with an ASD.

Due to the apparent preference for routines by individuals with an ASD, routines are an obvious choice for treatment, and they have been found beneficial for typically developing children (e.g., Drabman & Creedon, 1979; Drabman & Rosenbaum, 1980; Wurtele & Drabman, 1984) in addition to children with an ASD, including facilitating communication (Kashinath, Woods, & Goldstein, 2006). However, a preliminary step of thoroughly examining the relation between routines and behaviors viewed as problematic in children with an ASD has yet to be executed. Such preliminary studies would be beneficial to not only increase our knowledge of these relations in children with an ASD but also to further shape treatment studies.

Resistance to changes in routine has been established among children with certain developmental disorders (APA, 2000). However, no known studies have examined the response to change in a routine in children with an ASD; the response is likely maladaptive as children with an ASD have difficulty with irregular routines, such as holiday activities (Larson, 2006). Reactivity to change in a routine may be related to poor behavioral outcomes and interfere with the potential benefit of participating in a routine. Research indicates routines are not always beneficial, as coercion has been found in routines used by parents of children with developmental disabilities, including autism. Specifically, evaluation of parent-child interactions during unsuccessful home routines using observation of videotapes revealed coercion, including escape-driven or attention seeking behavior (Lucyshyn et al., 2004). In addition, using transcription of interviews with nine mothers of children with an ASD, Larson found nonfunctional ritualistic and repetitive behavior may interfere with participation in regular family routines. Interference with participation in regular family routines also may be viewed as frustrating by parents (Larson). Based on these findings, some routines may not be beneficial to children with an ASD. Specifically, routines comprised of primarily maladaptive activities may be of limited benefit, and routines of children with an ASD have been described as including "unusual" behaviors (Patzold et al., 1998). Therefore, it is important to examine the activities comprising the routines of children with an ASD. Likewise, sleep is another important behavior in need of study within children with an ASD, given that these children often experience higher rates of sleep disturbance (e.g., Allik, Larsson, & Smedje, 2006).

Sleep Hygiene and Sleep Quality

In understanding the higher rates of sleep disturbance found among children with an ASD compared to typical children (Richdale, 2001), an important starting point is to examine sleep hygiene and sleep quality. Sleep hygiene has been defined as a number of behavioral practices that can influence sleep initiation and maintenance, such as presence of a bedtime routine, caffeine consumption, daytime naps, and sleep environment (Durand, 1998). Bedtime routines have been identified as one of the eight domains of sleep hygiene. Sleep quality can be defined as a subjective feeling of good or poor sleep, or the ability to fall asleep and maintain sleep. Sleep quality has been measured in five areas: going to bed, falling asleep, night waking, returning to sleep, and waking in the morning (LeBourgeois, 2003). Measures of sleep hygiene, such as the Children's Sleep Hygiene Scale (CSHS; Harsh, Easley, & LeBourgeois, 2002) and sleep quality, such as the Children's Sleep-Wake Scale (CSWS; LeBourgeois & Harsh, 2006) have been developed to measure these constructs in children via parent report. Research has supported a positive correlation between sleep hygiene and sleep quality using questionnaires (Brown, Bulboltz, & Soper, 2002; Henderson & Jordan, 2008).

Studies examining other factors that may relate to sleep behaviors have further broadened our understanding of these constructs. For example, several relations have been supported between routines, sleep behaviors, and externalizing behavior. Henderson and Jordan (2008) evaluated the relation between general routines using either the CRQ or the CRQ-P, bedtime routines using the BRQ, sleep hygiene using the CSHS, sleep quality using the CSWS, and externalizing behavior using a composite from the BASC-2. Measures were completed by 226 caregivers of children ages 2 to 8 years. A significant

positive relation was supported between both bedtime and general routines and both sleep hygiene and quality. A significant negative relation was also supported between both sleep hygiene and quality and externalizing behavior. In addition, Sadeh, Gruber, and Raviv (2002) found sleep quality measured by actigraphy related to externalizing behavior as reported on the Child Behavior Checklist (CBCL) in a sample of 135 unreferred children in second, fourth, and sixth grades. Though these relations have been demonstrated in a community sample of children, they have yet to be explored in children with an ASD. In fact, few studies have examined sleep hygiene or sleep quality in children with an ASD even though these children suffer from higher rates of sleep problems.

ASD and Sleep Disturbance

Parents report sleep disturbance is more prevalent in children with an ASD than typically developing children (Allik et al., 2006; Couturier, Speechley, Steele, Norman, Stringer, & Nicolson, 2005; Hoffman, Sweeney, Gilliam, & Lopez-Wagner, 2006; Malow et al., 2006; Malow & McGrew, 2006; Paavonen et al., 2008; Richdale, 1999; Wiggs & Stores, 2004; Williams, Sears, & Allard, 2004b). Children with an ASD also report higher rates of sleep disturbance than typically developing children using self-report measures (Paavonen et al.). However, objective measures of sleep result in less consistent findings, with children with an ASD displaying a greater prevalence of sleep disturbance (Wiggs & Stores), no difference in prevalence of sleep disturbance (Allik et al.), and mixed findings (Malow et al.) compared to a control sample. Children with developmental disorders are known to have high rates of sleep problems, with reported rates of up to 80% (Piazza, Fisher, & Kahng, 1996), and, among developmental

disorders, children with an ASD reportedly have the highest rates of sleep disturbance (Cotton & Richdale, 2006; Richdale, 2001; Wiggs & Stores, 1996), with estimates ranging from 44% to 83% (Richdale, 1999).

Sleep disturbance among children with an ASD reportedly occurs at a similarly high rate at all IQ levels (Patzold et al., 1998; Richdale, 2001; Williams et al., 2004b), though discrepancies are found between studies. For example, Williams and colleagues (2004a) indicated night waking is more commonly reported on a parent-completed survey in children with autism with comorbid mental retardation, and Gabriels and colleagues (2005) found individuals with autism and a low nonverbal IQ experienced significantly more sleep disturbance than individuals with a high nonverbal IQ. However, sleep disturbance is reportedly more prevalent in children with an ASD than in IQ matched control groups (Bradley et al., 2004; Couturier et al., 2005; Patzold et al.; Paavonen et al., 2008; Richdale & Prior, 1995), suggesting mental retardation alone does not account for sleep disturbance.

Although mental retardation may not explain significant variance in sleep disturbance, research suggests that severity of ASD symptoms is related. In fact, findings show that reduced sleep quantity and poorer sleep quality in children are associated with more severe symptoms of ASD. For example, Schreck and colleagues (2004) found fewer hours of sleep each night to be related to overall autism scores on the GARS, including poorer social skills. Similarly, Hoffman and colleagues (2005) reported a significant relation between sleep disturbance using the Children's Sleep Habits Questionnaire (CSHQ) and frequency of stereotyped behavior, difficulty with social interaction, and overall autism score on the GARS in a sample of 80 children ages 4 to 15 years.

Moreover, Malow and colleagues (2006) found ASD poor sleepers compared to ASD good sleepers displayed greater affective problems as measured by the CBCL and more difficulty with reciprocal social interactions as measured by the ADOS.

Sleep disturbance (Horn & Dollinger, 1995) and sleep duration (Mindell & Owens, 2003) are typically reported as decreasing with age in children. Similarly, based on questionnaires of 167 parents of children with an ASD, younger age is related to sleep problems in children with an ASD (Liu, Hubbard, Fabes, & Adam, 2006). However, these relations may not apply to children with an ASD as contrary results have been found. Specifically, Schreck and Mulick (2000) reported no significant relation between age and sleep quality or sleep quantity in children with an ASD based on parent report using the BEDS and the GARS in a sample of 55 children ages 5 to 12 years. Thus, children with an ASD may have sleep problems that not only differ in severity from typical children but that also may follow a different developmental trajectory.

Sleep disturbance in children with an ASD typically includes problems with onset and maintenance of sleep (Cotton & Richdale, 2006; Patzold et al., 1998; Richdale, 1999). Though high rates of sleep disturbance are reported in children with an ASD, most studies employ questionnaires and sleep diaries completed by parents rather than physiological measures, such as actigraphy and polysomnography. Actigraphy is a method of monitoring sleep onset and offset using a device attached to the wrist or arm of a participant. The actigraph is worn for a period of time, such as 72 hours, to monitor sleep or wake times. Polysomnography involves attaching recording electrodes to the participant. The electrodes are attached to a recording device, which charts spindles

associated with sleep. The participant is only attached to the electrodes during set times, such as at night when in bed.

One study utilizing physiological measures compared eight children, ages 4 to 12 years, with an ASD diagnosis and parental report of sleep disturbance to eight non-ASD children, matched for age and sex, with parental report of no sleep disturbance. Using actigraphy, no significant differences were found between children with an ASD and non-ASD children other than an earlier waking time in children with an ASD (Hering, Epstein, Elroy, Iancu, & Zelnik, 1999). However, night waking and earlier waking time were the only differences reported by parents. Though parents of non-ASD children reported no night wakings, actigraphy revealed night waking in both groups of children. This indicates that parents of children with an ASD may be more aware of sleep disturbance than parents of non-ASD children. However, Hering and colleagues proposed the discrepancy between parental report and actigraphy may be due to parental oversensitivity to sleep disturbances of children with an ASD, rather than lack of sensitivity by parents of non-ASD children.

A similar study examined sleep patterns in 69 children ages 5 to 16 years with an ASD using both parental report and actigraphy (Wiggs & Stores, 2004). Results indicated that children with an ASD displayed more frequent disturbed sleep than control values. Specific differences include increased sleep onset latency, lower sleep efficiency, and greater time awake during the night. However, Allik and colleagues (2006) found no significant differences between 32 high-functioning children ages 8 to 12 years with an ASD and 32 controls in sleep duration when using actigraphy. Parent report within this study indicated that children with an ASD exhibited increased sleep onset latency. Allik

and colleagues attributed this to an earlier bed time in the ASD sample; however, another possibility includes greater sleep onset latency requiring an earlier bedtime to allow for similar duration of sleep.

Tani and colleagues (2005) used actigraphy to compare sleep in 19 young adults with Asperger syndrome with self-reported insomnia to a control sample of 10 young adults who denied sleep disturbance. Actigraphy revealed no differences in sleep quality. The authors indicated over-reporting of sleep disturbance by adults with Asperger syndrome may be accounted for by higher levels of reported anxiety or by greater sensitivity to sleep disturbance by this group. The report that the differences in self-report possibly related to greater sensitivity to sleep disturbance is noteworthy in that it indicates that the difference in report may be due to greater accuracy of individuals with an ASD as opposed to the control sample.

Polimeni, Richdale, and Francis (2005) found similar results using parent questionnaires. On a single question inquiring about the presence of sleep disturbance, parents of 105 children with an ASD reported higher rates of sleep disturbance compared to parents of 66 typically developing children. However, this discrepancy was not supported among other items on the questionnaire, as no significant differences were found in reported severity or type of sleep disturbance between groups. Conversely, Honomichl, Goodlin-Jones, Burnham, Gaylor, and Anders (2002) reported all 100 participating parents of children ages 2 to 11 years with an ASD reported longer sleep latency and more frequent and longer night wakings as reported on the CSHQ than typical children of similar ages based on previous research, though only 54% of the parents of children with an ASD reported sleep disturbance. Similarly, Honomichl and

colleagues reported "delayed or atypical sleep onsets and late bedtimes" among a group of children with an ASD (p. 115, Honomichl, Goodlin-Jones, Burnham, Hansen, & Anders, 2002).

Additionally, controversial findings pertaining to sleep in individuals with an ASD have been documented using polysomnography. Specifically, significantly shorter sleep periods, total sleep time, and time in bed were found in 17 children ages 5 to 16 years with an ASD compared to age- and gender-matched controls using polysomnography (Elia et al., 2000). Similarly, differences were demonstrated in sleep behaviors in 16 adults with an ASD who reported no sleep disturbance compared to 16 controls when using EEG recordings, including increased sleep onset latency, more frequent night-wakings, and lower sleep efficiency (Limoges, Mottron, Bolduc, Berthiaume, & Godbout, 2005). Conversely, no significant differences between total sleep time and sleep efficiency in eight individuals ages 7 to 53 years with as ASD and gender- and age-matched controls were reported using polysomnography (Godbout, Bergeron, Limoges, Stip, & Mottron, 2000). In a similar study, no significant differences were observed between 20 young adults with Asperger's Disorder with subjective reports of sleep disturbance and 10 demographically-matched controls with subjective reports of no sleep disturbance when using polysomnography and spectral power analysis of sleep (Tani et al., 2004). Tani and colleagues proposed that a greater level of anxiety reported in the adults with Asperger's Disorder compared to the control group resulted in a subjectively lower sleep quality not detected by the polysomnography. In addition, Malow and colleagues (2006) reported 11 poor sleepers with an ASD displayed increased sleep onset latency and decreased sleep efficiency on the first night of polysomnography

when compared to both 10 good sleepers with an ASD and 10 controls. However, no differences in sleep were found during the second night of recording. Good and poor sleepers were determined by parental report; all children were ages 4 to 10 years. Only two nights of sleep were recorded, precluding long-term findings.

Overall, though sleep disturbance is prevalent among individuals with an ASD when assessed using parent- or self-report questionnaires, results are more controversial when examining sleep using quantitative measures, such as actigraphy or polysomnography. It has been proposed that the discrepancies in parental report and physiological sleep disturbance may be a result of greater sensitivity to sleep disturbance in children with an ASD than in typical children in that sleep disturbance may be under-reported by parents of typical children as opposed to over-reported by parents of children with an ASD (Hering et al., 1999). Similar theories have been offered regarding adults with an ASD (Tani et al., 2005). In addition, higher rates of self-report of sleep disturbance among individuals with an ASD than typical adults may be a result of poorer sleep quality rather than differences in sleep quantity (Tani et al., 2004).

Though physiological measures of sleep may be beneficial to studying actual differences, such methods are timely and cost prohibitive. However, the use of a single question to inquire about sleep quality may be one reason that so many findings have been discrepant, as parents of children with an ASD have reported a higher frequency of sleep disturbance on a single question, though significant differences were not found on items comparing severity or type of sleep differences in children with and ASD and typical children (Polimeni et al., 2005). In addition, physiological measures are more difficult to use in children with an ASD than in typical children, as many children with an

ASD do not tolerate contact of experimental devices (e.g., Christodulu & Durand, 2004; Hering et al., 1999). Parent-report using questionnaires allows for a larger number of participants. Although parent-report may measure perceived behavior rather than actual behavior, perceived behavior may be of greater importance in determining related family and parental stress than actual behavior. For example, children with an ASD may not wake more frequently during the night, but these children may exhibit behaviors while awake that result in greater disruption of sleep for others in the home (Hering et al.). Therefore, it is important to examine differences in perceived sleep quality and other variables in children with an ASD using detailed parental questionnaires, such as in the present study, as well as to examine behaviors surrounding sleep, such as bedtime routines.

Bedtime Routines

Bedtime routines are "a set of observable, repetitive behaviors which directly involve the child and at least one adult acting in an interactive or supervisory role in a consistent environment, and which occur with predictable regularity in the time prior to bed each night" (p.3, Henderson & Jordan, 2008). Advantages of bedtime routines have been demonstrated to include prevention of long crying periods, reduction in frequency of bedtime struggles, and decreased levels of parental anxiety; disadvantages have been identified as the time commitment involved (Adams & Rickert, 1989) and that the use of gradual approaches may take weeks or months to note any change in behavior (Howlin, 1984; Rodlier & Houton, 1984). Another difficulty is that definitions of bedtime routines vary, reducing consistency across studies.

Bedtime routines are frequently reported by parents, such as one study using a single item on a questionnaire which indicated 90.2% of the children with an intellectual disability ($N = 52$, ages 1 to 19 years) and 80% of the typical children ($N = 25$, ages 2 to 17 years) participated in a bedtime routine, though bedtime routines were not defined (Richdale, Francis, Gavidia-Payne, & Cotton, 2000). In addition, one study examined bedtime routines in 31 children ages 3 to 12 years with an ASD and 36 gender, age, and IQ group-matched children using a sleep diary for two weeks and parent-report questionnaires (Patzold et al., 1998). Presence of a bedtime routine was identified in a similar percentage of children with an ASD (84.2%) and children in the control group (91.4%) as reported by parents. However, bedtime routines were not defined and presence of a bedtime routine was determined by a single question.

Patzold and colleagues (1998) found differences associated with ASD in the activities comprising bedtime routines based on completion of the sleep diary inquiring about activities performed before bed each night. For example, children with an ASD reportedly followed more "unusual" bedtime routines, including activities such as positioning blinds and curtains in a certain way. Failure to follow the bedtime routine resulted in a decrease in sleep quality in children with an ASD, though children in the control group were not reported to experience similar problems after not adhering to the bedtime routine. Though the study by Patzold and colleagues provides valuable information regarding the relation between bedtime routines and sleep quality in children with an ASD, limitations include the use of a single question to determine the presence of a routine and failure to define a bedtime routine. In addition, sleep quality was measured using a sleep diary; the validity of sleep diaries is controversial with many studies

supporting their validity and others finding discrepancies between sleep diaries and objective measures (Mindell, 1999).

The relation of bedtime routines and sleep in children with ASD is complicated by the unclear picture of routines and sleep within typical samples. For example, though bedtime routines are often cited as inversely related to sleep onset latency, a longitudinal study examining sleep and bedtime behavior using semistructured interviews with 109 parents of typically developing children ages 3 months to 5 years reported older children exhibited a significantly longer bedtime routine on average and experienced greater delays in falling asleep compared to younger children (Beltramini & Hertzig, 1983). This indicates increased length of a bedtime routine may not be beneficial, though the increase in sleep onset latency may be attributed to age rather than length of bedtime routine.

Based on the high rate of sleep disturbance, including prolonged sleep onset latency and tantrums at bedtime, and the preference for routines in children with an ASD, the relation between bedtime routines and sleep behaviors should be examined in this population. Much of the research evaluating bedtime routines and sleep involves intervention studies; though the present study did not attempt to examine the effect of implementing a bedtime routine, the intervention literature is helpful in building our understanding of the relations between these constructs. In addition, intervention studies involving manipulation of a routine can help clarify the possible effect of routines on sleep. Therefore, a review of intervention studies follows.

Bedtime Routines as Treatment

Researchers have examined a number of treatments for bedtime problems in children with developmental disorders, including children with an ASD. Recent reviews

of treatment techniques for childhood sleep disturbance have focused on several approaches, and bedtime routines have emerged as a promising intervention (Kuhn & Weidinger, 2000; Mindell, 1999; Owens, Palermo, & Rosen, 2002). In addition, bedtime routines have been evaluated as a method of decreasing problem behaviors before bed, such as tantrums, decreasing sleep onset latency, and decreasing night wakings (Adams & Rickert, 1989; Christophersen & Mortweet, 2003; Edwards & Christophersen, 1994; Horn & Dollinger, 1995; Kuhn & Weidinger, 2000; Milan, Mitchell, Berger, & Pierson, 1981; Mindell, 1999; Owens et al., 2002; Sanders, Bor, & Dadds, 1984; Seymour, 1987). Though medication is the most prevalent form of treatment of sleep disturbance in children with an ASD, behavioral interventions are viewed as more helpful by parents (Richdale, 1999), and parents report not liking medications as a treatment for sleep disturbance (Bramble, 1996).

Schreck (2001) reviewed four behavioral treatments for sleep disturbance in children with an ASD: bedtime routines, extinction, stimulus fading, and faded bedtimes. Of the reviewed treatments, extinction was the only treatment with enough studies to provide support as a possibly efficacious technique. However, Kuhn and Weidinger (2000) and Owens and colleagues (2002) indicated extinction, though effective, may be difficult to implement due to low parental acceptance. Extinction consists of "the parent putting the child to bed and ignoring the tantrum" (Adams & Rickert, 1989, p. 756). Bedtime routines may be more acceptable to parents and are frequently recommended. For example, Malow (2004) recommends parent education of sleep hygiene, such as "a regular and consistent bedtime [and] a structured bedtime routine" (p.124) for treatment of sleep disturbance in children with an ASD.

Though bedtime routines have often been included as a component of a treatment package, no studies have examined bedtime routines as an individual treatment for sleep disturbance in children with an ASD (Schreck, 2001). In typical children, positive routines were classified as a promising intervention for decreasing frequency of bedtime tantrums and sleep onset latency (Mindell, 1999; Owens et al., 2002). During a positive routine, children follow a set, quiet routine prior to bed, and parents praise the child after each step in the routine (Adams & Rickert, 1989). Positive routines have also been successful in treatment of bedtime tantrum behavior in children with mental retardation and a history of seizure activity (Milan et al., 1981), and in children with developmental disabilities, including an ASD, and severe sleep problems when used in combination with sleep restriction (Christodulu & Durand, 2004). Specifically, Christodulu and Durand found positive routines and sleep restriction resulted in improved sleep quality using actigraphy and parental report of improved behavior at bedtime in a sample of four children ages 2 to 5. Sleep restriction involved reducing the time spent in bed each night to 90% of the time spent sleeping at the onset of treatment.

Within typical children, Kuhn and Weidinger (2000), Mindell (1999), and Owens and colleagues (2002) noted that little research has been conducted with routines as the sole intervention. Routines are frequently combined with other treatments, such as delayed bedtime in which the child is put to bed later than the child's regular bedtime. Kuhn and Weidinger (2000) suggested positive bedtime routines function as a differential reinforcement procedure in which children are taught appropriate behaviors preceding bedtime and sleep onset skills. Though lacking empirical support as an individual intervention, review papers suggest that routines, often in conjunction with other

methods, are effective in treating sleep disturbance in children (Kuhn & Weidinger, 2000; Mindell, 1999; Owens et al., 2002). Furthermore, research evaluating use of bedtime routines in conjunction with other methods in children with an ASD provides additional support (e.g., Weiskop, Richdale, & Matthews, 2005). According to Mindell, additional well-controlled research with more participants is needed for all treatment techniques to determine efficacy.

Methods of evaluation of bedtime routines differ greatly across studies making comparisons difficult. To date, bedtime routines have been assessed in most studies by asking a single question on a survey, using semistructured interview or observational methods, or using parental sleep diaries. A single question is not able to adequately encompass all areas of a bedtime routine, such as consistency of different aspects of the routine (e.g., location, time, activities), and the other methods are time intensive. In addition, the validity of sleep diaries is controversial with many studies supporting their validity, yet others finding discrepancies between sleep diaries and objective measures (Mindell, 1999). Furthermore, sleep diaries are individually devised for use in each study, which presents problems that reduce the reliability and validity of sleep diaries. Many studies have consisted of few participants, maybe in part due to costly and time intensive observational methods. With limited participants, many studies of bedtime routines are unable to include control groups or group comparisons. From the research examining bedtime routines as an intervention, routines alone or in combination with other interventions have been found to decrease frequency of bedtime tantrums and sleep onset latency, and improve sleep quality, suggesting the need for further research evaluating the relation between bedtime routines and sleep disturbance.

Use of a parent-report measure that is more detailed than previous studies have employed is needed to provide more data than a single question. Though parent report of sleep disturbance may not be equivalent in children with an ASD compared to typical children, the differences may reflect actual differences in behavior, such as disruptive behavior while awake. Therefore, parent report of sleep disturbance is crucial to understanding the effect of perceived sleep disturbance on other behaviors. Use of a recently developed paper-and-pencil measure of bedtime routines (Henderson & Jordan, 2008) allows for quickly assessing bedtime routines in a large number of children with an ASD. More efficient measurement with a reliable and valid measure of bedtime routines helped to address some of the shortcomings of previous research in this area. Using this new measure, the present study, which sought to establish the relation of bedtime routines with sleep and behavioral outcomes among children with an ASD, is an important first step toward this goal.

ASD and Behavior Problems

In addition to sleep disturbance (Hoffman, Sweeney, Gilliam, & Lopez-Wagner, 2006; Malow & McGrew, 2006; Richdale, 1999), other behaviors that are not diagnostic symptoms of ASDs are often associated with ASDs, such as aggression and tantrums (Bradley et al., 2004). Furthermore, overactive behavior is correlated with severity of repetitive behaviors in individuals with an ASD (Gabriels et al., 2005), indicating the relation between routines and behavior may be of interest. Differences have been observed in rates of behavior problems in children with an ASD compared to children without an ASD, though reports are somewhat controversial. In a comparison of 12 individuals with an ASD with IQs below 40 and 12 individuals without an ASD matched

for age, gender, and nonverbal IQ, individuals with an ASD were found to have a greater incidence of comorbidity with psychiatric and behavior disorders reported using the Diagnostic Assessment for Severely Handicapped-II (Bradley et al.). Comorbidities included anxiety, mania, depression, sleep disorders, and organic syndromes. However, a significant difference was not found between groups in number of individuals who performed self-injurious behavior. In contrast to the overall findings by Bradley and colleagues, severity of behavior problems displayed by children with and without an ASD has been found to be similar in a sample of 46 children with an ASD (mean age = 12.15) using the Teacher Report version of the Developmental Behavior Checklist (Hastings & Brown, 2002). Scores were similar between the collected sample and group norms of children with mental retardation.

The purpose for disruptive behavior in children with an ASD compared to children without an ASD individually matched for chronological and developmental age and sex also has been examined using functional behavioral assessment interviews with parents of 46 children ages 2 to 5 years (Reese, Richman, Belmont, & Morse, 2005). Disruptive behavior in control children and girls with an ASD was typically used to gain attention, obtain items, or escape demands, though disruptive behavior in boys with an ASD typically revolved around behaviors or desires consistent with an ASD, such as to escape demands that interfered with repetitive behavior, to retain access to an item used in repetitive behavior, or to avoid aversive sensory stimuli. The authors indicated sex differences could be a result of girls having better social and language skills than boys and, therefore, being more sensitive to social reinforcers. As externalizing behavior may be more common in children with an ASD, it is important to explore the relation between

externalizing behavior and other factors, such as routines and sleep disturbance, which are both also reportedly more frequent in children with an ASD.

Sleep and Behavior. Although the primary focus of the present study was to examine different types of routines (general and bedtime) as they relate to both sleep and externalizing behavior in children with an ASD, it is also important to note that several studies have examined sleep itself as it relates to externalizing behavior among children and adolescents. The preponderance of evidence suggests that disordered sleep reportedly affects behavioral functioning (Malow & McGrew, 2006). One study reported that improved sleep patterns following treatment of 28 children ages 1 to 3 years with serious sleep problems resulted in a decrease in externalizing behavior problems (Minde, Faucon, & Falkner, 1994). Sleep was measured using a parent-completed sleep diary, a semistructured clinician interview, and videotapes of the child's sleep, and externalizing behavior was measured using the CBCL. The relation between sleep and behavior has also been examined in preschool children (Lavigne, Arend, Rosenbaum, & Smith, 1999). Parental report of amount of sleep at night was significantly inversely related to scores of externalizing behavior problems scale on the CBCL for 510 children.

Teacher report of behavior of 141 children ages 4 and 5 years have also been compared to parent report of nighttime sleep behavior, recorded in sleep logs created for the study (Bates, Viken, Alexander, Beyers, & Stockton, 2002). Amount of nighttime sleep recorded via parental sleep diaries had a negative relation to child behavior problems measured using the Preschool Behavior Questionnaire. Furthermore, disrupted sleep schedules were inversely related to positive preschool adjustment and positively related to negative preschool adjustment measured with the Preschool Adjustment

Questionnaire. The relation between sleep quality and behavior problems was examined by Sadeh and colleagues (2002) as described previously. Significant differences on the CBCL were revealed between groups of poor and good sleepers, with poor sleepers scoring higher on the CBCL delinquent behavior scale, thought disorder scale, and total behavior problem score. Similarly, parent report on the Sleep Behavior Questionnaire of sleep problems, such as difficulty falling asleep and frequent waking, were associated with both internalizing and externalizing behavior on the CBCL in a sample of 472 children ages 4 to 12 years (Stein, Mendelsohn, Obermeyer, Amromin, & Benca, 2001). Self-reported sleep pattern preferences were examined in 6,631 adolescents using the School Sleep Habits Survey, and researchers found adolescents with a later preferred sleep onset time to report greater daytime sleepiness and attention difficulties, poor school achievement, more frequent injuries, and more upset emotions (Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002). These findings suggest that sleep pattern preferences may provide a link between amount of sleep obtained during school nights and behavior exhibited during school days, such as behavior resulting in poor school achievement.

Finally, behavior problems have been related to sleep in children with intellectual disabilities (Richdale et al., 2000). Parents of 52 children with an intellectual disability, aged 2 to 19 years, and 25 typical children, aged 2 to 17 years, participated in the study. Children with sleep problems reported on a novel questionnaire created for the study had a higher number of behavior problems on average reported on the Developmental Behavior Checklist than children without sleep problems in both groups of children, though the difference between those with sleep problems and those without was significant only in the group of children with an intellectual disability, indicating that

intellectual disability moderated the relation between sleep and behavior. Wiggs and Stores (1996) surveyed 209 parents of children ages 5 to 16 years with mental retardation about sleep and behavior using a modified version of the Simonds and Parraga sleep questionnaire and the Aberrant Behavior Checklist. The researchers found children with sleep problems experienced more behavior problems. Similarly, greater number of sleep problems was correlated with more frequent and severe challenging behavior, or behavior involving injury to self or others, damage to property, or social disruption.

Overall, research supports a significant inverse relation between sleep and externalizing behavior in typically developing children and adolescents and in children with intellectual disabilities (Bates et al., 2002; Giannotti et al., 2002; Lavigne et al., 1999; Minde et al., 1994; Richdale et al., 2000; Sadeh et al., 2002; Stein et al., 2001; Wiggs & Stores, 1996), though this relation has yet to be examined in children with an ASD as in the present study. Specifically, amount of sleep, as well as absence of sleep problems, is inversely related to externalizing behavior using parent-report questionnaires, problem behavior, adjustment, and school performance. Such findings underscore the tremendous importance of examining sleep and possible influences on sleep, such as bedtime routines. In particular, research examining behaviors such as sleep and externalizing behavior is needed in populations that are at risk for experiencing difficulties in these areas, such as children with an ASD. The present study aims to address this gap in the literature.

Though no known studies have examined the relation between externalizing behavior and sleep in children with an ASD, Malow and colleagues (2006) examined the relation between sleep and syndrome scales of anxious/depressed, somatic complaints,

attention problems, and aggressive behavior, on the Child Behavior Checklist, as well as the Diagnostic and Statistical Manual scale of affective problems on the Child Behavior Checklist. Most germane to the present study, aggressive behavior did not differ significantly among the groups. However, the correlation between aggressive behavior and sleep latency during the first night of recording was significant. As only the first night of polysomnograph recordings was found to differ significantly between groups, correlations presented during this night are most apt to detecting differences between groups based on sleep patterns.

Routines and Behavior

The literature reviewed thus far suggests that bedtime routines and sleep both relate to child externalizing behavior; however, the study of these relations among children with an ASD is lacking much-needed attention. There is also a strong literature base that indicates general routines relate to externalizing behaviors in children. Again, however, this relation had not been fully explored in children with an ASD. As such, it is important to examine studies of typical children to guide theory and predictions of how these factors relate in children with an ASD. As with bedtime routines and sleep disturbance, the intervention literature examining changes in routines as treatment for behavior problems helped to clarify the relation between routines and child behavior. Indeed, several studies have examined the role of routines as a form of treatment of behavior problems. Specifically, implementation of routines has decreased inappropriate mealtime behavior (Dadds, Sanders, & Bor, 1984), morning dawdling (Drabman & Creedon, 1979; Drabman & Rosenbaum, 1980), and time required for preschool children to clean a play area (Wurtele & Drabman, 1984). Possible benefits of routines include

more pleasant and rewarding time together for parents and children and a decrease in time required getting the child to cooperate. Benefits are reported to last through adolescence. Woods and Goldstein (2003) reported that routines are a useful framework for providing a learning opportunity for children. However, routines are probably most beneficial if implemented moderately. For example, a highly structured environment with strict routines may be related to lower adaptability (Boyce et al., 1977).

Parenting experts have claimed that routines reduce resistance that often arises during transitions between activities (Eisenberg, Murkoff, & Hathaway, 1996), as well as decrease hassles between a parent and child (Nelson, Erwin, & Duffy, 1998) and promote self-control in children (Pruitt, 1998). Thus, frequent child routines may be related to aspects of daily life, such as low levels of child behavior problems. Sytsma and colleagues (2001) proposed a behavioral theory that consistent routines may act as a setting event for child compliance: "predictable occurrence of 'routine' activities may increase the probability of compliance with subsequent instructions" (Sytsma et al., 2001, p. 242). According to this theory, antecedent factors, such as location, caregiver, and sequence of activities, are important in that each component in the sequence serves as a discriminative stimulus for the next component in a behavioral chain, promoting compliance. Presumably, the more consistent each of these aspects is, the more adaptive the routine.

Recent studies have generated support for this theory by demonstrating an inverse relation between child routines and child behavior problems (Henderson & Jordan, 2008; Jordan, 2003; Sytsma et al., 2001). However, this relation may not generalize to all types of routines. For example, a relation between bedtime routines and behavior problems

among a community sample of children has not been supported in previous research (Henderson & Jordan). Furthermore, the relation between routines and child behavior may not be found in all populations of children. For example, no prior known studies have examined this relation in children with an ASD. The present study fills this gap in the literature.

Summary and Study

Children with an ASD have a propensity for routines based on diagnostic criteria, and reportedly experience sleep disturbance and behavior problems at a greater frequency than typical children. Thus, the present study examined how routines relate to these negative outcomes in children with an ASD. Though relations between these variables have been identified in typical children, this is the first known study to thoroughly address these issues in children with an ASD. Specifically, relations among general routines, bedtime routines, sleep hygiene, sleep quality, and externalizing behavior using structured measures assessing various components of each variable had yet to be examined in children with an ASD. Furthermore, diagnostic status (ASD or non-ASD) was examined as a possible moderator between bedtime routines and sleep quality, as well as between both bedtime and general routines and externalizing behavior.

In contrast to the benefits expected to result from routines, some factors associated with specific routines may be detrimental, such as inflexibility and maladaptive activities. A highly structured environment with strict routines may be related to lower adaptability, and resistance to changes in routine among children with certain developmental disorders is prevalent. Despite these findings, reactivity to changes in routine had yet to be evaluated in children with an ASD. Due to the high rates of sleep

problems and the established relation between the presence of bedtime routines and better sleep quality, reactivity to changes in bedtime routine was in need of evaluation in children with an ASD. In addition, routines of children with autism are known to include maladaptive activities and presence of maladaptive activities within a bedtime routine may suppress the potential benefits of routines. Therefore, the relation between maladaptive activities and both sleep quality and externalizing behavior was examined, as no known studies had examined these relations in children with an ASD. The recent development of the BRQ, which examines these components of a bedtime routine, assisted in the examination of these variables.

The present study is an important step in defining the relations between bedtime and general routines and other sleep and behavioral outcomes within a sample of children with an ASD. Based on previous studies, routines, sleep, and externalizing behavior are pertinent aspects to study in children with an ASD. Patzold and colleagues (1998) found these variables to be related in children with an ASD employing the use of a single item to examine bedtime routines and sleep diaries to examine sleep quality. In addition, previous studies have found similar results using structured, comprehensive questionnaires in non-ASD children. It was important to attempt to replicate these findings in children with an ASD using structured measures that include comprehensive questions. Discovery of relations could result in qualitative improvements in the lives of children with an ASD and their families by guiding intervention studies and informing clinicians about areas of behavior to address in children with an ASD.

The primary purpose of the present investigation was to examine relations among general routines, bedtime routines, sleep hygiene, sleep quality, and behavior problems in

children with an ASD. A second purpose was to determine if diagnostic status (ASD or non-ASD) moderates the relations between these variables. A third purpose was to examine other factors relative to bedtime routines, such as reactivity to changes in routine, and how they relate to sleep quality and externalizing behavior in children with an ASD.

Hypotheses

It was expected that relations between the measured constructs in children with an ASD would be similar to relations previously found in a community sample of children. First, bedtime routines and general routines were expected to be positively related in a sample of children with an ASD, as were all possible pairings of sleep hygiene, sleep quality, and externalizing behavior. Second, it was expected that routines would relate to theoretically relevant outcomes. Specifically, bedtime routines were expected to be positively related to sleep hygiene and sleep quality, and both bedtime routines and general routines were expected to be inversely related to externalizing behaviors. Third, sleep quality was expected to at least partially mediate the relation between bedtime routines and externalizing behavior in children with an ASD. Fourth, diagnostic status (ASD or non-ASD) was expected to moderate the relation between bedtime routines and sleep quality, bedtime routines and externalizing behaviors, and general routines and externalizing behaviors. Specifically, the relations between routines and outcomes were expected to be stronger among children with an ASD than among non-ASD children. Fifth, reactivity to changes in the bedtime routine and presence of maladaptive activities comprising the bedtime routine were expected to inversely relate to sleep quality and positively relate to externalizing behavior in children with an ASD.

CHAPTER II

METHOD

Participants

Based on the results of analyses performed with a community sample evidencing a correlation, $r = .36$ between bedtime routines and sleep quality and between general routines and externalizing behavior, a medium effect size ($.36^2$), $f^2 = .13$, was estimated for the proposed study, as children with an ASD are theoretically expected to exhibit an even stronger relation between these variables. Power was calculated using a statistical power analysis computer program (Faul, Erdfelder, Lang, & Buchner, 2007), with a medium effect size, $f^2 = .13$, $\alpha = .05$, and a maximum of two predictors for the mediational model (control variables were not counted since this number was unknown and may have been zero); it was determined that $N = 55$ participants would be necessary to obtain power = .80. Thus, 58 primary caregivers of children with an ASD participated in the study. A sample of 57 parents of children without an ASD was collected for procedures requiring a comparison, resulting in a total sample size of 115 (see Table 1 for demographic characteristics). Based on power analysis performed with a predicted medium effect size (.15), $\alpha = .05$, and 3 predictors, 119 participants were needed to assess for moderation. The measures used in the study overlap between the ages of 6 and 8 in the child's age used for validation of the measure. However, the age range was expanded to include ages 9 to 12 as there is no theoretical reason not to use the measures that do not extend this far for these ages. Therefore, children were between 6 and 12 years of age at the time parents completed the measures (ASD $M = 9.0$, $SD = 2.09$; Non-ASD $M = 8.25$, $SD = 1.98$; Total Sample $M = 8.63$, $SD = 2.06$). All caregivers were over the age of 18 at

Table 1

Demographic Characteristics

Sample Characteristics Descriptors	ASD *n* (%)	Non-ASD *n* (%)	Total Sample *N* (%)	Group differences
Caregiver Gender				
Female	56 (96.6%)	51 (89.5%)	107 (93.0%)	*ns*
Male	2 (3.4%)	6 (10.5%)	8 (7.0%)	
Child Gender				
Female	8 (13.8%)	27 (47.4%)	80 (69.6%)	$p < .001$
Male	50 (86.2%)	30 (52.6%)	35 (30.4%)	
Child Race				
White	51 (87.9%)	44 (77.2%)	95 (82.6%)	*ns*
Black	3 (5.2%)	10 (17.5%)	13 (11.3%)	
Hispanic	2 (3.4%)	0 (0%)	2 (1.7%)	
Asian	0 (0%)	0 (0%)	0 (0%)	
Other	2 (3.4%)	3 (5.3%)	5 (4.3%)	
SES				
High	24 (41.4%)	24 (42.1%)	48 (41.7%)	*ns*
Medium	13 (22.4%)	15 (26.3%)	28 (24.3%)	
Low	21 (36.2%)	17 (29.8%)	38 (33.0%)	
ASD Classification				
Autistic Disorder	22 (38%)			
Asperger's Disorder	19 (33%)			
PDD-NOS	17 (29%)			

Note. Group differences = Differences between groups; SES = socioeconomic status (mean family income / number of people in the home).

the time of participation. The child was currently living in the home with the family. In the event that two or more siblings were diagnosed with an ASD, the parent was asked to complete the measures on only one child. A diagnosis of an ASD was identified through parent report via the demographic form and confirmed using a cutoff score on a measure of autistic symptom severity. ASD participants were recruited through autism clinics, support groups, and organizations involving children with an ASD, and non-ASD participants were recruited through a database of participants who participated in previous research, as well as through research assistants or the experimenter. Data were collected from parents only, and children did not directly participate in the project.

Measures

Demographic Form

A demographic form was used to gather descriptive information about the participant and target child, as well as information about typical bedtime and wake time of the target child. The demographic form asked about the child's age, gender, race, diagnosis of an ASD, and school placement. It also asked about the primary caregiver's gender, age, race, marital status, educational background, occupation, and household income (see Appendix A).

Children's Social Behavior Questionnaire

The Children's Social Behavior Questionnaire (CSBQ; Hartman, Luteijn, Serra, & Minderaa, 2006) is a 49-item parent-report measure of autistic symptom severity for use with children ages 3 to 18. In the present study, the CSBQ was used to verify the independent diagnosis of an ASD as reported in the demographic form. The measure was refined using 3,407 participants and includes six subscales: behavior/emotions not

optimally tuned to the social situation/aggressive behavior; reduced contact and social interest/withdrawn; difficulties in understanding social information; orientation problems in time, place, or activity; stereotyped behavior; and fear of and resistance to changes. The internal consistency of the total score (.94), inter-rater reliability (.86), and test-retest reliability (.90) were good, as were convergent and divergent validity. Though no known studies evaluated a cutoff total score as a measure of diagnostically categorizing children, clinical groups displayed higher total score averages than nonclinical controls, including children with an ASD. Specifically, children with an ASD, such as those with a diagnosis of high functioning autism, PDD-NOS, combined diagnosis of Attention-Deficit/Hyperactivity Disorder and PDD-NOS, and mental retardation and PDD, received mean scores ranging from 33.64 to 47.22 (SD = 14.51 – 15.94), while nonclinical children received a mean score of 10.28 (SD = 9.05). Thus, any participant in the ASD group receiving a total score below 20 was eliminated as a participant in the study; all participants collected in the ASD group met criteria and were retained. Coefficient alpha in the total present sample was .98.

Child Routines Questionnaire

The CRQ (Sytsma et al., 2001; Jordan, 2003) is a parent-report measure of frequency of typical routines of elementary school-aged children. The tool is a 39-item questionnaire that assesses routines in four domains: daily living routines, household responsibilities, discipline routines, and homework routines. All items are scored on a five-point Likert scale measuring frequency ranging from "never" to "nearly always." The CRQ has been standardized on typical children between the ages of 5 and 12 and has demonstrated adequate psychometric properties, with excellent internal consistency, α =

.90, and good test-retest reliability, $r = .86$. Interrater reliability across parents has been measured at .66. There is evidence of construct validity. (Sytsma et al.; Sytsma-Jordan, Kelley, & Henderson, 2002; Jordan). Coefficient alpha in the total present sample was .92.

Bedtime Routines Questionnaire

The Bedtime Routines Questionnaire (BRQ; Henderson & Jordan, 2008; see Appendix B) consists of 46 items specific to consistency of weekly bedtime routines at the residence of the respondent, as well as other theoretically relevant aspects of bedtime routines, including frequency of adaptive and maladaptive activities, consistency of weekend routines, having a second permanent residence, and reactivity to changes in the routine. All items are scored on a five-point Likert scale. Reactivity is measured ranging from 1 "Not at all" to 5 "Extremely," whereas other items are measured ranging from 1 "Almost never" to 5 "Nearly always." The Total Consistency scale will be used in all analyses examining the consistency of bedtime routines, the Reactivity scale of the BRQ will be used to evaluate reactivity to changes in the bedtime routine, and the Activities scale will be used to evaluate adaptive and maladaptive activities comprising the routine. The BRQ was developed using a community sample of children (ages 2 – 8) and has demonstrated a solid factor structure, good internal consistency, and fair validity coefficients. The mean of items comprising Consistency ranged from 3.12 to 4.53 with standard deviations between .87 and 1.23. A moderate positive relation exists between BRQ Consistency and measures of general routines ($r = .30$ to $.53$, $p < .01$). The BRQ demonstrated fair temporal stability when examined between seven and 21 days ($n = 20$), with a reliability coefficient of .72. In the total present sample, coefficient alpha of the

Total Consistency scale was .85, the Reactivity scale was .91, the Adaptive Activities scale was .75, and the Maladaptive Activities scale was .51.

Children's Sleep Hygiene Scale

The Children's Sleep Hygiene Scale (CSHS; Harsh et al., 2002) consists of 25 items measuring activities surrounding sleep used with children ages 2 to 8 years. The measure is completed by caregivers. All items are scored on a six-point Likert scale measuring frequency ranging from "never" to "always." There are items in eight domains: physiological activation, cognitive activation, emotional activation, environment, bedtime routine, sleep schedule activity, daytime sleep, and bed sharing. The total scale displays adequate internal consistency, with coefficient alpha of .76. Item-total correlations ranged from .23 to .49 (Harsh et al.). For the purposes of the proposed study, the total scale was calculated excluding the bedtime routine domain when the relation between sleep hygiene and bedtime routines as measured by the BRQ was examined. For analyses not involving the BRQ, the overall total scale for the CSHS was used. Coefficient alpha in the total present sample was .72; the value did not improve above .73 with deletion of any items.

Children's Sleep-Wake Scale

The Children's Sleep-Wake Scale (CSWS; LeBourgeois, 2003; LeBourgeois, & Harsh, 2006) consists of 42 items measuring sleep quality in children between the ages of 2 and 8 years. Items are organized into the categories of going to bed, falling asleep, arousing and awakening, returning to sleep, and waking in the morning. All items are scored on a six-point Likert scale measuring frequency ranging from "never" to "always." Initial studies indicate adequate to excellent psychometric properties of content

validity, internal consistency, and test-retest reliability, as well as good construct validity (LeBourgeois, Hancock, & Harsh, 2001; LeBourgeios & Harsh). Coefficient alpha in the total present sample was .95.

Child Behavior Checklist

The Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) is a parent-report broadband measure of child psychopathology commonly used in clinical research. The measure consists of 118 items for children between the ages of 6 and 18 years and provides normative scores in broad areas: Internalizing, Externalizing, and Total Problems. All items are scored on a three-point Likert scale ranging from "not true" to "very true or often true." The Externalizing Problems composite score was used in the analyses pertaining to externalizing behavior and is based on the composition of two subscales: Aggressive Behavior and Rule-Breaking Behavior. The CBCL is designed to yield normative *T*-scores, with a mean of 50 and a standard deviation of 10. *T*-scores of $\geq$ 70 ($\geq 98^{th}$ percentile) are in the clinical range, scores between 65 and 70 ($93^{rd} - 97^{th}$ percentile) are in the borderline clinical range, and $\leq$65 ($\leq 93^{rd}$ percentile) are in the normal range. The average *T*-scores for the Externalizing Composite Scale of referred children are $T = 68.5$, $SD = 9.7$ for boys ages 6 to 11; $T = 65.6$ $SD = 9.9$ for boys ages 12 to 18; $T = 65.7$, $SD = 11.6$ for girls ages 6 to 11; and $T = 64.6$, $SD = 10.3$ for girls ages 12 to 18 (Achenbach & Rescorla). The CBCL has been used to accurately classify individuals with an ASD Disorder into the correct diagnostic group compared to children with other psychiatric disorders and typically developing children (Duarte, Bordin, de Oliveira, & Bird, 2003).

Psychometric properties of the Externalizing Problems composite of the CBCL include good internal consistency with a coefficient alpha from a general norm sample of .94; test-retest reliability with a correlation of .92 over a 1-week interval within a general norm sample (Achenbach & Rescorla, 2001); and construct validity with correlations with other measures of externalizing behavior including a .85 to .88 correlation with the Externalizing Problems scale of the Behavior Assessment System for Children, Second Edition, Parent Rating Scale (BASC – 2, Reynolds & Kamphaus, 2004; Achenbach & Rescorla).

Procedure

This project was reviewed and approved by the University of Southern Mississippi Institutional Review board before recruitment of participants (see Appendix C). ASD participants were recruited using various methods such as e-mail over autism support group listservs and postings on ASD-related websites. Non-ASD participants were contacted through a database of participants who participated in previous research. Additional ASD participants as well as non-ASD participants were approached by research assistants or the experimenter and asked to participate. Research assistants were instructed to give a flyer containing information about the study, as well as contact information to contact the research team, to any interested caregiver with a child between the ages of six and twelve years. Furthermore, a snowball sampling technique was used, whereby participants who know of other families meeting criteria for the study referred those families to participate in the study. This further expanded the geographic coverage of the study. Participants were recruited from various geographic locations in the United States. The caregiver, if interested in participation, e-mailed or called a research assistant

to obtain access to the survey. A link to a secure, password-protected website was e-mailed to the participant or a paper-and-pencil packet was mailed to the participant's home based on participant preference. Both the secure website and the paper-and-pencil packet included a consent form, instructions, and a packet of questionnaires regarding their child (e.g., a demographic form, the BRQ, CRQ, CSHS, CSWS, CBCL, and CSBQ). Participation time was 45 minutes to one hour. As compensation for participation, five dollars was donated to an autism research foundation (independent of the research team conducting the proposed study) for each caregiver of a child with an ASD who completed the on-line or paper-and-pencil packet. Compensation was not offered for parents of non-ASD children who completed the packet of questionnaires.

Once the online surveys were completed, the researchers had access to the responses. When the paper-and pencil measures were returned *(n* = 2, 1.7%), they were entered into the database of on-line participants. Once the dataset was complete, it was downloaded and the identifying information (i.e., name, phone number, address) was separated from all other responses and kept in a separate file to ensure anonymity (see Table 2 for descriptive statistics of measures). Largely incomplete packets (failure to complete an entire measure; $n = 2$) were excluded.

Table 2

Descriptive Statistics for Measures

Sample Characteristics Descriptors	ASD *M* (*SD*) range	Non-ASD *M* (*SD*) range	T-test (comparing groups) *t*	Total Sample *M* (*SD*) range
BRQ Consistency	41.67 (6.36)	41.70 (7.02)	.02	41.69 (6.70)
	29 – 50	21 – 50		21 – 50
BRQ Reactivity	11.93 (5.90)	7.37 (3.23)	-5.14 ***	9.67 (5.27)
	5 – 25	5 – 20		5 – 25
CRQ Total	101.07 (18.84)	119.39 (15.57)	5.68 ***	110.14 (19.52)
	50 – 144	71 – 144		50 – 144
CSHS Total	4.94 (.40)	5.07 (.43)	1.76 †	5.00 (.42)
	4.12 – 5.88	3.96 – 5.96		3.96 – 5.96
CSWS Total	4.05 (.87)	4.69 (.58)	4.57 ***	4.37 (.80)
	1.56 – 5.51	2.69 – 5.59		1.56 – 5.59
CBCL Ex T	60.09 (9.96)	46.25 (9.89)	-7.48 ***	53.23 (12.08)
	41 – 81	33 – 73		33 – 81

Note. BRQ Consistency = Bedtime Routines Questionnaire Consistency; BRQ Reactivity = Bedtime Routines Questionnaire Reactivity; CRQ Total = Child Routines Questionnaire Total Score; CSHS Total = Children's Sleep Hygiene Scale Total Score; CSWS Total = Children's Sleep Wake Scale Total Score; CBCL Ex T = Children's Behavior Checklist Externalizing T-Score

† $p < .10$, *** $p < .001$

CHAPTER III

RESULTS

First, zero-order correlations were performed with demographic variables, including age, gender, race, SES, and parent reported level of cognitive functioning, to explore possible relations among demographic variables and the two main outcome variables, sleep quality and externalizing behavior. The correlations were performed twice, once analyzing the ASD data and once analyzing all of the data combined due to the need to explore relations in both samples. Within the combined samples, only one demographic variable, child's gender, was found to relate to one outcome variable, externalizing behavior (see Table 3). Therefore, child's gender was used as a control variable in subsequent analyses with this outcome when examining group differences. However, within the ASD sample alone, no demographic variables were found to relate to any outcome variables and, therefore, no control variables were used in analyses involving only the ASD sample (see Table 3).

Zero-order correlations were also performed between cognitive functioning as assessed by parent report (5-point scale ranging from "well below average" to "well above average") and all other variables (e.g. demographic variables, bedtime routines, sleep quality, etc.). Only general routines were significantly related to cognitive functioning ($r = .02, p < .001$). As general routines were not an outcome examined in any analyses, level of cognitive functioning was not used as a control variable. Furthermore, level of cognitive functioning was not used as a control variable in any analyses as it was not related to any outcome variables.

Table 3

Correlations among Outcome Variables and Demographic Variables

	Combined Group		ASD Group	
	CSWS	CBCL Ex T	CSWS	CBCL Ex T
Child Age	-.01	.00	.21	-.19
Child Gender	.09	-.25*	.09	-.13
Child Race	-.06	-.02	-.05	.05
SES	.07	-.17	.04	-.19
Cognitive	.07	-.14	-.22	.20

Note. CSWS = Children's Sleep Wake Scale Total Score; CBCL Ex T = Child Behavior Checklist Externalizing T-Score; SES = socioeconomic status (mean household income / number of people in the home); Cognitive = Level of cognitive functioning; Child Race dichotomized to include White and minority.
* $p < .01$

Previously identified relations predicted in the first two hypotheses among bedtime routines, as assessed by the BRQ; sleep quality, as assessed by the CSWS; sleep hygiene, as assessed by the CSHS; general routines, as assessed by the CRQ; and behavior problems, as assessed by the CBCL were examined in the present ASD sample using zero-order correlations. Correlations were considered significant at alpha less than .05. Correlations between sleep hygiene and all other variables were significant, as were correlations between bedtime routines and both general routines and sleep quality and between sleep quality and externalizing behavior (see Table 4).

Table 4

Correlations among Bedtime and Behavior Measures in ASD Group

	BRQ	CRQ	CSHS	CSWS
CRQ	.29*			
CSHS	.45[a]***	.51***		
CSWS	.32*	.08	.49***	
CBCL Ex T	.02	-.04	-.39**	-.45***

Note. BRQ = Bedtime Routines Questionnaire Consistency; CRQ = Child Routines Questionnaire Total Score; CSHS = Children's Sleep Hygiene Scale Total Score; CSWS = Children's Sleep Wake Scale Total Score; CBCL Ex T = Children's Behavior Checklist Externalizing T-Score

[a] CSHS total score used in this calculation did not include bedtime routine items

* $p < .05$, ** $p < .01$, *** $p < .001$

A One-Way Analysis of Variance (ANOVA) was performed to explore diagnostic differences within the ASD group (i.e. Autistic Disorder, Asperger's Disorder, PDD-NOS). Externalizing behavior was the only variable significantly related to ASD diagnosis. Correlation analyses within each ASD group between externalizing behavior and other measured variables revealed no additional significant relations.

The third hypothesis examining sleep quality as a mediator between bedtime routines and externalizing behavior in children with an ASD was not explored because bedtime routines were not significantly related to externalizing behaviors, $r = .02$, p = ns. Therefore, mediation criteria were not met (Baron & Kenny, 1986).

To test the fourth hypothesis, diagnostic status (ASD or non-ASD) was examined as a moderator of the relation between consistency of bedtime routines and sleep quality, consistency of bedtime routines and externalizing behaviors, and general routines and

externalizing behaviors. Specifically, the relations between routines and outcomes were expected to be stronger among children with an ASD than among non-ASD developing children. To examine diagnostic status as a moderator, independent variables were first centered by subtracting the group mean from each item prior to creating the interaction terms (Aiken & West, 1991) in order to reduce the multicollinearity between predictors and any interaction terms among them and to facilitate the testing of simple slopes (Holmbeck, 2002). Then a series of moderated multiple regression analyses were run separately for bedtime routines and sleep quality, bedtime routines and externalizing behavior, and general routines and externalizing behavior to examine whether associations between routines and the outcome variables were moderated by group (ASD vs. non-ASD).

Of the demographic variables previously evaluated, child's gender was the only potential confounding variable with externalizing behavior (see Table 3). In addition, child's gender was theoretically relevant in all analyses as there were significantly more males than females in the ASD sample (86%) but not in the non-ASD sample (53%). Therefore, child's gender was entered in the first step of each regression in order to control for any effects. In the first of these analyses, group status and consistency of bedtime routines were entered simultaneously in the second step. The interaction term was entered in the third step to determine if the interaction significantly increased the amount of variance explained in sleep quality. Similar regression analyses were used to examine the other predicted interactions on externalizing behaviors. The relation of the predictor variable (e.g., consistency of bedtime routines) with the criterion variable (e.g., sleep quality) was expected to change linearly with respect to the moderator variable

(group status). A moderator was indicated by a significant effect for the interaction term (e.g., group status X bedtime routines), while the main effects for bedtime routines and group status were controlled statistically.

All predictor variable main effects were significant. Specifically, within the model examining group status and consistency of bedtime routines as predictors of sleep quality, a significant main effect was found for both bedtime routines, $\beta = .36$, $t(110) = 4.49$, $p < .001$, and group status, $\beta = -.42$, $t(110) = -4.83$, $p < .001$, were significant predictors. However, the interaction between bedtime routines and group status was not significant, $\beta = .01$, $t(110) = .13$, $p =$ ns (see Table 5). Similarly, within the model examining group status and consistency of bedtime routines as predictors of externalizing behavior, a main effect was found for both bedtime routines, $\beta = -.13$, $t(110) = -1.68$, $p < .01$, and group status, $\beta = .56$, $t(110) = 6.76$, $p < .001$. However, the interaction between bedtime routines and group status was only marginally significant, $\beta = .18$, $t(110) = 1.75$, $p < .10$ (see Table 6). The marginally significant interaction was plotted to determine the nature of the relation of the variables (Baron & Kenny, 1986; Holmbeck, 2002; see Figure 1). Within the model examining group status and general routines as predictors of externalizing behavior, a main effect was found for both general routines, $\beta = -.18$, $t(110) = -2.03$, $p < .05$, and group status, $\beta = .47$, $t(110) = 5.10$, $p < .001$. Likewise, the interaction between group status and general routines in predicting externalizing behavior was significant, $\beta = .25$, $t(110) = 2.00$, $p < .05$ (see Table 7). Given that the significant interaction was maintained within a reduced model that included only the main effects and the interaction term, the interaction was plotted to determine the nature of the relation of the variables (Baron & Kenny, Holmbeck; see Figure 2). Results indicated that higher

consistency of general routines were related to lower externalizing behaviors among non-ASD children but not among children with an ASD, who had higher externalizing behavior problems overall, regardless of level of general routines.

Table 5

Group Status as a Potential Moderator between Bedtime Routine and Sleep Quality

Step and Predictor Variable	R^2	ΔR^2	β
Step 1 (Covariates)			
Child Gender	.01		.09
Step 2 (Main Effects)	.29***	.28***	
Child Gender			-.06
Consistency of Bedtime Routine			.36***
Group Status			-.42***
Step 3 (Interaction)	.29***	.00	
Child Gender			-.06
Consistency of Bedtime Routine			.35**
Group Status			-.42***
Consistency BR X Group Status			.01

** $p < .01$, *** $p < .001$.

Table 6

Group Status as a Potential Moderator between Bedtime Routine and Externalizing Behavior

Step and Predictor Variable	R^2	ΔR^2	β
Step 1 (Covariates)			
Child Gender	.06**		-.25**
Step 2 (Main Effects)	.35***	.29***	
Child Gender			-.05
Consistency of Bedtime Routine			-.13**
Group Status			.56***
Step 3 (Interaction)	.37***	.02†	
Child Gender			-.07
Consistency of Bedtime Routine			-.25*
Group Status			.55***
Consistency BR X Group Status			.18†

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

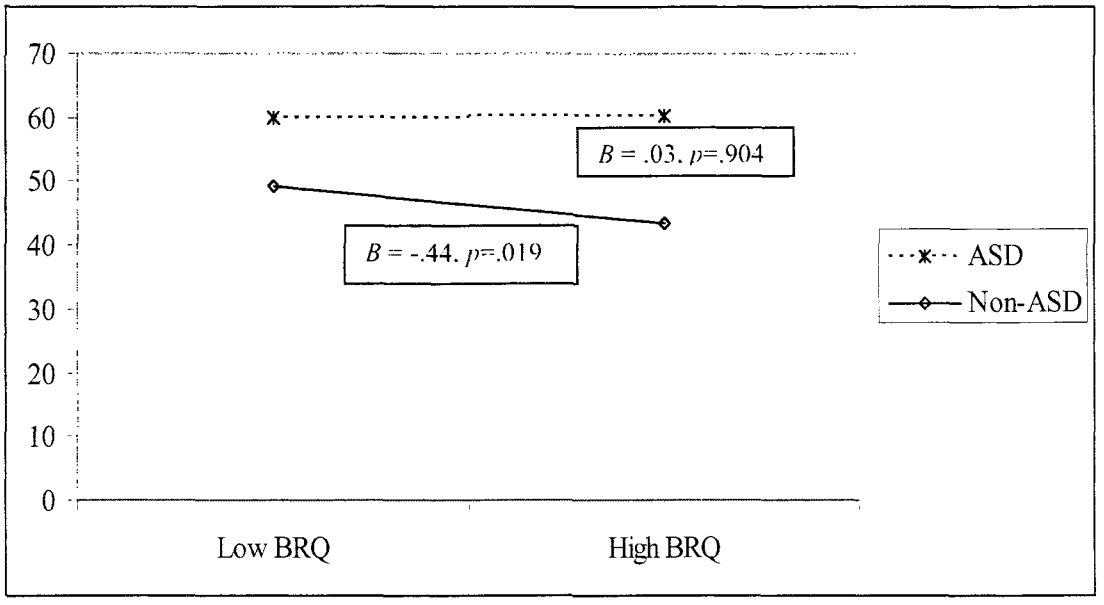

Figure 1. Interaction between Bedtime Routines and Diagnostic Status in Predicting Externalizing Behavior

(*Note*. Low BRQ = Low Consistency of Bedtime Routines as measured by the Bedtime Routines Questionnaire, High BRQ = High Consistency of Bedtime Routines as measured by the Bedtime Routines Questionnaire)

Table 7

Group Status as a Potential Moderator between General Routines and Externalizing Behavior

Step and Predictor Variable	R^2	ΔR^2	β
Step 1 (Covariates)			
Child Gender	.06**		-.25**
Step 2 (Main Effects)	.36***	.29***	
Child Gender			-.06
Consistency of General Routine			-.18*
Group Status			.47***
Step 3 (Interaction)	.38***	.02*	
Child Gender			-.08
Consistency of General Routine			-.39**
Group Status			.45***
Consistency GR X Group Status			.25*

* $p < .05$, ** $p < .01$, *** $p < .001$.

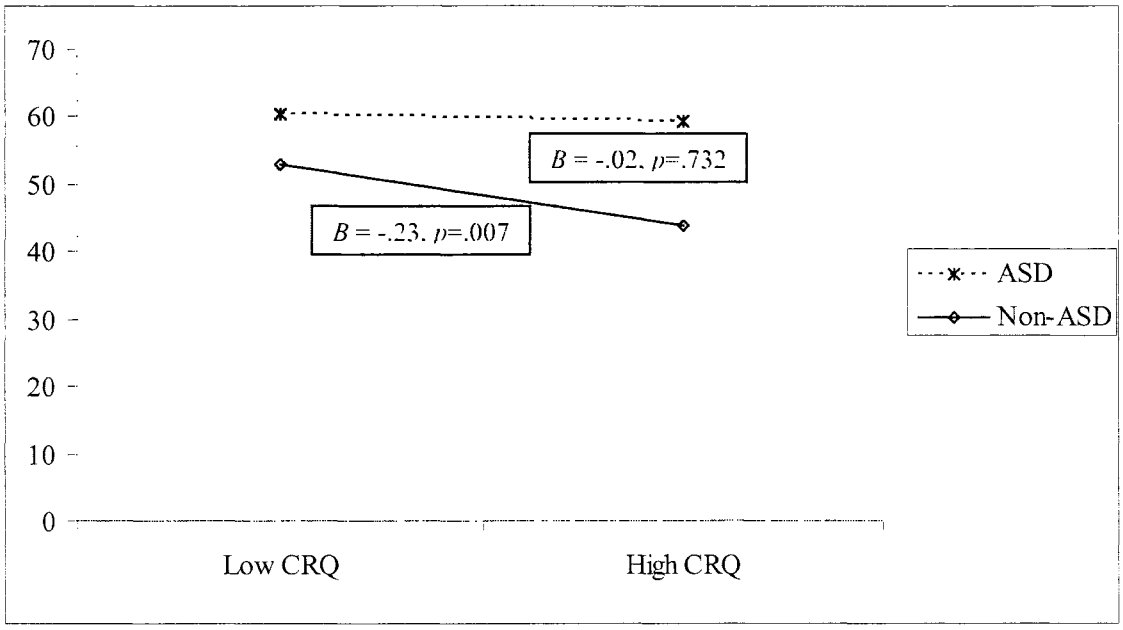

Figure 2. Interaction between General Routines and Diagnostic Status in Predicting Externalizing Behavior

(*Note.* Low CRQ = Low Consistency of General Routines as measured by the Child Routines Questionnaire, High CRQ = High Consistency of General Routines as measured by the Child Routines Questionnaire)

As delineated in the fifth hypothesis, the relation between reactivity to changes in the bedtime routine and presence of maladaptive activities comprising the bedtime routine with both sleep quality and externalizing behavior were examined in children with an ASD through zero-order correlations. Though three of the relations demonstrated a small effect size, none of these correlations were significant (see Table 8).

Table 8

Correlations among Aspects of Bedtime Routines and Behavior Measures in ASD Group

	CSWS	CBCL Ex T
BRQ Reactivity	-.16	.22
BRQ Maladaptive	-.05	.21

Note. BRQ Reactivity = Bedtime Routines Questionnaire Reactivity to Changes; BRQ Maladaptive = Bedtime Routines Questionnaire Maladaptive Activities; CSWS = Children's Sleep Wake Scale Total Score; CBCL Ex T = Children's Behavior Checklist Externalizing T-Score

CHAPTER IV

DISCUSSION

Literature indicates that children with an ASD display a preference for routines (APA, 2000) and benefit from a structured environment (Hendriks, 1998). Therefore, routines are likely beneficial to children with an ASD, possibly relating to daily behaviors that are more severe and frequent in children with an ASD than non-ASD children, such as sleep disturbance (Richdale, 2001) and externalizing behavior problems (Bradley et al., 2004). Furthermore, the severity of restrictive, repetitive, and stereotyped behaviors in individuals with an ASD has been shown to correlate with sleep disturbance (Schreck et al., 2004) and overactive behavior (Gabriels et al., 2005). However, comprehensive relations between routines and behavior have not previously been examined in children with an ASD. Thus, the aim of the present study was to examine previously unexplored relations among general routines, bedtime routines, sleep hygiene, sleep quality, and behavior problems in children with an ASD, as well as to determine if diagnostic status moderates the relations between certain variables. Other factors relative to bedtime routines and how they relate to sleep quality and externalizing behavior in children with an ASD were also examined.

As predicted in the first hypothesis, relations between the measured constructs are similar to relations previously found in a community sample. Specifically, a significant positive relation with a small effect size was found between bedtime routines and general routines. Furthermore, a significant positive relation with a medium effect size was found between all pairings of sleep hygiene, sleep quality, and externalizing behavior. In addition, as predicted in the second hypothesis, bedtime routines were positively related

to both sleep hygiene and sleep quality, with a medium effect size. However, contrary to prediction, neither bedtime routines nor general routines were inversely related to externalizing behaviors. The third hypothesis in which it was predicted that sleep quality would act as a mediator between bedtime routines and externalizing behavior in children with an ASD was not further examined as there was not a relation to be mediated (i.e., consistency of bedtime routines was not significantly related to externalizing behaviors). As predicted in the fourth hypothesis, diagnostic status was found to significantly moderate the relation between general routines and externalizing behavior; however, it was typical children, not children with an ASD, who benefited most from routines. Likewise, contrary to prediction, diagnostic status did not moderate the relation between bedtime routines and either sleep quality or externalizing behavior. The results examining the relation between reactivity to changes in the bedtime routine and the presence of maladaptive activities comprising the bedtime routine with both sleep quality and externalizing behavior did not support the fifth hypothesis, though a small effect size was displayed between reactivity and both sleep quality and externalizing behavior, as well as between maladaptive activities and externalizing behavior.

Integration of Findings with Previous Research

Relations of Variables in the ASD Group

Given the dearth of research involving ASD samples, thorough inspection of studies examining children in general is essential to guide theory and predictions of how these factors relate in children with an ASD. Bedtime routines are considered a subset of general routines and were positively correlated in a community sample of children (Henderson & Jordan, 2008). Similarly, sleep hygiene is considered a component of sleep

quality and these constructs are also positively related (Brown, Bulboltz, & Soper, 2002; Henderson & Jordan, 2008). Significant inverse relations have also previously been identified between behavior problems and sleep behaviors, including sleep hygiene, sleep quality, and quantity of sleep (Bates et al., 2002; Giannotti et al., 2002; Henderson & Jordan, 2008; Lavigne et al., 1999; Minde et al., 1994; Richdale et al., 2000; Sadeh et al., 2002; Stein et al., 2001; Wiggs & Stores, 1996), though this relation had not been examined in children with an ASD until the present study. Consistent with the literature on the general population and children with an intellectual disability, all aforementioned relations were replicated in the present ASD sample.

Prior research has found a significant association between the severity of restrictive, repetitive, and stereotyped behaviors and sleep disturbance in children with an ASD (Schreck et al., 2004). Furthermore, a relation between bedtime routines and both sleep hygiene and sleep quality has been established previously in a community sample of children (Henderson & Jordan, 2008), and a relation between bedtime routines and sleep quality has been previously established in children with an ASD (Patzold et al., 1998). However, the study by Patzold and colleagues employed the use of a single question to determine the presence of a bedtime routine. These results were replicated in the present ASD sample using a comprehensive measure of bedtime routines, further substantiating confidence in the findings. Though not initially predicted, results indicated that general routines and sleep quality were related in the present ASD sample. This follows from the literature supporting this relation in a community sample (Henderson & Jordan). The present findings support the presence of a relation between both bedtime and general routines and sleep behavior; this indicates there is a need to further evaluate

the use of routines as a treatment for sleep disturbance. Though causality cannot be determined due to the correlational nature of the present study, it is possible that presence of routines influence sleep quality in children with an ASD. Establishment of general routines has not been explored as a treatment for sleep disturbance, but may be beneficial. Similarly, bedtime routines have not been examined as a sole intervention of sleep disturbance in children with an ASD (Schreck, 2001), but may be beneficial as a target of intervention in this population.

Literature supports a relation between general routines and externalizing behavior in community samples of children (Henderson & Jordan, 2008; Jordan, 2003; Sytsma et al., 2001). Though no known studies have examined this relation in children with an ASD, this population displays a preference for routines (APA, 2000) and possibly exhibits a greater frequency and severity of disruptive behavior (Bradley et al., 2004), supporting the importance of research in this area. In addition, higher levels of restrictive, repetitive, and stereotyped behavior have been linked to undesirable behavior (Gabriels et al., 2005). Furthermore, intervention literature indicates that the implementation of routines decreases undesirable behavior in community samples (Drabman & Creedon, 1979; Drabman & Rosenbaum, 1980; Wurtele & Drabman, 1984) and increases desirable behavior (e.g., facilitated communication) in a sample of children with an ASD (Kashinath et al., 2006). In the present study, compared to a non-ASD sample, parents of children with an ASD reported significantly less consistent general routines and higher rates of externalizing behavior among their children (see Table 2). Despite the fact that the ASD sample had higher externalizing behaviors and less consistent routines, there was not a significant relation between routines and externalizing behaviors in the ASD

sample. Although there may be a methodological or sample-specific reason for not finding this relation, it may also be that these variables relate differently within this population.

Though previous literature fails to support a relation between bedtime routines and behavior problems in a community sample of children (Henderson & Jordan, 2008), a relation was expected in children with an ASD. Theoretically, consistency of all routines, including bedtime routines, is beneficial to children with an ASD beyond the benefits expected in a non-ASD sample, as literature indicates children with an ASD benefit from a structured environment (Hendricks, 1998) and display a preference for routines (APA, 2000). Examining a specific routine domain was intended to further the understanding of the relation between routines and behavior. Contrary to expectation, the findings of the present study failed to support a relation between bedtime routines and behavior problems, which is consistent with the lack of a significant relation between general routines and behavior problems within the present ASD sample. Given that the initial variable (bedtime routines) failed to correlate with the outcome (externalizing behaviors), there was no exploration of any mediating factors between bedtime routines and externalizing behavior. In addition to possibly too small of a sample size, the nonsignificant findings may be at least partially accounted for by the suggested lower adaptability to changes in routines in individuals with an ASD based on previous literature, in that even small variations from a routine may result in undesirable effects. This is supported by the maladaptive response exhibited by children with an ASD during irregular routines, including holiday activities (Larson, 2006). Furthermore, adverse reactions to changes in routines may compromise the potential benefits of routines. The

present study assessed the reaction to changes in bedtime routines; however, many children reportedly experienced highly consistent bedtime routines (66% reported consistency scores of ≥40/50 with 50 = most consistent) and, therefore, did not have the opportunity to react to changes in the routine. Consequently, evaluation of these research questions among a group of children with an ASD who experience less consistent bedtime routines is needed to aid in clarification of the nature of the relation between the variables. The highly consistent routines may be related to the recruitment method (i.e. parents with internet access who participate in support groups), which may have resulted in a biased sample (Mandell & Salzer, 2007). In addition, some children may not experience disturbance in these areas regardless of the routines, whereas children who experience such difficulties may benefit from the presence of consistent routines.

Diagnostic Status as a Moderator

Due to the many noted differences between children with and without an ASD, diagnostic status was expected to moderate the relation between variables, with stronger relations expected to result between routines and both sleep and externalizing behaviors in children with an ASD when compared to a non-ASD sample. Group status failed to moderate the relation between bedtime routines and both sleep quality and externalizing behavior. This may be partially due to being slightly underpowered, as the model had four predictors (as opposed to the anticipated three predictors), which required 129 participants, 14 more than collected. Though the relation was not significant, as demonstrated in Figure 1, the general trend suggests children in the non-ASD sample displayed lower levels of behavior problems when performing a consistent bedtime routine and children with an ASD exhibited high rates of behavior problems regardless of

consistency of routines As bedtime routines were highly consistent in both children with an ASD and the non-ASD sample, it may be of greater importance to examine this relation in children in both samples who experience sleep disturbance. This is an important next step to further understand the importance of bedtime routines on these outcomes. Conversely, group status significantly moderated the relation between general routines and externalizing behavior. However, the nature of the moderation was not as expected, with children in the non-ASD sample displaying lower levels of behavior problems when performing a consistent routine and children with an ASD exhibiting high rates of behavior problems regardless of consistency of routines. Specifically, children in the ASD sample demonstrated behavior problem rates one standard deviation above the standard normative mean and significantly higher than children in the present non-ASD sample. These findings indicate that routines do not serve as a protective factor among children with an ASD as they do among children without an ASD. The protective factor displayed by children in the non-ASD sample is consistent with previous findings (Henderson & Jordan, 2008; Jordan, 2003; Sytsma et al., 2001). In sum, lower levels of general routines were related to higher externalizing behavior problems but only the non-ASD group seemed to benefit from higher levels of general routines.

Reactivity to Change and Maladaptive Routines

The lack of strong support for the relations between reactivity to changes in the bedtime routine and sleep quality and externalizing behavior in the form of small effect sizes is not consistent with the literature indicating children with an ASD display resistance to changes in routine (APA, 2000) and have difficulty with irregular routines (Larson, 2006). However, 53.4% of the children with an ASD were reported to have a

score of 10 or less on the Reactivity scale (range 5 – 25 with 5 = no reactivity), indicating low levels of reactivity to change. This may be due to the high consistency of bedtime routines evidenced by children with an ASD, failing to allow for consideration of reactivity to inconsistent routines. The lack of significant findings may be attributed to the small sample size. An important next step is to measure reactivity to change in children with an ASD who experience inconsistent routines, as well as to examine these relations in a larger sample.

Contrary to expectations, maladaptive activities comprising the bedtime routine were not significantly related to either sleep quality or externalizing behavior, though the relation between maladaptive activities and externalizing behavior did evidence a small effect size. Routines of children with an ASD are reported to include "unusual" behaviors (Patzold et al., 1998), which may compromise the potential benefits of routines. However, the Maladaptive Activities scale of the BRQ may not have captured the "unusual" behaviors exhibited by children with an ASD. In addition, the lack of significant findings may be attributed to the small sample size. Further research is required to determine how these "unusual" behaviors as a component of a routine are related to subsequent behavior, and these relations should be explored in a larger sample.

Limitations and Directions for Future Research

There were several major limitations to this study that should be noted. The first major limitation was reliance on a single informant and format (e.g., parent-report) for data collection. Use of a single informant and single method of data collection for the initial completion of measures introduces the possibility that all measures are subject to a particular response set or perception idiosyncratic to that individual, which may or may

not be accurate, as well as to method variance. Additional validation methods, including observational data or completion of the measure by more than one caregiver would be beneficial. Unfortunately, there is no existing observational measure of bedtime or general routines with which to compare the present rating scales. Further efforts to examine relations among variables would benefit from employing the multitrait-multimethod matrix method (Campbell & Fiske, 1959) to reduce limitations of a single method of administration. Whereas using parents as informants on a brief questionnaires is efficient and inexpensive, this method may be affected by social desirability. Using multiple informants may be beneficial; for example, two primary caregivers could complete the questionnaires. In addition, the recruitment method (i.e. parents with internet access who participate in support groups), may not have resulted in a representative sample. Specifically, parents of children with an ASD who participate in support groups are not a representative sample of all parents of children with an ASD (Mandell & Salzer, 2007). Therefore, recruitment procedures that target a more representative sample, such as recruitment through schools, may be beneficial.

A second major limitation pertains to constraints on external validity. Given the age range included in the present study, findings can only generalize to school-aged children. However, the age range is in need of expansion. Future studies should examine the strength of similar relations in younger and older children, including pre-schoolers and adolescents. In addition, the majority of participants were White (87.9% of ASD sample, 77.2% of non-ASD sample), limiting the ability to generalize findings to other ethnic groups. Future studies should explore the use of multiple informants to examine accuracy of report and attempt to expand the age range and ethnicity of participants.

Finally, as previously discussed, other directions for future research (e.g., examining questions among children with an ASD who experience less consistent routines and/or greater sleep disturbance, studying with a larger sample size to increase power) should be considered.

Conclusion

In summary, the present study supported many significant relations between routines, sleep behavior, and externalizing behavior in children with an ASD, including relations between bedtime routines and general routines, sleep hygiene, and sleep quality; general routines and sleep hygiene; sleep hygiene and both sleep quality and behavior problems; and sleep quality and behavior problems. However, other predicted relations were not supported, including the relation between bedtime routines or general routines and externalizing behavior; general routines and sleep quality; and reactivity to changes in bedtime routines or presence of maladaptive activities comprising the bedtime routine and both sleep quality and externalizing behavior. Group status was found to significantly influence the relation between general routines and externalizing behavior; no other significant moderations were identified. Future studies should further explore relations among sleep, routines, and behavior in children with an ASD, especially within children displaying less consistent routines and children exhibiting sleep disturbance. In addition, future studies should examine specific behaviors comprising the routine of children with an ASD, as behaviors have been previously labeled "unusual," but only traditional behaviors were explored in the present study.

Despite emphasis commonly placed on the importance of routines and sleep disturbance in children with an ASD, data regarding efficacy of routines and sleep

behavior remain limited. Moreover, research is limited in these areas within the general child population. This study furthers the research that has been conducted in the important areas of sleep and routines and is a first attempt to pull together the literature from these areas within ASD research. More research is needed in this area, especially within the ASD population, before commonly held beliefs regarding the utility of child routines and the importance of sleep can be substantiated.

APPENDIX A

DEMOGRAPHICS FORM

These forms are for caregivers with children between the ages of 6 and 12 years. If you **do not** provide most of the care for a child age 6 to 12, please **STOP** now. Fill out the following information about your child.

Age _____ **Date of Birth** _____ **Sex?** Girl ___ Boy ___ **First and last initials** _____
Month/Day/Year

Race: White ___ Black ___ Hispanic ___ Asian ___ Other _____

Have this child ever received help (from a counselor, therapist, or psychologist) due to behavior problems?

Yes ____ No ____ If *yes*, when? From: _____ To: _____
Month / Year Month / Year

Is your child in special education ? Yes ____ No _____ If *yes*, what for? _____

What time does your child usually go to sleep at night?_____ Wake up?_____

ABOUT YOU AND YOUR FAMILY

Your gender: *Female* _____ *Male* _____ ***Your age:*** _____ *years*

Race: *White*____ *Black*____ *Hispanic* ____ *Asian* ____ *Other*_____

Marital Status: Never Married/Living Alone _____ Never Married/Living with Someone _____
Married _____ Separated _____ Divorced _____ Widowed_____

Education: What is the highest level of education completed by:

Yourself		Your Spouse/Significant Other
____6th grade or less		__ 6th grade or less
____Junior high school (7th, 8th, 9th grade)	_____	Junior high school (7th, 8th, 9th grade)
____Some high school (10th, 11th grade)	_____	Some high school (10th,11th grade)
____High school graduate	_____	High school graduate
____Some college (at least 1 year) or specialized training		__ Some college (at least 1 year) or specialized training
____Standard college or university graduate	_____	Standard college or university graduate
____Graduate professional degree (Master's, Doctorate)	_____	Graduate professional degree (Master's, Doctorate)

Occupation: Please provide your job title or position, NOT the just name of your employer. For example, if you are a teacher at Lee High School, please state "high school teacher". If you are **retired**, please state your prior occupation. If you **do not work** outside the home, state "unemployed".

What is your occupation? _____
(please be specific)

What is your spouse's occupation?_____
(please be specific)

Income: What is the total annual income of your household? (Combine the income of **all** the people living in your house.)

_____ $ 0 -- $ 4,999 _____ $15,000 -- $24,999 _____ $50,000 -- $74,999

_____ $ 5,000 -- $ 9,999 _____ $25,000 -- $34,999 _____ $75,000 -- $99,999

_____ $10,000 – $14,999 _____ $35,000 -- $49,999 _____ $100,000 and above

APPENDIX B

BEDTIME ROUTINES QUESTIONNAIRE

Bedtime routines are a set sequence of events that occur regularly in the same order and with the same caretaker before a child goes to bed. For each item below, please rate how often your child engages in each aspect of a bedtime routine or the intensity of your child's reaction by circling a rating of your child's behavior in the past month. Further instructions are provided for each set of questions.

During **weeknights** (Sunday through Thursday nights only) for the past **month**, how often did your child…	How **often** does it occur? 1 = Almost never 2 = Occasionally 3 = Half the time 4 = Often 5 = Nearly always
1) …perform the **same activities** in the hour before going to bed (for example, bathe, brush teeth, read/listen to story, listen to music)?	1 2 3 4 5
2) …perform activities **in the same order** before going to bed (for example, bathe, brush teeth, read/listen to story, go to bed)?	1 2 3 4 5
3) …sleep **in the same place** (for example, in his/her bed, in parent's bed, on couch)?	1 2 3 4 5
4) …go to bed **at the same time** (within 10 minutes)?	1 2 3 4 5
5) …get put to bed **by the same person**?	1 2 3 4 5
During **weekends** (Friday and Saturday nights) for the past **month**, how often did your child…	How **often** does it occur? 1 = Almost never 2 = Occasionally 3 = Half the time 4 = Often 5 = Nearly always
6) …perform **the same activities** in the hour before going to bed?	1 2 3 4 5
7) …perform events **in the same order** before going to bed (for example, bathe, brush teeth, read/listen to story, go to bed)?	1 2 3 4 5
8) …sleep **in the same place** (for example, in his/her bed, in parent's bed, on couch)?	1 2 3 4 5
9) …go to bed **at the same time** (within 10 minutes)?	1 2 3 4 5
10) …get put to bed **by the same person**?	1 2 3 4 5
How upset does your child get if he or she **does NOT**…	How **upset** does your child get? 1 = Not at all 2 = A little 3 = Moderately 4 = Quite a bit 5 = Extremely
11) …perform the **same activities** in the hour before going to bed (for example, bathe, brush teeth, read/listen to story, listen to music)?	1 2 3 4 5
12) …perform activities **in the same order** before going to bed (for example, bathe, brush teeth, read/listen to story, go to bed)?	1 2 3 4 5
13) …sleep **in the same place** (for example, in his/her bed, in parent's bed, on couch)?	1 2 3 4 5
14) …go to bed **at the same time** (within 10 minutes)?	1 2 3 4 5
15) …get put to bed **by the same person**?	1 2 3 4 5

In the past **month**, in the hour ***before*** going to bed, how often did your child…	How **often** does it occur? 1 = Almost never 2 = Occasionally 3 = Half the time 4 = Often 5 = Nearly always
16) …read/listen to a story?	1 2 3 4 5
17) …play with games or toys?	1 2 3 4 5
18) …have active play (such as roughhouse or run around)?	1 2 3 4 5
19) …watch TV?	1 2 3 4 5
20) …play video games?	1 2 3 4 5
21) …listen to music?	1 2 3 4 5
22) …have a snack or drink?	1 2 3 4 5
23) …take a shower/bath?	1 2 3 4 5
24) …brush teeth?	1 2 3 4 5
25) …use the toilet?	1 2 3 4 5
26) …hug/kiss caregiver?	1 2 3 4 5
27) …say goodnight to family members?	1 2 3 4 5
28) …get tucked in?	1 2 3 4 5
29) …put on pajamas?	1 2 3 4 5
30) …say prayers?	1 2 3 4 5
31) …cuddle with caregiver?	1 2 3 4 5
In the past **month**, in the hour ***after*** your child initially went to bed, how often did your child…	How **often** does it occur? 1 = Almost never 2 = Occasionally 3 = Half the time 4 = Often 5 = Nearly always
32) …get out of bed?	1 2 3 4 5
33) …ask for a drink from bed?	1 2 3 4 5
34) …call out from bed?	1 2 3 4 5
33) …throw a tantrum?	1 2 3 4 5
34) …ask you not to leave/ to sleep with him/her?	1 2 3 4 5
35) …sleep with caregiver part of the night?	1 2 3 4 5
In the past **month**, how often did your child…	1 = Almost never 2 = Occasionally 3 = Half the time 4 = Often 5 = Nearly always
36) …nap during the 4 hours before bed?	1 2 3 4 5
37) …share a bed with someone all night (such as a sibling or parent)?	1 2 3 4 5
38a) …spend the night at a second permanent residence (such as other parent's house or grandparent's house)?	1 2 3 4 5
38b) ***IF*** your child has a second permanent residence, what nights of the week does your child spend the night there?	1 = weekends only 2 = mostly weekends 3 = weekends and weeknights 4 = mostly weeknights 5 = weeknights only n/a = not applicable 1 2 3 4 5 n/a

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
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HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **27111205**
PROJECT TITLE: **Routines and Family Characteristics in the Household of a Child With an Autism Spectrum Disorder**
PROPOSED PROJECT DATES: **08/01/07 to 12/20/08**
PROJECT TYPE: **Dissertation or Thesis**
PRINCIPAL INVESTIGATORS: **Stephanie Bader**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Psychology**
FUNDING AGENCY: **N/A**
HSPRC COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF APPROVAL: **11/12/07 to 11/11/08**

Lawrence A. Hosman
Lawrence A. Hosman, Ph.D.
HSPRC Chair

11-13-07
Date

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