Effects of Child Behavior Problems on the Development of Preschoolers' Sleep Problems: A Longitudinal Examination

by

Devon Oosting

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science with Honors in Psychology from the University of Michigan

2012

Advisors: Sheryl Olson, Ph.D. and Barbara Felt, M.D.

Collaborating Graduate Student: Adam Grabell

Abstract

Sleep regulation is thought to be an important contributor to the development of behavior problems in children. However, little research has focused on the mechanisms underlying the development of sleep problems in early childhood. The main goal of this study was to examine the direction and strength of the relationship between child sleep problems and behavior problems across the early childhood period (3-6 years). A secondary goal was to examine the role of maternal harsh parenting and child effortful control abilities in the development of associations between sleep and behavior problems. Mothers reported the amount of sleep problems and externalizing behavior problems their children had at ages 3 and 6, as well as their use of harsh parenting strategies. Teachers also reported child externalizing behavior problems at ages 3 and 6. Children's effortful control, an index of early self-regulatory control over attention and impulses, was assessed using both laboratory tasks and maternal ratings. Hierarchical multiple regression and structural equation analyses showed that mother-reported behavior problems at age 3 significantly contributed to sleep problems at age 6. The relationship between teacher-reported behavior problems at age 3 and child sleep problems at age 6 was mediated by early child effortful control. Results support careful consideration of other regulatory problems when diagnosing and treating sleep and behavior problems in young children.

Keywords: parenting, executive function, sleep problems, behavior problems, longitudinal, preschool

Effects of Child Behavior Problems on the Development of Preschoolers' Sleep Problems: A Longitudinal Examination

The ability to regulate sleep is an important skill that develops rapidly during the preschool years. Sleep regulation abilities develop around the time that children gain more control over their emotions and behavior, and thus difficulties with sleep regulation are thought to contribute to the development of behavior problems such as ADHD (Dahl, 1996; Hvolby, Jorgenson, & Bilenberg, 2009; Li, Jin, Yan, Wu, Jiang, & Shen, 2009). In order to better diagnose and treat sleep and behavioral problems, it is important to understand how these problems develop both individually and in relation to each other. The main goal of this study was to propose an explanatory model of how children's sleep and behavioral problems develop in light of maternal use of harsh discipline and child executive function abilities, specifically child effortful control. One important component of this study was its proposition of these models based on data that spans the early childhood period (from 3 to 6 years). Regulatory problems in sleep and behavior are especially crucial to study longitudinally because early onset problems are often not only predictive of later problems, but also affect both the parenting strategies used to manage these problems in later childhood as well as the formation of the child's executive function abilities. In what follows, I discuss the current literature on the links between parental harsh discipline, executive function, and these two types of regulatory problems. In addition, the current understanding of how age affects the individual constructs and the relationships between them will be explored.

Sleep and Behavior Problems

A small body of existing literature has shown that children with sleep problems also suffer from high levels of behavioral adjustment problems (Bates, Viken, Alexander, Beyers, &

Stockton, 2002; Paavonen et al., 2002; Reid, Hong, & Wade, 2008). For example, Paavonen et al. (2002) found that problems such as sleep onset difficulties and frequent night waking were associated with increased behavioral and emotional problems, poor school attendance, and hyperactivity. Reid et al. (2008) found that child sleep problems were positively correlated with the development of both internalizing and externalizing problems and that sleep problems heightened the effects of behavioral problems. Furthermore, Bates et al. (2002) looked at the relationship between sleep disturbance and behavioral adjustment in 202 preschool-aged children and found that disrupted sleep patterns (i.e.,: varied amounts of sleep and late or varied bedtimes) predicted poor behavioral adjustment in preschool. Interestingly, this relationship held even when environmental factors such as family management practices (i.e.,: family cohesion and parenting behaviors) are considered. Because early onset sleep problems have implications for children's current and later behavioral adjustment, it is important to examine environmental factors that influence their development.

Sleep Problems and Parenting Style

One of the mechanisms that may underlie the development of effective sleep and behavioral regulation is parenting behavior. It has been posited that maternal separation anxiety, excessive use of physical comfort, and little encouragement of autonomy increases sleep problems in infants, and that adverse parenting styles lead to lower quality sleep in adolescents (Brand, Hatzinger, Beck, & Holsboer-Traschler, 2009; Morrell & Cortina-Borja, 2002; Sadeh, Tikotzsky, & Scher, 2010; Scher & Blumberg, 1998). However, the effects of parenting behaviors on the development of sleep and behavior problems in preschool-aged children are less clear. In one study that examined the sleep-related attitudes and behaviors of the parents of 110 preschool-aged children, an increased number of parental interactions at bedtime, problematic

parental sleep-related cognitions, and weak bedtime limit-setting significantly predicted child sleep problems (Johnson & McMahon, 2008). The authors suggested that parents' inability to establish bedtime limits and then respond accordingly to their child's bedtime delaying behaviors influenced the development of child sleep problems. Apart from this study, research on the role of parenting style in the development of sleep problems during the preschool years has been limited. To my knowledge there have been no studies that focus specifically on the effects of harsh parenting on preschool children's sleep problems.

It has been established, however, that parental use of harsh discipline is related to high levels of child behavior problems, specifically attention and aggression problems (Ho, Bluestein, & Jenkins, 2008; Hughes & Ensor, 2006; Wu et al., 2002). However, few studies have examined the effects of harsh discipline on behavior during the transition into preschool and kindergarten. Lower executive function abilities have also been shown to relate to more problems with aggression and inhibition in preschool-aged children (Dennis & Miller Brotman, 2003; Hughes & Ensor, 2008; Hughes & Ensor, 2009; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Raaijmakers et al., 2008).

Sleep Problems and Executive Function

Although low levels of inhibitory control have been related to externalizing behaviors in children, studies examining the relationship between executive function (EF) and sleep have been relatively limited. Existing studies have paid little attention to behavioral sleep problems; instead, "sleep problems" have often been defined in terms of shortened sleep duration and medical sleep difficulties such as sleep disordered breathing (SDB). A lower percentage of nighttime sleep has been related to lower cognitive performance and lower impulse control in toddlers and preschoolers (Bernier, Carlson, Bordeleau, & Carrier, 2010; Lam, Mahone, Mason,

& Scharf, 2011). Sleep duration, however, has been found to be unrelated to EF in both adolescents and toddlers (Anderson, Storfer-Isser, Taylor, Rosen, & Redline, 2009; Bernier et al., 2010). Sleep-disordered breathing has been related to lower EF performance in preschoolers and adolescents, although the components most affected differ based on age (Friedman, Corley, Hewitt, & Wright, 2008; Gottlieb et al., 2004; Karpinski, Scullen, & Montgomery-Downs, 2008). In preschoolers, SDB has been related specifically to deficits in inhibition and inattention (Gottlieb et al., 2004; Karpinski et al., 2008). In adolescents, however, SDB has been related to lower behavioral (but not executive) inhibitory control. While some research has been conducted on medical sleep problems, very little research has been done on the relationship between behavioral sleep problems and executive function.

Current Longitudinal Research

Longitudinal studies that focus on the effects of sleep problems on behavior in light of multiple risk factors are relatively rare. One such study by Hall, Zubrick, Zilburns, Parsons, & Kurinczuk (2007) explored relationships between lax parenting and parental conflict, behavioral sleep problems, and aggressive behavior longitudinally in a sample of 2,214 Australian preschool-aged children. Results showed that conflicted and lax parenting and disrupted sleep rhythmicity in toddlerhood predicted higher levels of sleep problems at age three, which then predicted more aggressive behavior at age four. The results supported a model in which the relationship between parental conflict and child aggressive behavior was mediated by sleep problems.

Some longitudinal research has been conducted either on individual constructs or on the relationships between a select few of the constructs of interest in this study. For example, longitudinal studies on the relationship between harsh discipline and externalizing behavior

problems have revealed findings similar to the cross-sectional studies already discussed: Parental use of harsh discipline predicts child externalizing behavior problems, a relationship that remains stable as children age (Lansford et al., 2011). In one study of toddler boys, Verhoeven, Junger, van Aken, Dekovic, & van Aken (2007) found that while harsh parenting style did not predict externalizing behavior, boys' behavior problems did predict parental use of harsh parenting and other poor parenting strategies over an extended period of time. It is possible then that the relationship between harsh parenting and child externalizing behavior is bidirectional (Verhoeven et al., 2007).

Child effortful control, an important domain of executive function, has been shown to relate to child externalizing problems across development (Eisenberg et al., 2009; Valiente et al., 2003). In addition, high levels of harsh parenting have predicted low initial levels of child effortful control, whereas high levels of positive emotionality in mothers' interactions with their toddlers and young children have been shown to relate to higher levels of effortful control in later childhood (Cipriano & Stifter, 2010; Moilanen, Shaw, Dishion, Gardner, & Wilson, 2010; Valiente et al., 2006).

Multiple longitudinal studies have shown that sleep problems in early childhood relate to behavior problems in later childhood and early adolescence (El-Sheikh, Kelly, Buckhalt, & Hinnant, 2010; Gregory & O'Connor, 2002; Quach, Hiscock, Canterford, & Wake, 2009). Levels of reported sleep problems also decrease from toddlerhood to early childhood (Gregory & O'Connor, 2002). In a study by Fricke-Oerkermann et al. (2007), children reported less difficulty maintaining sleep in later childhood, but reported much more difficulty initiating and maintaining sleep than their parents reported.

To my knowledge this study was the first to examine relationships between multiple risk factors and the development of regulatory problems using a longitudinal design. The aims of the current study were twofold: l) to examine the direction and strength of the relationships between behavioral sleep problems and externalizing behavior problems; and 2) to determine whether child effortful control and harsh parental discipline affect the development of these problems.

Hypotheses and Proposed Model

In accordance with Dahl's work on sleep problems and behavior problems, I predicted that the relationship between sleep problems and behavior problems would be bidirectional and mediated by differences in effortful control (Dahl, 1996). I expanded this notion by including the amount of maternal harsh discipline as a predictor of both sleep and behavior problems. I predicted that high levels of harsh discipline and low effortful control at age 3 would lead to higher levels of sleep and behavior problems at age 3 and age 6. In regard to sleep problems exclusively, I predicted that high levels of harsh discipline and low effortful control would partially predict sleep problems, but that the strongest predictor of sleep problems would be prior and concurrent externalizing behavioral problems (Dahl, 1996; Paavonen et al., 2002; Reid et al., 2008).

Method

Participants

Participants (N = 199) were taken from a sample of 240 3-year-old children (118 girls) who were enrolled in an ongoing longitudinal study of young children at risk for school-age conduct problems (Olson et al., 2005). Children represented the full range of externalizing symptom severity on the Child Behavior Checklist/2-3 (Achenbach, l992), with an oversampling of toddlers in the medium high to high range of the Externalizing Problems scale ($\underline{T}$ > 60; 44%).

The remaining sample was split relatively evenly between children whose Externalizing Problems T-scores were above 50 but below 60 and those with T-scores below 50. Most families (95%) were recruited from newspaper announcements and fliers sent to day care centers and preschools; others were referred by preschool teachers and pediatricians.

In order to recruit children with a range of behavioral adjustment levels, two different ads were periodically placed in local and regional newspapers and child care centers, one focusing on hard-to-manage toddlers, and the other on normally developing toddlers. The child's enrollment in a formal preschool program was not an absolute requirement for family participation. Once a parent indicated interest, a screening questionnaire and brief follow-up telephone interview were used to determine the family's appropriateness for participation and willingness to engage in a longitudinal study. Children with serious chronic health problems, cognitive delay, and/or pervasive developmental disorders were not included in the study. Families were assessed at two different points in development: when children were 3 years old (T1; M = 41.40, SD = 2.9 months) and again following transition to kindergarten (T2; M = 66.3, SD = 2.8 months).

Most children (91%) were of European American heritage. Others were of African-American (5.5%), Hispanic American (2.5%), and Asian American (1%) racial or ethnic backgrounds. The majority (87.9 %) resided in two-parent families; of the remaining households, 5.3% of parents identified themselves as single (never married), and 6.8% as divorced. Fifty-five percent of mothers worked outside the home on a full-time basis. Nineteen percent of mothers and 24% of fathers had achieved high school education; 46% of mothers and 34% of fathers had completed four years of college; and 35% of mothers and 42% of fathers had completed

additional graduate or professional training. The median annual family income was $52,000, ranging from $20,000 to over $100,000.

Of the 240 families assessed initially, 210 (88%) participated in all aspects of data collection. Twenty families moved out of state but continued to provide questionnaire data. Of the 10 families no longer in the study only 2 have refused participation (too busy). The other 8 withdrew due to family or child illness. Attrition was not selective based on comparisons of major sociodemographic or study characteristics.

Procedure

Mothers were visited in their homes by a female social worker when children were 3 years old, and again when they entered kindergarten. Subsequent to the interview, mothers completed a packet of questionnaires (described below) and provided demographic information. Families were paid for their participation.

Age 3. Children participated in a Saturday morning laboratory session scheduled at a local preschool. Following 20-30 minutes of rapport building, measures of effortful control, social-cognitive maturity, and cognitive competence were individually administered. Children received small gifts for their participation.

The majority of the children in our study (86%) were enrolled in preschool or daycare programs outside the home. Preschool teachers were asked to contribute ratings of children's behavioral adjustment, and 95% agreed (N = 189) and were given gift certificates for their participation.

Age 6. Kindergarten teachers were asked to provide follow-up measures of child adjustment, and were given gift certificates for their participation (N = 190). At follow-up,

approximately 9% (20) of the children exceeded clinical cutoffs on the Externalizing Problems scale of the Teacher Report Form (Achenbach & Rescorla, 2001).

Measures

Harsh Discipline. Maternal reports of the frequency of physical punishment (e.g. spank, grab, shake) administered during the previous three months were gathered in an in-home interview administered by a female social worker when children were three years old and six years old (Dodge, Pettit, & Bates, 1994). Possible answers included "never" (0), once/month (1), once/week (2), daily (3), several times daily (4). These reports were used to create a summary scale representing harsh discipline, with the lowest score assigned to children who received no physical punishment from either parent and the highest score assigned to children who received physical punishment several times daily from both parents (Kerr, Lopez, Olson & Sameroff, 2004). Approximately 73% of parents endorsed occasional use of physical punishment, and 39% stated that they used corporal punishment at least once per month.

Effortful Control. Individual differences in effortful control were assessed using behavioral tasks and maternal ratings (described below).

Age 3 behavioral battery. During a laboratory visit, children were administered 6 tasks from Kochanska, Murray, Jacques, Koenig, & Vandegeest's (l996) toddler-age behavioral battery (adapted from Olson et al., 2005). Each behavioral task was designed to tap Rothbart's (l989) general construct of effortful control (suppressing a dominant response and initiating a subdominant response according to varying task demands). All tasks were introduced as "games," and children were reminded of the rules midway through each task. In order to provide a check on accuracy of recording, 15 test administrations were videotaped and independently scored.

Reliability was excellent, K = .95. As recommended by Kochanska et al. (l996), a total behavioral score was computed by summing individual subtest scores (standardized α = .70).

Turtle and Rabbit. This task measured the child's ability to slow down motor activity. The child's task was to move 3 agents, a same-sex doll (baseline), a fast rabbit, and a slow turtle, along a curved path depicted on a poster board. The child was instructed to stay on the path and bring each figure "home" to a toy barn under the following conditions: a) the "fastest rabbit in the world" needs to go home fast, and b) the "slowest turtle in the world" needs to get home slowly, with two trials for each condition. A slightly adapted version of Kochanska et al.'s scoring reflected 1) accuracy in following the path, in which the child, (1 = negotiates less than half of the path, 2 = negotiates more than half of the path, 3 = stays within lines and follows path) and 2) ability to slow down motor activity, which was the difference between averaged fast and slow trials. Standardize mean scores were computed.

Tower Task. This task measured the child's ability to initiate and inhibit activity using verbal signals. In this task, the child and examiner took turns building a block tower using 20 blocks (3 total trials). Before placing each block, the examiner waited until the child indicated he or she was giving the examiner a turn. Coding reflected the proportion of blocks placed by the child in relation to the total number of blocks in the tower. Scores were then reversed so that higher scores represented higher levels of effortful control; that is, if the child gave the examiner all due turns, the child's score would equal one-half the total number of blocks. Scores from all trials were averaged.

Snack Delay. In this task, the child had to wait to get a piece of candy from under a glass cup until the examiner rang a bell. Four trials were conducted, with delays of 10, 15, 20, and 30 s. In the middle of each trial, the examiner picked up the bell as if ready to ring it. The child's

response was scored as follows: 0 = eats candy before examiner rings bell, 1 = eats candy after bell is lifted, 2 = touches bell or cup before bell is lifted, 3 = touches bell or cup after bell is lifted, 4 = waits until bell is rung. A mean score of four trials was computed.

Whisper Task. This task assessed the child's ability to lower his or her voice while listing the names of 10 cartoon characters as they were presented consecutively. Trials were coded from 0 to 2 (0 = shout, 1 = normal, 2 = whisper).

Tongue Task. The child was asked to hold a small piece of candy on his or her tongue, without chewing, eating, or swallowing it, for four trials of differing delay amounts (10, 15, 20, 30 s). Coding reflected the amount of time that elapsed before the child ate the candy, and mean scores were computed.

Lab Gift. The child was asked to sit facing away from the examiner while the examiner noisily wrapped a gift for the child (about 60 s). The examiner asked the child not to look so that the "surprise" could be wrapped. Next, the wrapped gift was placed next to the child, who was then asked to wait while the examiner searched for a bow (120 s). Coding was based on 4 behaviors: 1) frequency of peeking during the wrapping interval, 2) number of verbal references the child made to the gift, 3) number of times the child touched the gift, and 4) the number of seconds that elapsed before the child took the gift. The scores were then composited into a single index (α = .82) (adapted from Kochanska et al., 1996).

Age 6 behavioral battery. An early school-age behavioral battery consisting of six tasks was administered at age 6 (Kochanska, Murray, & Coy, 1997). These behavioral batteries are related to maternal effortful control ratings and have a high internal consistency (Kochanska et al., 1996; Kochanska et al., 1997). Tasks were presented as games and children were reminded of the rules midway through each task.

Simon Says. The Simon Says task measured the ability to initiate or suppress a movement according to changing instructions. The child was instructed to follow the tester's commands only when they were preceded by the phrase "Simon Says" and was given up to 3 practice trials. The tester instructed the child to play Simon Says with a young woman in a video. Children's responses to ten trials of the "Simon Says" command were scored as either: 2 (correct), 1 (self-correct after error), or 0 (incorrect). Children's responses to ten trials when "Simon Says" did not precede the command were coded in a similar manner. The child's scores for the suppression trials were aggregated into a final score for the task.

KRISP. Wright's (1971) Kansas Reflectivity/Impulsivity Scale for Preschoolers (KRISP) task measured cognitive reflectivity and required a picture notebook placed in clear view of the child, who was instructed to point at the picture on the bottom of the page matching the same picture presented at the top (Kochanska et al., 1997). On three practice items, the child was provided with hints when incorrect and brief reinforcement when successful. The child was allowed up to three incorrect choices for each of the 15 matching trials before moving on. The total number of errors was reverse coded and aggregated into a final score for the task.

Walk-a-Line-Slowly. The Walk-a-Line-Slowly task measured the ability to slow down gross motor activity and required a stopwatch and a 6-inch (15 cm) wide by 6-foot (1.83 m) long piece of red tape placed as a straight line on the floor. For each trial, the tester recorded the time it took for the child to walk the line from one end to the other. During a baseline trial, the child was instructed to walk down the path and stop at the end. In the next two trials, the child was instructed to walk as slowly as possible along the path. The final score was the mean of the two slow trials.

Green-Red Signs. The Green-Red Signs task evaluated the ability to initiate or suppress a movement according to changing instructions. The tester instructed the child to keep his/her hands flat on the floor while in a seated position. The tester explained that when the green sign is raised, the child should raise the hand on the same side of the sign as fast as possible. The tester then turned on the videotape and the child completed ten trials with the green sign only. Next, the tester explained that they would now use the red sign only, which the child had to raise the opposite hand to. After 10 video trials, the tester explained that they would now use both signs for 20 trials. Scoring for each trial were as follows: 3 (correct), 2 (self-correct), 1 (partial self-correct), and 0 (incorrect). The final score was the sum of scores for each series of trials.

SHAPES. The Shapes task, a version of the Stroop paradigm. (Rothbart & Bates, 1998) measured children's effortful attention. The child was first shown a sheet of all shapes and reviewed names of each with the tester. During practice trials, the child was instructed to identify small shapes that formed a large shape. If the child named the large shape, they were reminded to name the smaller shape only. The 12 consistent trials had a large shape made up of identical smaller shapes, and the 12 inconsistent trials had a large shape made up of different smaller shapes. The tester scored the child's responses as follows: 2 (correct), 1 (self-corrects), and 0 (incorrect). Only the inconsistent trials were coded and their sum represented the task final score.

Drawing: Circle/Star. Two drawing trials assessed the ability to slow down fine motor activity. The child was instructed to draw a line along either a circle or star on three separate trials for each shape and at 3 different speeds (i.e.,, regular for baseline trial 1, slow for trial 2, and fast for trial 3). The tester recorded the time it took for the child to draw the shape for each trial. The final score was the average difference in latency time between the fast and slow trials.

Maternal rating (CBQ; Rothbart, Ahadi, & Ye, l993)**.** An abbreviated version of Rothbart's Child Behavior Questionnaire was used to assess individual differences in maternal perceptions of child temperament at both ages. An Effortful Control index was created by summing children's scores on Inhibitory Control (α = .77) and Attentional Focusing (α = .85), the two most theoretically and empirically salient components of the construct (Posner & Rothbart, 2000).

Total effortful control score. Olson et al. (2005) previously reported that the maternal rating index as described above and laboratory behavioral composite index of EC were significantly intercorrelated (α = .60 at T1 and T2). Thus, to create a more objective and comprehensive construct of effortful control, a summary index was created by aggregating children's standardized scores on these measures and the maternal ratings (Olson et al., 2005).

Sleep Habits Questionnaire (SHQ; Seifer, Sameroff, Dickstein, Hayden, & Schiller, 1996). The SHQ addresses child sleep habits and difficulties at bedtime, during the night, at morning wake-up, and during the day, as well as parental perception of the amount of sleep their child is getting and parental response to night waking (Seifer et al., 1996). The Bedtime scale of the SHQ (6 items) was used to assess children's problems around bedtime and during sleep initiation in the most recent typical week (Owens, Spirito, & McGuinn, 2000). These items represent a range of sleep initiation problems, including bedtime variability, bedtime resistance, and an inability or unwillingness to sleep alone. Mothers rated the frequency that the each problem occurred on a 3 = rarely (0-2 times per week), 2 = sometimes (2-4 times per week), 1 = usually (5-7 times per week) scale, and those scores were averaged to form a total SI score. The higher the child's score, the more sleep initiation problems he or she is reported to have.

Child Behavior Checklist (CBCL 2-3; 6-18; Achenbach, 1991, 1992; Achenbach & Rescorla, 2001). Mothers reported children's behavior problems on the CBCL at both the 3-year and 6-year assessments. Mothers rated the child on 99 items that described the child's behavior over the previous 2 months. The items were rated on 3-point scales (0 = not true of the child; 1 = somewhat or sometimes true; 2 = very or often true). The Externalizing behavior scale is a broadband, factor-analytically derived dimension of child behavior and includes, in the CBCL/2-3, the 26 items on the aggressive behavior and destructive behavior subscales (Achenbach, 1992; Achenbach & Rescorla, 2001). In the CBCL/6-18, the Externalizing behavior scale is composed of the 24 items on the aggressive behavior and attention problems subscales (Achenbach & Rescorla, 2001). Achenbach (1992) reported high test-retest reliability for the Externalizing scale (r = .84) of the CBCL/2-3.

Caregiver/Teacher Report Form (CTRF 2-5; Achenbach, 1992; TRF 6-18; Achenbach & Rescorla, 2001). Teachers completed the developmentally-appropriate Caregiver/Teacher Report Form at the 3-year and 6-year assessments. A broad Externalizing scale with a high level of test-retest and internal reliability was derived (Achenbach & Rescorla, 2001).

Results

Descriptive Statistics

Pearson correlations were used to determine the direction and strength of bivariate relationships between child sleep initiation problems and the three constructs of interest: harsh discipline, child effortful control, and child externalizing behavior problems. Though the study questions did not highlight gender, for clarity and completeness one-way ANOVAs (analyses of variance) were used to examine gender differences in all constructs and control variables. Teacher and maternal ratings of externalizing behavior problems and maternal ratings of harsh

discipline at both time points were log-transformed to meet better the normality assumptions. The results corresponding to each test are reported in Tables 1-6.

Construct differences by gender and age (T1 & T2). As shown in Table 1, the amount of reported sleep initiation problems did not differ significantly by gender at either age. Males were reported as having more externalizing problems than females at age 6 and also at age 3, but only by teachers, not by mothers. Males also had a lower level of effortful control at age 3, but males and females were not significantly different in their effortful control at age 6. Mothers reported using more harsh discipline with their male children at age 3, but this difference was non-significant at age 6. There was no significant difference in child IQ or SES by gender.

As shown in Table 2, sleep initiation problems and effortful control were not significantly different between T1 and T2. However, significant differences were seen in harsh discipline and both mother-reported and teacher-reported externalizing behavior problems (see Table 2 for means and standard deviations).

Construct stability. For males, all constructs were highly stable between ages 3 and 6 years. For females, sleep initiation problems were modestly stable, whereas externalizing behavior problems were moderately stable. As shown in Table 3, harsh discipline and effortful control were very stable for females.

Concurrent correlates, age 3 years. Significant positive relationships between sleep initiation problems and both maternal use of harsh discipline and maternal report of externalizing behavior problems were observed (see Table 4 for correlations). Children who displayed more sleep initiation problems exhibited more problems with regulation of behavior, and had mothers who reported higher levels of harsh discipline use. Sleep problems were unrelated to child effortful control or teachers' perceptions of externalizing behavior problems.

Concurrent correlates, age 6 years. A significant positive relationship between sleep initiation problems and maternal reports of child externalizing behavior was found (see Table 5 for correlations). As sleep problems increased, children's difficulties with the regulation of behavior also increased. Child effortful control and mother-reported use of harsh discipline at age 6 were unrelated to child sleep initiation problems at age 6.

Predictive correlates, ages 3 to 6 years. As shown in Table 6, low effortful control at age 3 and relatively high levels of child externalizing behaviors were related to higher levels of sleep problems at age 6. Reports of harsh discipline use and teacher reports of externalizing behavior problems at age 3 were unrelated to age 6 sleep problems. Children's early difficulties with effortful control and behavioral regulation were related to later difficulties with initiating sleep.

Hierarchical Regression Analyses

Hierarchical multiple regression analysis was used to examine longitudinal associations between sleep problems and behavioral problems. First, the stability of child sleep and behavior problems was confirmed. As expected, mother reports of externalizing behavior problems at age 3 made significant contributions to externalizing behavior problems at age 6 ($\beta = .34$, $p < .001$), as did teacher reported externalizing behavior problems at age 3 ($\beta = .30$, $p < .001$). Sleep problems at age 3 made significant contributions to sleep problems at age 6 ($\beta = .37$, $p < .001$).

The relationship between child sleep problems at age 3 and later externalizing problems was examined first. The dependent variable was the average of mother and teacher reports of externalizing behavior problems at age 6. Mother and teacher reported externalizing problems were entered as the first and second steps to control for stability over time. Sleep problems at age 3 was entered in the third step. As shown in Table 7, only maternal and teacher ratings of

externalizing behavior problems at age 3 made significant contributions to externalizing behavior problems at age 6.

Second, the relationship between early externalizing behavior problems and later child sleep problems was examined. The dependent variable was sleep problems at age 6. Sleep problems at age 3 was entered in the first step, to control for stability over time. Child externalizing behavior (mother and teacher reported) were entered in the second and third steps. As shown in Table 8, maternal, but not teacher, reports of externalizing behavior problems made significant contributions to sleep problems at age 6.

Structural Equation Modeling

Structural equation modeling (SEM) was used to describe how effortful control and maternal harsh discipline at age 3 affected the relationship between early externalizing problems and later sleep problems (SEM; Mplus, Munthén & Munthén, 2012). One advantage to using SEM as opposed to multiple regression was the ability to test both additive and mediation models simultaneously. SEM analysis provided both the predictive contributions and the indirect effects of early risk factors on the relationship between sleep and behavior problems, which allowed for a comparison of the overall mediation model fit to the individual coefficients (Kline, 1998; Sudano, n.d.). In addition, the SEM approach and programs used to execute it (in this study, Mplus) have highly effective missing data imputation capacities and are able to utilize non-standardized data (Sudano, n.d.; Munthén & Munthén, 2012). The 31 missing observations were handled using list-wise deletion. Model fit was determined used the comparative fit index (CFI), while the root mean square error of approximation (RMSEA) was used as a misfit index (Raykov, Tomer, and Nesselroade, 1991). Fit indices above .90 and RMSEA misfit indices at or below .06, respectively, indicate acceptable fit (Hu & Bentler, 1999).

Two separate models were run. The dependent variable in both was child sleep problems at age 6 and in both models maternal harsh discipline at age 3 and child effortful control at age 3 were tested as mediators. The independent variable in the first model was mother-reported externalizing behavior problems at age 3. This analysis produced a good fit to the data (See Figure 1; $\chi^2 = 90.25$, df = 6, $p > .001$, CFI = 1.0, RMSEA = 0.00). In the standardized model, mother-reported behavior problems at age 3 predicted sleep problems at age 6, while maternal harsh discipline and child effortful control did not make significant contributions (see Figure 1). Child effortful control and maternal harsh discipline at age 3 did not have a significant mediating effect on the relationship between mother-reported behavior problems at age 3 and sleep problems at age 6.

Next, the same mediation model was tested with the relationship between teacher-reported externalizing behavior problems at age 3 and child sleep problems at age 6. This was done to provide a contrast to the first model and to examine any reporter bias effects. The analysis produced a good fit to the data (See Figure 2; $\chi^2 = 37.83$, df = 6, $p > .001$, CFI = 1.0, RMSEA = 0.00). In the standardized model, teacher-reported behavior problems did not make significant contributions to child sleep problems at age 6, as expected. However, effortful control mediated the relationship between teacher-reported behavior problems at age 3 and child sleep problems at age 6 ($\beta = 0.06$, $p = .04$), and while the contributions of maternal harsh discipline to child sleep problems neared significance ($p = .055$), the mediating effect of maternal harsh discipline was nonsignificant (see Figure 2).

In summary, the relationship between mother-reported behavior problems at age 3 and child sleep problems at age 6 was not mediated by either effortful control or maternal harsh

discipline at age 3. In contrast, age 3 child effortful control was shown to mediate the relationship between teacher-reported behavior problems at age 3 and later child sleep problems.

Discussion

The main goal of this study was to examine mechanisms by which sleep problems arise during early childhood, with a focus on the effects of externalizing behavior problems on the development of sleep problems. Specifically, the relationship between early behavior problems at age 3, as reported by two separate informants, and child sleep problems at age 6 was examined while simultaneously exploring the mediating effects of early environmental (harsh discipline) and intrachild (effortful control) risk factors. When considering mother reports of early externalizing behavior problems, harsh discipline and effortful control were not significant predictors nor did they demonstrate a mediating influence. The strongest predictor of later sleep problems was mother-reported early behavior problems. However, when teacher reports of externalizing behavior problems were examined in place of mother reports, effortful control demonstrated a significant mediating effect and harsh discipline, while not a significant mediator, neared significance as a predictor of later sleep problems.

Bidirectional Relationship between Sleep and Behavior Problems

My first prediction was that the relationship between externalizing behavior problems and sleep problems would be bidirectional (Dahl, 1996). Results contradicted this prediction; early behavior problems were shown to contribute to later sleep problems, but the reverse was not true. This finding seems to contradict other longitudinal studies (e.g. Gregory & O'Connor, 2002; Quach et al., 2009), which found early sleep problems to be predictive of later behavior problems. One explanation may involve differences in the sleep constructs themselves. While the measure of the existence of a general 'sleep problem' and its perceived severity used in Quach et

al. (2009) may have represented other sleep problems such as night waking, restless sleep, and sleep-disordered breathing, the sleep construct used in this study focused exclusively on sleep problems occurring around bedtime. Similarly, the CBCL items used in the sleep composite in Gregory & O'Connor's (2002) study had a heavier emphasis on problems of sleep duration and sleep continuity, rather than those occurring around sleep initiation. It is possible that problems affecting the quality, duration, or continuity of sleep, such as restless sleep, night waking, and trouble maintaining sleep, are associated with later behavior problem development more so than those occurring at bedtime (Dahl, 1996; Goodnight, Bates, Staples, Pettit, & Dodge, 2007; Gregory & O'Connor, 2002; Quach et al., 2009). As suggested by Dahl (1996), this may be because poor quality sleep and shortened sleep duration negatively impacts children's abilities to regulate their emotions and behavior. It follows logically that persistent disruption of sleep and the regulatory deficits that accompany poor sleep quality and duration may contribute to the development of long-term regulatory problems such as those with inattention and aggression (Dahl, 1996).

The sleep problems captured in this study's measure did not directly assess the quality or duration of child sleep. Some items may have resulted in shorter sleep duration (i.e., if a child rarely goes to bed at the same time each night), but the majority of the items focused exclusively on problematic behaviors occurring at bedtime. This unique focus on behaviorally-based sleep initiation problems may explain the conflicting finding regarding direction of the sleep and behavior problems relationship.

Multiple studies report that levels of non-medical sleep problems (i.e., night waking, nightmares) decrease substantially from early childhood (ages 3-4) to later childhood (ages 5-7) (Gregory & O'Connor, 2002; Quach et al., 2009). It is possible then that early sleep initiation

problems did not predict later behavior problems simply because many children exhibit sleep problems around age 3, especially as this is a transitory period in which children are becoming increasingly self-reliant and often desire more independence from their parents and caregivers. This explanation may be particularly salient considering the nature of the sleep problems this study addressed. Most of the items in the sleep problems construct represented issues of independence, separation, and control. For example, children desiring more control and independence might resist bedtime rules set by their parents, and children struggling with being apart from their caregivers during sleep onset might display more resistance to sleeping alone. At this crucial point in young children's lives, many of them may have been exhibiting these common problems, which may have later dissipated as they became accustomed to their new roles.

To explain the contribution of early behavior problems to later sleep problems, it is important to consider the implications of persisting sleep initiation problems. Many of the sleep problems addressed in this study have a distinct behavioral component (i.e., resisting, struggling, or attempting to control bedtime routines) or could involve disruptive behavior (i.e., crying at bedtime, child is afraid of sleeping alone). Children who have persisting sleep initiation problems likely also exhibit externalizing behavior problems, as some of the behaviors accompanying these sleep problems are similar to aggression and attention externalizing behavior problems (i.e., resisting bed and stubbornness or uncooperativeness) and are likely to have similar underlying causes (Paavonen et al., 2002). While many children's sleep problems resolve in later childhood as their regulatory abilities improve, it is possible that the children who exhibited persisting sleep problems had lower baseline self-regulatory and inhibitory control abilities, deficits that first appeared in early externalizing behavior problems and that contributed

to the persistence of both externalizing behavior problems and sleep initiation problems in later childhood (Dahl, 1996; Eisenberg et al., 2009; Goodnight et al., 2007).

Externalizing Behavior Problems as a Predictor

Results partially supported my hypothesis that early externalizing behavior problems would predict sleep problems in later childhood; the maternal report of early externalizing behavior problems was the sole predictor of later sleep problems. However, when teacher reports of early externalizing behavior were used in place of mother reports, effortful control was found to mediate the relationship between early externalizing behavior problems and later sleep problems, aligning with previous work by Dahl (1996). Thus, when both behavior problems and sleep regulation difficulties were reported by the same source (mothers), the relationship between the two was strong and neither effortful control nor harsh discipline had any effect. When the regulatory problems were reported by different sources an entirely different path was found, underscoring the likely existence of rater bias.

As some cross-sectional research has suggested, it is possible that early externalizing behavior problems did predict later sleep problems, especially with regard to the similarity between externalizing behaviors and some of the sleep problem behaviors considered in this study (Paavonen et al., 2002; Reid et al., 2008). Conversely, mothers' ratings of general levels of uncooperativeness, stubbornness, and defiance their children displayed could have been affected by their perceptions of similarly disruptive bedtime behaviors, thus increasing the stability of these two constructs by double-reporting. By comparing models based on two reporting sources, I was able to uncover possible rater bias and propose an alternate pathway that was minimally confounded by this bias.

Effortful Control as a Predictor

As predicted, early effortful control made significant contributions to later sleep problems and was a significant mediator in the relationship between teacher-reported externalizing behavior problems and sleep problems. One possible explanation is that the deficits in inhibition of aggressive behavior and difficulty regulating attention seen in early externalizing behavior problems are the result, at least in part, of low effortful control ability in early childhood (Dennis & Miller Brotman, 2003; Hughes & Ensor, 2008; Hughes & Ensor, 2009; Olson et al., 2005). Underdeveloped effortful control, and in particular a reduced ability to regulate emotions like fear and anger, may contribute to later sleep problems as well (Dahl, 1996; Rothbart, 1989; Rothbart & Bates, 2006). For example, a child with low effortful control may be less able to regulate his or her reaction to a feared situation (i.e., sleeping alone) or to something that frustrates him or her (i.e., being told to go to bed) (Rothbart & Bates, 2006). It is possible that it is not the presence of disruptive behavior problems in early childhood that is a major predictor of later sleep problems. Instead, the deficits in children's early ability to regulate behavioral impulses and attention that likely underlie the development of early externalizing behavior problems may also contribute to the development of later sleep problems (Dahl, 1996).

Non-Significant Contributions of Harsh Discipline

Maternal harsh discipline at age 3 did not contribute significantly to sleep problems at age 6, although a nonsignificant trend was observed. It is possible that the harsh discipline measure used in this study did not access the 'type' of harsh discipline that contributes most to later sleep problems. For instance, verbal harsh discipline (shouting/yelling, name-calling, insulting) was not assessed. These forms of harsh discipline may be particularly relevant, especially considering the types of sleep problems in the construct and the types of responses they are likely to elicit. For example, if a child is refusing to get into bed or is whining about not

wanting to sleep without a parent, physical punishment may not be the first harsh strategy parents use. Instead they may spend time arguing with the child, which could eventually escalate into using verbal harsh discipline as bedtime is delayed and frustration rises. Had the measure encompassed a wider range of harsh, punitive parenting behaviors, it is possible that harsh discipline would have been a significant contributor to later sleep problems.

Although age 3 harsh discipline did not correlate with age 6 sleep problems in preliminary analyses, harsh discipline was tested as a potential contributor and mediator because few studies to date have directly examined the influence of harsh parenting on sleep problem development and I wanted to address that gap. Furthermore, since high levels of harsh discipline and low effortful control relate both to each other and to higher levels of externalizing behavior problems, it was important to examine whether harsh discipline influenced the overall predictive model (Lansford et al., 2011; Moilanen et al., 2010). There are a few possible explanations for my finding that harsh discipline was not a mediating influence on the relationship between early behavior problems and later sleep problems.

First, interactions between study variables may be more complex than originally thought. Since neither age 3 nor age 6 harsh discipline reports were related to age 6 sleep problems, it seems plausible that the construct did not capture the types of harsh discipline parents might use to discourage their children's disruptive bedtime behaviors (i.e., verbal harsh discipline instead of physical punishment). Additionally, the Moilanen et al. (2010) finding that parental harsh discipline only affects initial level of effortful control might suggest a different model, by which age 3 parental harsh discipline directly predicts effortful control, which then mediates the relationship between early behavior problems and later sleep problems (Moilanen et al., 2010). In light of Verhoeven et al. (2007), who found that early externalizing behaviors predicted

parental use of harsh parenting strategies later in children's lives, and other studies that found the reverse relationship (i.e., Lansford et al., 2011), it is likely that harsh discipline still relates to externalizing behaviors throughout early childhood. For example, the particular harsh parenting strategies tested in this study might have mediated or contributed to the development of behavioral problems from early sleep problems (a relationship not demonstrated in this study). In order to be a significant contributor or mediator in the early behavioral problems to later sleep problems relationship, the harsh discipline construct might have to be expanded to include other dimensions of harsh discipline besides physical punishment (i.e., Moilanen et al., 2011).

Strengths and Limitations

One of the greatest strengths of this study was that study design allowed for longitudinal examination of the mechanisms underlying sleep problem development during a developmentally important time period in which these problems emerge and often become increasingly disruptive. Additionally, most of the constructs were created using information from multiple informants or with information obtained in multiple settings (home, school, and laboratory), which helps to decrease the effects of biases often seen when using reports from a single source. Furthermore, in addition to examining the relationship between sleep and behavior problems, study design allowed a consideration of both intrachild risk factors (effortful control) and environmental risk factors (use of harsh discipline).

One of the most important limitations of this study was the reliance on maternal ratings alone as measures of child sleep problems. Scher, Epstein, Sadeh, Tirosh, and Lavie (1992) studied relationships between mother reports of toddler sleep problems and actigraphy report and found that maternal reports did not correlate with mechanically recorded readings on most of the sleep dimensions tested (i.e.,: number of night wakings, total sleep duration). It is possible that

the maternal rating of bedtime variability obtained in this study was not accurate, as this dimension is more difficult to observe and report accurately (Scher et al., 1992).

In addition, the interview based assessment of harsh discipline focused on the frequency of parents' use of physical punishment, but did not directly address the larger area of punitive discipline, such as screaming, yelling, and other deprecating behaviors. In future studies, including information about parents' use of these other types of harsh discipline would be worthwhile to increase sensitivity and accuracy of harsh discipline constructs, especially given the current lack of research looking at the effect of harsh discipline on sleep problem development.

Furthermore, because most children in the study were from intact, two-parent middle-class families, the findings of this study may not generalize as well to children growing up in other family arrangements or to children whose families struggle economically. Similarly, our sample was reflective of the local population, with parents and children primarily from European American backgrounds which may limit the generalizability of the findings to racially and ethnically diverse groups of young children. Finally, the findings may not generalize well to clinically referred children because while this study used an oversampling of children with externalizing behavior scores in the medium-high to high range, relatively few had externalizing scores in the extreme range.

Future Directions

Future analyses of this data will examine gender differences in the mechanisms underlying the development of sleep problems. Gender differences in many of the constructs in this study have been shown; for example, males have been shown to have lower effortful control abilities, higher levels of externalizing behavior problems, and have parents who use more

physical punishment than with females (Card, Stucky, Sawalani, & Little, 2008; Karreman, van Tuijl, van Aken, & Dekovic, 2009; Kochanska et al., 1997; McKee et al., 2007; Miner & Clarke-Stewart, 2008; Moilanen et al., 2010; Olson et al., 2005). The relationship between effortful control and externalizing behavior has also been shown to be inversely related for boys but unrelated for girls, and the relationship between externalizing behavior problems and parenting behaviors is stronger for boys than for girls (Chang, Olson, Sameroff, & Sexton, 2011; Karreman et al., 2009; Rothbaum & Weisz, 1994). Thus far, most longitudinal studies on sleep problems in young children have either controlled for gender (e.g. Gregory & O'Connor, 2002; Quach et al., 2009) or have not addressed the influence of gender on sleep problems.

Future analyses may also include a sleep problems construct that focuses on issues surrounding sleep continuity (i.e., night waking, trouble maintaining sleep, sleep duration). As mentioned earlier, it is possible that sleep continuity problems (especially night waking and total sleep duration) may more strongly predict later behavior problems than difficulties surrounding sleep initiation. A construct like this was not used in the current study due to the potential overlap of sleep continuity problems and medically-related sleep problems such as sleep-disordered breathing and restless leg syndrome (Gottlieb et al., 2004; Karpinski et al., 2008). In addition, study design could be improved with the addition of actigraphy to measure sleep onset time and bedtime variability, as well as an objective measure of sleep initiation problems (such as a video recording) to improve and support maternal ratings (Scher et al., 1992).

Additional research on the relationship between these risk factors and regulatory issues should consider measuring other dimensions of child temperament, as research has linked difficult temperament in infancy to higher levels of sleep problems in preschool, and children who are highly resistant to control have been shown to exhibit higher levels of both sleep and

behavior problems (Goodnight et al., 2007). Future research should also assess maternal mood, as maternal psychopathology has been shown to affect the ability of the parent to monitor bedtime routines, which may lead to higher levels of sleep problems or to inaccurate reports of sleep problems (Shang, Gau, & Soong, 2006). Moreover, differences in externalizing behavior problem development in response to structured parenting, depending on the absence or presence of maternal psychopathology, have been shown (Leve et al., 2009). Difficulty with limit setting at bedtime has also been a shown or suggested contributor to the development of early sleep problems, so the inclusion of an assessment of parenting strategies specifically surrounding bedtime and sleep may be particularly useful and informative (Bates et al., 2002; Hall et al., 2007; Johnson & McMahon, 2008).

Conclusion

A better understanding of how sleep and behavioral problems develop during early childhood, including what factors most affect the development of these problems, is of theoretical and clinical importance. The results of this study can help clinicians as they offer strategies to parents on how to better manage and improve their child's disruptive behavior and may eventually help to provide information on how to deter the development of these problems altogether. Awareness and understanding of the ways in which both child-focused risk factors and environmental risk factors affect the development of children's sleep and behavior problems may help clinicians better identify the presence of these risk factors, thus making the problems themselves easier to recognize, manage, and treat.

References

Achenbach, T. M. (1992). *Manual for the Child Behavior Checklist/2-3 and 1992 profile.* Burlington, VT: University of Vermont, Department of Psychiatry.

Achenbach, T. M. (2001). *Child Behavior Checklist for Ages 6 to 18*. Burlington, VT: University of Vermont, Research Center for Children, Youth, and Families.

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual of ASEBA preschool forms and profiles.* Burlington, VT: University of Vermont, Research Center for Children, Youth, and Families.

Ahadi, S. A., Rothbart, M. K., & Ye, R. (1993). Children's temperament in the U.S. and China: Similarities and differences. *European Journal of Personality, 7*, 359–378.

Anderson, B., Storfer-Isser, A., Taylor, H. G., Rosen, C. L., & Redline, S. (2009). Associations of executive function with sleepiness and sleep duration in adolescents. *Pediatrics, 123,* e701-e707. doi:10.1542/peds.2008-1182

Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., & Stockton, L. (2002). Sleep and adjustment in preschool children: Sleep diary reports by mothers relate to behavior reports by teachers. *Child Development, 73,* 62-74.

Bernier, A., Carlson, S. M., Bordeleua, S., & Carrier, J. (2010). Relations between physiological and cognitive regulatory systems: Infant sleep regulation and subsequent executive function. *Child Development, 81,* 1739-1752.

Brand, S., Hatzinger, M., Beck, J., & Holsboer-Traschler, E. (2009). Perceived parenting styles, personality traits and sleep patterns in adolescence. *Journal of Adolescence, 32,* 1189-1207.

Card, N., Stucky, B., Sawalani, G., & Little, T. (2008). Direct and indirect aggression during childhood and adolescence: A metaanalytic review of gender differences, intercorrelations,

and relations to maladjustment. *Child Development, 79,* 1185–1229. doi: 10.1111/j.1467-8624.2008.01184.x

Chang, H., Olson, S. L., Sameroff, A. J., & Sexton, H. R. (2011). Child effortful control as a mediator of parenting practices on externalizing behavior: Evidence for a sex-differentiated pathway across the transition from preschool to school. *Journal of Abnormal Child Psychology, 39,* 71-81. doi:10.1007/s10802-010-9437-7

Cipriano, E. A., & Stifter, C. A. Predicting preschool effortful control from toddler temperament and parenting behavior. *Journal of Applied Developmental Psychology, 31,* 221-230. doi:10.1016/j.appdev.2010.02.004

Dahl, R. E. (1996). The regulation of sleep and arousal: Development and psychopathology. *Development & Psychopathology, 8,* 3-27.

Dennis, T. A., & Miller Brotman, L. (2003). Effortful control, attention, and aggressive behavior in preschoolers at risk for conduct problems. *Annals New York Academy of Sciences, 1008,* 252-255. doi:10.1196/annals.1301.026

Dodge, K. A., Pettit, G. S., & Bates, J. E. (1994). Socialization mediators of the relation between socioeconomic status and child conduct problems. *Child Development, 65,* 649–665.

Eisenberg, N., Valiente, C., Spinrad, T. L., Cumberland, A., Liew, J., Reiser, M., ... Losoya, S. H. (2009). Longitudinal relations of children's effortful control, impulsivity, and negative emotionality to their externalizing, internalizing, and co-occurring behavior problems. *Developmental Psychology, 45,* 988-1008. doi:10.1037/a0016213

El-Sheikh, M., Kelly, R. J., Buckhalt, J. A., & Hinnant, B. J. (2010). Children's sleep and adjustment over time: The role of socioeconomic context. *Child Development, 81,* 870-883.

Fricke-Oerkermann, L., Plüch, J., Schredl, M., Heinz, K., Mitschke, A., Wiater, A., & Lehmkuhl, G. (2007). Prevalence and course of sleep problems in childhood. *Sleep, 30,* 1371-1377.

Friedman, N. P., Corley, R. P., Hewitt, J. K., & Wright, K. P. (2008). Individual differences in childhood sleep problems predict later executive control. *Sleep, 32,* 323-333.

Goodnight, J. A., Bates, J. E., Staples, A. D., Pettit, G. S., & Dodge, K. A. (2007). Temperamental resistance to control increases the association between sleep problems and externalizing behavior development. *Journal of Family Psychology, Special issue: Carpe Noctem: Sleep and Family Processes, 21,* 39-48.

Gottlieb, D. J., Chase, C., Vezina, R. M., Heeren, T. C., Corwin, M. J., Auerbach, S. H., ... Lesko, S. M. (2004). Sleep-disordered breathing symptoms are associated with poorer cognitive function in five-year-old children. *Journal of Pediatrics, 145,* 458-464. 10.1016/j.jpeds.2004.05.039.

Gregory, A., & O'Connor, T. J. (2002). Sleep problems in childhood: A longitudinal study of developmental change in association with behavioral problems. *Journal of American Academy of Child and Adolescent Psychiatry, 41,* 964-971.

Hall, W. A., Zubrick, S. R., Silburn, S. R., Parsons, D. E., & Kurinczuk, J. J. (2007). A model for predicting behavioural sleep problems in a random sample of Australian pre-schoolers. *Infant and Child Development, 16,* 509-523.

Ho, C., Bluestein, D. N., & Jenkins, J. M. (2008). Cultural differences in the relationship between parenting and children's behavior. *Developmental Psychology, 44,* 507-522. doi:10.1037/0012-1649.44.2.507

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1-55.

Hughes, C., & Ensor, R. (2006). Behavioral problems in 2-year-olds: links with individual differences in theory of mind, executive function and harsh parenting. *Journal of Child Psychology and Psychiatry, 47,* 488-497. doi:10.1111/j.1469-7610.2005.01519.x.

Hughes, C., & Ensor, R. (2008). Does executive function matter for preschoolers' problem behavior? *Journal of Abnormal Child Psychology, 36,* 1-14. doi:10.1007/s10802-007-9107-6

Hughes, C., & Ensor, R. (2009). Independence and interplay between maternal and child risk factors for preschool problem behaviors? *International Journal for Behavioral Development, 33,* 312-322. 10.1177/0165025408101274.

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

Johnson, N., & McMahon, C. (2008). Preschoolers' sleep behaviour: associations with parental hardiness, sleep-related cognitions and bedtime interactions. *Journal of Child Psychology and Psychiatry, 49,* 765-773.

Karpinski, A. C., Scullin, M. H., & Montgomery-Downs, H. E. (2008). Risk of sleep-disordered breathing and executive function in preschoolers. *Sleep Medicine, 9,* 418-424. doi:10.1016/j.sleep.2007.06.004

Karreman, A., van Tuijl, C., van Aken, M. A. G., & Dekovic, M. (2009). Predicting young children's externalizing problems interactions among effortful control, parenting, and child gender. *Merrill-Palmer Quarterly, 55,* 111-134.

Kerr, D. C. R., Lopez, N. L., Olson, S. L., & Sameroff, A. J. (2004). Parental discipline and externalizing behavior problems in early childhood: The roles of moral regulation and child gender. *Journal of Abnormal Child Psychology, 32,* 369-383.

Kline, R. B. (1998). *Principles and Practice of Structural Equation Modeling.* New York: The Guilford Press.

Kochanska, G., Murray, K., Jacques, T. Y., Koenig, A. L., & Vandegeest, K. A. (1996). Inhibitory control in young children and its role in emerging internalization. *Child Development, 67,* 490–507. doi:10.2307/1131828

Kochanska, G., Murray, K., & Coy, K. C. (1997). Inhibitory control as a contributor to conscience in childhood: From toddler to early school age. *Child Development, 68,* 263–277. doi:10.2307/1131849

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36,* 220–232.

Kochanska, G., & Aksan, N. (2006). Children's conscience and self-regulation. *Journal of Personality, 74,* 1587–1617.

Lam, J. C., Mahone, M., Mason, T. B. A., & Scharf, S. (2011). The effects of napping on cognitive function in preschoolers. *Journal of Developmental Behavioral Pediatrics, 32,* 90-97.

Lansford, J. E., Criss, M. M., Laird, R. D., Shaw, D. S., Pettit, G. S., Bates, J. E., & Dodge, K. A. (2011). Reciprocal relations between parents' physical discipline and children's externalizing behavior during middle childhood and adolescence. *Development and Psychopathology, 23,* 225-238. doi:10.1017/S0954579410000751.

Leve, L. D., Harold, G. T., Ge, X., Neiderhiser, J. M., Shaw, D., Scaramella, L. V., & Reiss, D. (2009). Structured parenting of toddlers at high versus low genetic risk: Two pathways to child problems. *Journal of the American Academy of Child & Adolescent Psychiatry, 48,* 1102-1109. doi:10.1097/CHI.0b013e3181b8bfc0

Li, S., Jin, X., Yan, C., Wu, S., Jiang, F., & Shen, X. (2009). Sleep problems in Chinese school-aged children with a parent-reported history of ADHD. *Journal of Attention Disorders, 13,* 18-26.

McKee, L., Roland, E., Coffelt, N., Olson, A. L., Forehand, R., Massari, C., ... Zens, M. S. (2007). Harsh discipline and child problem behaviors: The roles of positive parenting and gender. *Journal of Family Violence, 22,* 187-196. doi:10.1007/s10896-007-9070-6

Miner, J. L., & Clarke-Stewart, K. A. (2008). Trajectories of externalizing behavior from age 2 to age 9: Relations with gender, temperament, ethnicity, parenting, and rater. *Developmental Psychology, 44,* 771-786. doi:10.1037/0012-1649.44.3.77

Moilanen, K. L., Shaw, D. S., Gardner, F., & Wilson, M. (2010). Predictors of longitudinal growth in inhibitory control in early childhood. *Social Development, 19,* 326-347. doi:10.1111/j.1467-9507.2009.00536.x.

Morrell, J., & Cortina-Borja, M. (2002). The developmental change in strategies parents employ to settle young children to sleep, and their relationship to infant sleeping problems, as assessed by a new questionnaire: the Parental Interactive Bedtime Behaviour Scale. *Infant and Child Development, 11,* 17-41.

Murray, K. T., & Kochanska, G. (2002). Effortful control: Factor structures and the relation to externalizing and internalizing behaviors. *Journal of Abnormal Child Psychology, 30,* 503–514.

Muthén, L. K., & Muthén, B. O. (1998-2011). Mplus User's Guide. Sixth Edition. Los Angeles, CA: Muthén & Muthén.

Olson, S. L., Sameroff, A. J., Kerr, D. C. R., Lopez, N. L., & Wellman, H. M. (2005). Developmental foundations of externalizing behavior problems in young children: The role of effortful control. *Development and Psychopathology, 17,* 25-45. doi:10.10170S0954579405050029

Owens, J. A., Spirito, A., & McGuinn, M. (2000). The Children's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep, 23,* 1-9.

Paavonen, E. J., Almqvist, F., Tamminen, T., Moilanen, I., Piha, J., Räsänen, E. & Aronen, E. T. (2002). Poor sleep and psychiatric symptoms at school: An epidemiological study. *European Child & Adolescent Psychiatry, 11,* 10-17.

Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology, 12,* 427–441.

Quach, J., Hiscock, H., Canterford, L., & Wake, M. (2009). Outcomes of sleep problems over the school-transition period: Australian population longitudinal study. *Pediatrics, 123,* 1287-1292. doi:10.1542/peds.2008-1860

Raaijmakers, M. A., Smidts, D. P., Sergeant, J. A., Maassen, G. H., Posthumus, J. A., van Engleland, H., & Matthys, W. (2008). Executive functions in preschool children with aggressive behavior: Impairments in inhibitory control. *Journal of Abnormal Child Psychology, 36,* 1097-1107. doi: 10.1007/s10802-008-9235-7

Raykov, T., Tomer, A., & Nesselraode, J. R. (1991). Reporting structural equation modeling results in Psychology and Aging: Some proposed guidelines. *Psychology and Aging, 6,* 499-

503.

Reid, G. J., Hong, R. Y., & Wade, T. J. (2008). The relation between common sleep problems and emotional and behavioral problems among 2- and 3 year-olds in the context of known risk factors for psychopathology. *Journal of Sleep Research, 8,* 49-59.

Rothbart, M. K. (1989). Temperament and development. In G. A. Kohnstamm, J. E. Bates, & M. K. Rothbart (Eds), *Temperament in childhood* (pp. 187-247). New York: Wiley.

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In W. Damon (Series Ed.) and N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Social, emotional, personality development* (Vol. 3, pp. 105–176). New York: Wiley.

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In W. Damon (Series Ed.) and N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Social, emotional, personality development* (Vol. 3, pp. 99–166). New York: Wiley.

Rothbaum, F., & Weisz, J. R. (1994). Parental caregiving and child externalizing behavior in nonclinical samples: A meta-analysis. *Psychological Bulletin, 116,* 55–74.

Sadeh, A., Tikotzsky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Medicine Reviews, 14,* 89-96.

Scaramella, L. V., Neppl, T. K., Ontai, L. L., & Conger, R. D. (2008). Consequences of socioeconomic disadvantage across three generations: Parenting behavior and child externalizing problems. *Journal of Family Psychology, 22,* 725-733.

Scher, A., Epstein, R., Sadeh, A., Tirosh, E., & Lavie, P. (1992). Toddlers' sleep and temperament: Reporting bias or valid link? A research note. *Journal of Child Psychology and Psychiatry, 33,* 1294-1254. doi: 10.1111/j.1469-7610.1992.tb00943.x

Scher, A. & Blumberg, O. (1998). Night waking among 1-year olds: a study of maternal separation anxiety. *Child: Care, Health and Development, 25,* 323-334.

Shang, C., Gau, S., Soong, W. (2006). Association between childhood sleep problems and perinatal factors, parental mental distress and behavioral problems. *Journal of Sleep Research, 15*, 63-73.

Seifer, R., Sameroff, A. J., Dickstein, S., Hayden, L. C., & Schiller, M. C. (1996). Parental psychopathology and sleep variation in children. *Child & Adolescent Psychiatric Clinics of North America: Sleep Disorders, 5*, 715-727.

Sudano, J. J. (n.d.) *Structural Equation Modeling (SEM) for Dummies* [PDF document]. Retrieved from http://www.chrp.org/pdf/HSR050903.pdf

Valiente, C., Eisenberg, N., Smith, C. L., Reiser, M., Fabes, R. A., Losoya, S., ... Murphy, B. C. (2003). The relations of effortful control and reactive control to children's externalizing problems: A longitudinal assessment. *Journal of Personality, 71,* 1172-1196.

Valiente, C., Eisenberg, N., Spinrad, T. L., Reiser, M., Cumberland, A., Losoya, S. H., & Liew, J. (2006). Relations among mothers' expressivity, children's effortful control, and their problem behaviors: A four-year longitudinal study. *Emotion, 6,* 459-472. doi:10.1037/1528-3542.6.3.459

Verhoeven, M., Junger, M., van Aken, C., Dekovic, M., & van Aken, M. A. G. (2007). Parenting and children's externalizing behavior: Bidirectionality during toddlerhood. *Journal of Applied Developmental Psychology, 31,* 93-105. doi:10.1016/j.appdev.2009.09.002

Wright, J. C. (1971). *KRISP (Kansas Reflection-Impulsivity Scale for Preschoolers)*. University of Kansas, Lawrence.

Wu, P., Robinson, C. C., Yang, C., Hart, C. H., Olsen, S. F., Porter, C. L., ... Wu, X. (2002). Similarities and differences in mothers' parenting of preschoolers in China and the United States. *International Journal of Behavioral Development, 26,* 481-491. doi:10.1080/01650250143000436

Author Note

Devon Oosting, Center for Human Growth and Development, Department of Psychology, University of Michigan, Ann Arbor.

With deepest thanks to my mentors Dr. Sheryl Olson and Dr. Barbara Felt. At no point in the past three years have they stopped believing in me and supporting me, and I am indescribably grateful. I also thank Adam Grabell, who took the time to teach me something new, and most importantly, made sure I understood it. In addition, I would like to thank the University of Michigan, the Department of Psychology, Child Behavioral Health at the U-M Mott Children's Hospital, the Center for Human Growth and Development, and the University of Michigan Autism and Communication Disorders Center for providing me with invaluable research and clinical opportunities that have cultivated in me a clear and motivated direction for my future.

Please address all correspondence to: Devon Oosting, Department of Psychology, 530 Church St., Ann Arbor, MI, USA.

Table 1

Means (and standard deviations) of all variables by gender

Variable	Gender		*F*	Sig.
	Males	Females		
SES	54.97 (10.58)	53.70 (11.32)	0.79	0.37
Child IQ	21.72 (5.45)	22.34 (5.44)	0.72	0.40
Harsh Discipline T1	7.30 (7.58)	5.23 (5.82)	5.51	0.02
Effortful Control T1	3.00 (0.54)	3.29 (0.70)	12.98	0.00
Sleep Initiation T1	1.94 (0.30)	1.89 (0.22)	1.86	0.17
Externalizing Problems M [a] T1	11.84 (7.37)	11.17 (7.27)	0.49	0.48
Externalizing Problems T [b] T1	12.01 (13.80)	7.88 (10.41)	5.30	0.02
Harsh Discipline T2	4.76 (6.29)	3.34 (4.54)	2.72	0.10
Effortful Control T2	3.08 (0.85)	3.18 (0.76)	0.72	0.40
Sleep Initiation T2	1.93 (0.24)	1.86 (0.26)	2.97	0.09
Externalizing Problems T2	6.42 (6.93)	4.62 (5.11)	4.94	0.03

[a]*Note*. Mother-reported externalizing behavior problems at age 3.

[b]*Note*. Teacher-reported externalizing behavior problems at age 3.

Table 2

Means (and standard deviations) of constructs of interest by age

	Child Age			
Variable	Age 3	Age 6	*t*	Sig.
Harsh Discipline	6.70 (7.13)	4.13 (5.61)	4.99	0.00
Effortful Control	3.13 (0.60)	3.13 (0.81)	-0.03	0.98
Sleep Initiation Problems	1.93 (0.28)	1.90 (0.25)	1.39	0.17
Externalizing Behavior M[a]	11.46 (7.15)	5.57 (6.19)	12.18	0.00
Externalizing Behavior T[b, c]	9.95 (12.37)	5.36 (5.29)	5.51	0.00

[a]*Note*. Mother-reported externalizing behavior problems.

[b]*Note*. Teacher-reported externalizing behavior problems.

[c]*Note*. While the average of mother-reported and teacher-reported externalizing behavior problems at age 6 were used in analyses, the separate reports at age 3 were compared to the separate reports at age 6 in this table.

Table 3

Stability of constructs between ages

Variable	Together	Males	Females
Harsh Discipline	.40***	.37***	.44***
Effortful Control	.43***	.43***	.43***
Sleep Initiation Problems	.37***	.44***	.23*
Externalizing Behavior[a]	.39***	.42***	.33**

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

[a]*Note*. The average of mother and teacher externalizing reports was compared to T2 externalizing composite because of the similarity of correlation between mother and teacher reports and the externalizing T2 composite.

Table 4

Concurrent correlations between sleep initiation problems at age 3 and harsh discipline, effortful control, and externalizing behavior problems at age 3

Variable	Sleep Initiation Problems Age 3
Harsh Discipline T1	.25***
Effortful Control T1	-.07
Externalizing M[a] T1	.24***
Externalizing T[b] T1	.11

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

[a]*Note*. Mother-reported externalizing behavior problems at age 3.

[b]*Note*. Teacher-reported externalizing behavior problems at age 3.

Table 5

Concurrent correlations between sleep initiation problems at age 6 and harsh discipline, effortful control, and externalizing behavior problems at age 6

Variable	Sleep Initiation Problems Age 6
Harsh Discipline T2	.12
Effortful Control T2	.00
Externalizing[a] T2	.29***

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

[a]*Note*. Average of mother-reported and teacher-reported externalizing behavior reports at age 6.

Table 6

Predictive correlations between harsh discipline, effortful control, and externalizing behavior problems at age 3 and sleep initiation problems at age 6

Variable	Sleep Initiation Problems Age 6
Harsh Discipline T1	.11
Effortful Control T1	-.22**
Externalizing M[a] T1	.39***
Externalizing T[b] T1	.18*

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

[a]*Note*. Mother-reported externalizing behavior problems at age 3.

[b]*Note*. Teacher-reported externalizing behavior problems at age 3.

Table 7

Hierarchical regression analysis of sleep problems at age 3 as a predictor of externalizing behavior problems at age 6

Outcome Variables	ΔR^2	ΔF	*df*	*p*
1. Mother Externalizing T1	.14	29.82	1, 180	<.001
2. Teacher Externalizing T1	.09	20.93	1, 179	<.001
3. Sleep Problems T1	.00	0.00	1, 178	*ns*

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

Table 8

Hierarchical regression analysis of externalizing behavior problems at age 3 as a predictor of sleep problems at age 6

Outcome Variables	ΔR^2	ΔF	*df*	*p*
1. Sleep Problems T1	.11	16.51	1, 130	<.001
2. Mother Externalizing T1	.14	24.96	1, 129	<.001
3. Teacher Externalizing T1	.01	1.44	1, 128	*ns*

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

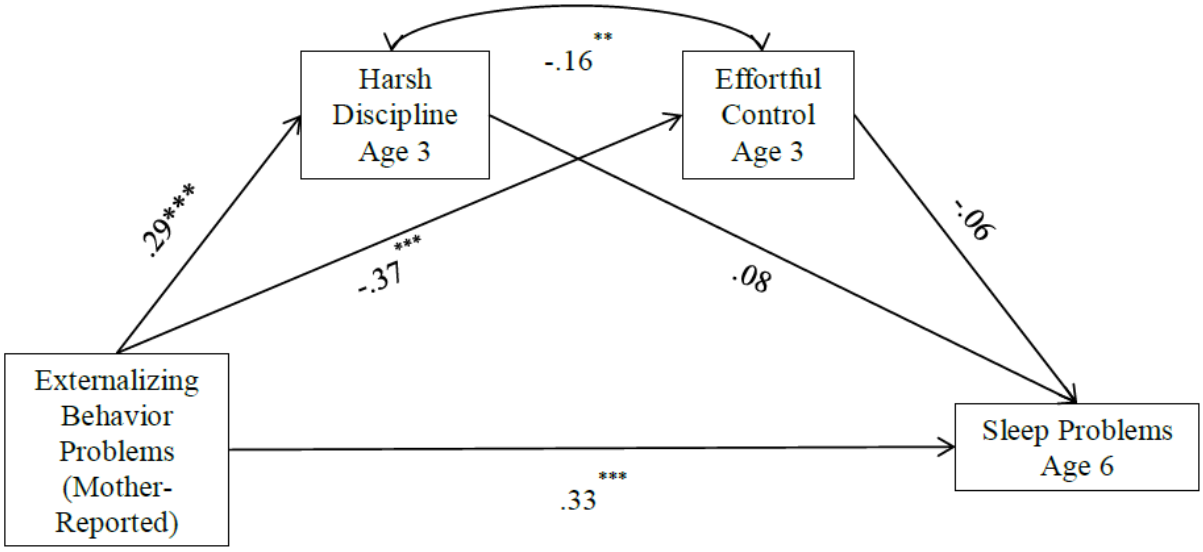

Figure 1. *Model of mother-reported externalizing behavior problems to sleep problems with harsh discipline and effortful control as mediators.*

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

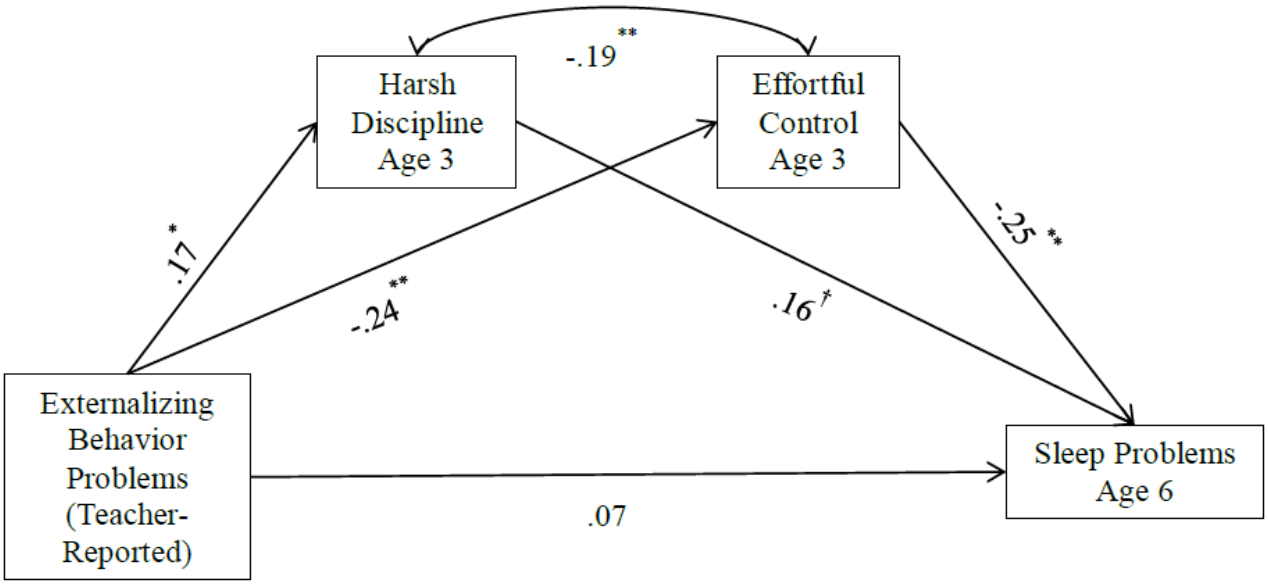

Figure 2. *Model of teacher-reported externalizing behavior problems to sleep problems with harsh discipline and effortful control as mediators.*

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