

INFANT FEEDING AND SLEEP PRACTICES AND CHILDHOOD
SYMPTOMS OF ADHD

By

Maria M. Antoshina

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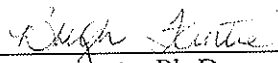
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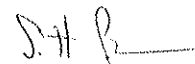
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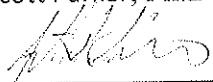
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Chair:


Bryan Fantie, Ph.D.


Scott Parker, Ph.D.


Arthur Shapiro, Ph.D.


Dean of the College of Arts and Sciences


Date

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DEDICATION

To my son, to B.S., and to all of the other little boys who need help to sleep.

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ABSTRACT

There is growing consensus that at least some subtypes of ADHD may be associated with certain sleep difficulties and that these difficulties may contribute to the symptoms of the disorder. Recent sleep research has indicated that the sleep physiology of solitary sleeping infants differs from that of infants who cosleep with an adult. This study explored the potential link between infant sleep and later ADHD symptoms using survey methodology. The relationships between various sleep arrangements in infancy, along with relevant covariates, were examined in relation to each other and to symptoms of ADHD in children ages 3 to 6. No relationship was found between sleep arrangements at birth and later ADHD symptoms, however, several significant relationships were found among the other variables. The results of this study demonstrate the complex nature of the relationships between variables known to affect the risk for ADHD symptoms.

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INTRODUCTION

According to the National Institutes of Health, Attention Deficit Hyperactivity Disorder is one of the most widespread childhood disorders (National Institutes of Health, 2008) and the US CDC currently lists ADHD as “a serious public health problem” due to its prevalence and morbidity (Division of Human Developmental, 2010). Estimates of the prevalence of all types of ADHD range from 1 to 8.6%, with boys being more than twice as likely to be affected as girls (Faraone, Sergeant, Gillberg, & Biederman, 2003; Merikangas et al., 2010). Children with ADHD experience problems with attention, hyperactivity, and impulsivity and their functioning at home and in school is severely impaired (American Psychiatric Association, 1994).

Studies that have included physiological measures have also provided evidence of disturbances in REM sleep in children with ADHD when compared to controls. Some researchers have even suggested that abnormalities in REM sleep are responsible for the restlessness and increased nighttime arousals seen in some children with ADHD (Crabtree et al., 2003; O’Brien, Holbrook, et al., 2003). Using polysomnography, O’Brien and colleagues (2003b) found reductions in REM sleep percentage (out of total sleep) and

increases in REM sleep latency in children with ADHD symptoms as opposed to controls, as well as increased periodic limb movements in sleep and decreased nighttime arousals in children with both ADHD symptoms and clinical sleep problems. In another study, O'Brien, Holbrook, et al. (2003) found that reductions in REM sleep percentage accounted for a small, but significant amount of the variance in ADHD symptoms of hyperactivity and impulsivity and increased REM latency was related to decreased attention and executive function. Gruber and colleagues (2009) conducted polysomnography in the homes of children with ADHD and also found decreases in REM sleep duration (out of total sleep time) and percentage, as well as decreased total sleep time. Conversely, another polysomnography study found increased REM sleep duration and decreased REM sleep latency coupled with a greater number of sleep cycles and increased episodes of brief movements during light (stage I and II) sleep in children with ADHD (Kirov et al., 2004).

While differing methods and definitions have led to contradictory conclusions in studies of sleep difficulties, several recent reviews have demonstrated that at least some forms of sleep disturbances are often reported in children with ADHD (Cohen- Ziona & Ancoli-Israel, 2004; Gruber, 2009; Walters, Silvestri, Zucconi, Chandrashekariah, & Konofal, 2008). Physiological data are less uniform, and reviews of the ADHD and sleep literature have concurred that, with the exception of findings of decreases in REM sleep coupled with a greater number of sleep cycles, data on sleep disturbances in ADHD from studies using polysomnography are ambiguous. On the other hand, actigraphic studies indicate that children with ADHD are more restless sleepers and that their sleep patterns

are less consistent than those of controls (Cohen- Ziona & Ancoli-Israel, 2004; Gruber, 2009; Walters et al., 2008).

A review of 47 studies published between 1980 and 2004 (children aged 3-19 years) confirmed that most studies examining nocturnal enuresis, sleepwalking, and nightmares found these difficulties were more prevalent in ADHD children. All of the reviewed studies examining sleepwalking and teeth grinding found increased incidence in children with ADHD (Cohen- Ziona & Ancoli-Israel, 2004). The results of the reviewed studies that used objective measures were less conclusive, with 3 out of 4 studies indicating greater nighttime activity in children with ADHD and most studies (6 out of 10) indicating reduced REM sleep, but no consistent evidence of other differences in sleep quality, quantity, or architecture between ADHD children and controls.

Cohen- Ziona and Ancoli-Israel concluded that ADHD is associated with some sleep difficulties, and that children with ADHD often experience abnormal daytime sleepiness, which may lead them to excessive activity as a way of maintaining alertness and thus exacerbate their behavioral difficulties. A later review by Gruber (2009) concluded that up to one third of unmedicated children with ADHD suffer from sleep onset insomnia and that different types of sleep difficulties are characteristic of different ADHD subtypes, with greater sleep disturbance found in ADHD-Combined type and greater daytime somnolence in ADHD-Inattentive.

A meta-analysis of 16 studies spanning from 1987-2008 also found differences in a number of sleep parameters between unaffected children and those diagnosed with ADHD. Children with ADHD were more likely to display bedtime resistance, sleep onset difficulties, night-waking, and difficulties with morning awakenings, as well as

experience sleep disordered breathing and daytime sleepiness compared with the controls. The combined data of nine polysomnography studies and four actigraphic studies also showed significant differences between children with ADHD and controls in sleep onset latency, sleep efficiency, true sleep time, stage shifts/hour sleep, and the occurrence of sleep disordered breathing episodes (Cortese, Faraone, Konofal, & Lecendreux, 2009).

Given this association, a key question in the etiology of ADHD becomes the exact nature of the relationship between sleep problems and the development of ADHD. There are several possible hypotheses explaining the possible relationship between ADHD and sleep problems. Several studies have posited a common genetic vulnerability affecting the Catechol-O-Methyltransferase (COMT) gene, which regulates dopamine activity, and affects the regulation of arousal, for both ADHD symptoms and sleep disorders (Bellgrove et al., 2005; Gruber, Grizenko, Schwartz, Amor, Gauthier, De Guzman, & Joober, 2006; Pálmason et al., 2010). Disturbed circadian rhythms due to phase-delay in evening melatonin release was found in some adults and children with ADHD, and there is some evidence of improvement in ADHD symptoms when this disturbance is addressed (Dahl, Pelham, & Wierson, 1991; Gruber, Grizenko, & Joober, 2007; Van der Heijden, Smits, Van Someren, & Gunning, 2005). In addition, children who lack sleep often exhibit hyperarousal and behavioral difficulties similar to ADHD symptoms. For example, a polysomnography study of 67 kindergarten children by Hatzinger and colleagues (2008) found that poor sleep was associated with higher baseline cortisol and that greater sleep efficiency was correlated with lower levels of impulsivity. Children who experience diagnosable sleep difficulties, such as sleep-disordered breathing, can

also have neuropsychological difficulties similar to ADHD (Goraya et al., 2009; Gottlieb et al., 2003; Gozal, 2008; Hill et al. 2006) and in some samples, treating sleep disordered breathing has ameliorated ADHD symptoms (Dillon et al., 2007; Huang et al., 2007; Wei, Mayo, Smith, Reese, & Weatherly, 2007).

Despite this, current evidence suggests that, in many cases of ADHD, sleep disturbance is secondary to the disorder itself. A study of electrophysiological and cognitive factors indicated that children with sleep difficulties and ADHD compose a separable group from those children with ADHD or sleep difficulties alone (Sawyer et al., 2009). Differences in periodic limb movements in sleep between children with ADHD from a community sample and those referred through a sleep clinic also point to a potentially different etiology in ADHD symptoms between those groups (O'Brian et al., 2003a). The finding by O'Brien, Holbrook, and colleagues (2003), that only mild symptoms of ADHD are correlated with sleep-disordered breathing, also supports the idea that children with ADHD alone, and those with ADHD as well as sleep disorders, constitute separate cohorts.

Thus, while it is unlikely that ADHD is caused by sleep difficulties, a substantial number of children diagnosed with ADHD may be affected by sleep disturbances, and for this subgroup, sleep difficulties may contribute to the manifestations of the disorder (Gruber, & Sadeh, 2004). For example, Touchette and colleagues (2009) attempted to elucidate the relationship between sleep disturbances and hyperactivity with a longitudinal study of sleep, beginning in infancy. As they had hypothesized, children who consistently slept ten or more hours per night were less likely to display symptoms of hyperactivity than children who slept for shorter periods. On the other hand, the

likelihood of short sleep duration among those children who were hyperactive was greater than the likelihood of hyperactivity in those who slept for shorter periods. Thus, the results also suggested that a tendency toward hyperactivity might be more likely to interfere with a child's ability to sleep than lack of sleep leading to hyperactivity.

Many of the sleep difficulties seen in children with ADHD correspond to parental behaviors concerning their children's sleep. In a large study of 4505 children, 3-years old and younger, Sadeh, Mindell, Luedtke, & Wiegand (2009) found that parental behaviors, such as bedsharing (i.e., a child sleeping in the parental bed), nursing a child back to sleep, giving a bottle at night, and roomsharing (i.e., keeping a child's crib/bed in the same room as the parental bed) were related to night waking, shorter sleep episodes, and less total nightly sleep. Sadeh and colleagues concluded that parental behaviors have a strong influence on children's sleep, however, they did not measure infant temperament, nor the reasons for parental behaviors. Because the study was cross-sectional in nature, they could not assess the consequences of parental behaviors over time, and in fact, found that the parents of the older children in the sample tended to use less active interventions in their children's sleep. Thus, it is unclear from their study whether the consequences of parental interference in young infant's sleep remain the same over time.

A similar study that compared children in Western countries to those from Asian cultures found the same relationships for Western cultures, but not for Asian cultures, where cosleeping and parental presence at bedtime are the norm (Mindell, Sadeh, Kohyama, & Howd, 2010). While parental behaviors such as nursing back to sleep were predictive of night-waking and shorter sleep episodes in both cultures, total sleep

duration was affected by parental behaviors only in Western cultures, and parental presence at bedtime was correlated with sleep location and sleep outcomes. However, because this study was cross-sectional, and included only children under 4-years old, it is unclear whether these relationships persisted into childhood. In the Touchette and colleagues (2009) study described earlier, children who were comforted outside of their own bed at the age of eighteen months were more likely to exhibit short nighttime sleep duration coupled with hyperactivity during later childhood. However, infant temperament was not considered, and it cannot be ruled out as an explanation for the relationship.

Conversely, studies that have specifically examined the influence of parental behaviors on later sleep troubles and have included a measurement of infant temperament, have generally found that correlations between parental behaviors and children's sleep difficulties are explained by parent's reactivity to pre-existing sleep difficulties in their child (Gaylor, Burnham, Goodlin-Jones, & Anders, 2005; Simard, Nielsen, Tremblay, Boivin, & Montplaisir, 2008; Zeller, 2008). Simard and colleagues (2008) investigated the relationship between parental behaviors related to sleep and sleep problems from the age of five months through six years and found that sleep fragmentation and difficulty falling asleep at five months of age were better predictors of sleep disturbances at subsequent ages than sleep-related parental behaviors. Simard and colleagues also concluded that difficult temperament in infancy was likely to be responsible for the development of sleep difficulties because their observations indicated that the parental behaviors associated with sleep difficulties, such as comforting children outside of their own beds after nighttime awakening, arose in response to prior

difficulties with sleep. Moreover, the data indicated that parental behaviors had variable effects at different times during a child's development as well as in different contexts.

Another longitudinal study that included video monitoring of infant sleep and followed children's sleep patterns from six months to four years of age reached similar conclusions with regard to parental behaviors and later sleep problems (Gaylor et al., 2005). In this study, children who coslept during their first year of life were not more likely to have sleep difficulties later, though children who roomshared with their parents at 12 months of age were more likely to awaken briefly at night at 4 years of age and to become chronic cosleepers. Gaylor and colleagues also determined that night-time waking decreased with age, while sleep onset latencies remained the same or increased and that it was children's lack of ability to self-soothe as infants, rather than parental interventions, that was related to later sleep difficulties.

In the Western world, the inability to sleep alone is itself viewed as a sleep problem, however, cosleeping, wherein the infant sleeps in close proximity to an adult caregiver, is common in most non-Western cultures, and anthropologists have suggested that it is unnatural for mammal infants to sleep alone (Latz, Wolf, & Lozoff, 1999; McKenna & McDade, 2005; Mindell et al., 2010). Mindell and colleagues (2010) found that the outcomes related to cosleeping are culture-specific, with a decreased relationship between sleep variables and sleep arrangements in cultures where cosleeping is the norm. Another study focused on differences in sleep arrangements and outcomes between young American and Japanese children (Latz et al., 1999). While cosleeping was related to night-waking in both countries, in the US sample, where cosleeping is frowned upon, sleep struggles and stressful sleep problems were both more common and were related to

cosleeping. Japanese children, where cultural beliefs encourage adult body contact with their children at night, experienced fewer sleep difficulties overall, and the rates of night waking were comparable to those of solitary-sleeping US children. The authors noted that because cosleeping and night-waking are seen as abnormal in the US, their occurrence leads to greater nighttime disruption for US parents and children (who are often transferred from one bed or room to another), and this disruption leads to sleep difficulties. In Japan, night-waking is dealt with quickly and easily due to the proximity of the mother, and thus, does not lead to major disruptions in sleep or routine. Similarly, the findings of a longitudinal Swiss study (Jenni, Fuhrer, Iglowstein, Molinari, & Largo, 2005) also indicated that cosleeping with young infants was not related to cosleeping in later childhood, despite finding that the incidence of cosleeping increased among older children. There is also some evidence of a lower incidence of sleep disturbances in adulthood in cultures where cosleeping is the norm (McKenna, & McDade, 2005; Worthman, & Brown, 2007). Thus, recent research has suggested the interesting possibility that co-sleeping with infants may, in fact, decrease the likelihood of sleep difficulties in later childhood (McKenna, Ball, & Gettler, 2007).

A number of studies have found differences in infant physiology and sleep architecture between bedsharing and solitary sleeping infants. A study comparing bedsharing to solitary sleeping infants found that bedsharing infants woke more frequently during the night, but slept the same amount as solitary sleeping infants due to briefer awakenings (Mao, Burnham, Goodlin-Jones, Gaylor, & Anders, 2004). Infants also have a lower heart rate when sleeping alone than when sleeping with their mothers,

and this effect is likely due to the added body heat of the mother because heart rate is correlated with body temperature (Richard & Mosko, 2004).

There are also differences between bedsharing and solitary sleeping infants in the duration of sleep phases and the pattern of awakenings, some of which are contingent upon typical sleep arrangement, (Mosko, Richard, & McKenna, 1997a; Richard, Mosko, & McKenna, 1998). A high level of synchrony between maternal and infant awakenings and sleep patterns is demonstrated in bedsharing mother-infant pairs, implying that bedsharing mothers and infants influence each-other's physiology (Mosko, Richard, & McKenna, 1997b). Bedsharing has also been shown to facilitate breastfeeding frequency and may exert an effect on infant development through this relationship (Hauck, Signore, Fein, & Raju, 2008; McKenna, Mosko, & Richard, 1997; Norton, Karrisa, & Grellner, 2010). It is therefore possible that early bedsharing could induce changes in infant physiology that could affect sleep patterns in later childhood.

With regard to ADHD, it is possible that sleep arrangements in early infancy could affect either children's emotional development or sleep physiology in a way that alters the potential to develop sleep difficulties and symptoms of ADHD subsequent to such difficulties. While children with ADHD often have a number of sleep disturbances, one study found that they slept alone as often as controls (O'Brian et al., 2003b). However, Gruber and colleagues (2009) found increased sleep anxiety (i.e., needing a parent in the room to sleep or fear of the dark) in children with ADHD. Studies have also previously linked such factors as maternal warmth to the likelihood of a child developing ADHD symptoms (Silverman, & Ragusa, 1992; Sonuga-Barke et al., 2008; Tully, Arseneault, Caspi, Moffitt, & Morgan, 2004), and a study by Rodriguez and colleagues

(2005) linked maternal responsivity during stressful situations in infancy to children's ability to sustain attention and focus. It is possible that due to the increased responsivity of bedsharing mothers, cosleeping children may experience greater feelings of security than those who sleep alone and this, in turn, may influence their attitude toward sleep. For example, bedtime resistance is a common occurrence in children with ADHD (Corkum, Moldofsky, Hogg-Johnson, Humphries, & Tannock, 1999), but children who cosleep are less likely to resist going to bed. Given the physiological differences found between bedsharing and solitary sleeping infants (Mosko, Richard, & McKenna, 1997a; Richard & Mosko, 2004; Richard, Mosko, & McKenna, 1998), it is also possible that the physiological effects of sleeping alone could lead to sleep difficulties in vulnerable children. Bedsharing could also exert an effect on ADHD symptoms through its role in facilitating breastfeeding, as there is some evidence of a link between extended breastfeeding and ADHD symptoms (Julvez et al., 2007). Given the relationship between ADHD symptoms and obstructive sleep apneas (Goraya et al., 2009; Gottlieb et al., 2003; Gozal, 2008; Hill et al. 2006), it is also noteworthy that bedsharing decreases the occurrence of obstructive sleep apneas in infants (Gozal, 2008).

The goal of the current study is to investigate whether a relationship exists between various sleep arrangements in infancy and symptoms of ADHD during later childhood. Three important aspects of this study are: First, the differentiation of the effects of reactive cosleeping due to infant temperament from cosleeping, which is irrespective of temperament; Second, the recognition of the relationship between cosleeping and increased breastfeeding; and Third, the inclusion of other variables that may moderate any observed relationships. As discussed previously, it is likely that

reactive cosleeping occurs in response to pre-existing difficulties with self-regulation in some infants, and it is this difficulty, rather than the parental behavior, that is responsible for later sleep difficulties. Thus, the reason behind cosleeping is itself an important modifier of any observed relationships between sleeping arrangements and later behaviors.

I used several variables to differentiate reactive and non-reactive cosleeping. I asked survey respondents about the ages at which they used various sleeping arrangements and whether difficulty sleeping in a particular arrangement (alone vs. with others) was the reason behind decisions to begin or end a particular arrangement. I also asked about their child's temperament during infancy.

Another factor that received considerable attention in this study is breastfeeding. Breastfeeding causes a hormonal cascade in both infants and their mothers and thus exerts a significant influence on the physiology of both. Since increased proximity to the mother is known to promote breastfeeding, it is possible that the physiological effects of bedsharing (or cosleeping) are actually due to higher breastfeeding frequency. It was also unknown whether the timing of breastfeeding (day vs. night) influences sleep and/or later behaviors. To this end, breastfeeding during the day was differentiated from breastfeeding at night. On the other hand, physical proximity to others during sleep has physiological effects that are independent of breastfeeding (Richard & Mosko, 2004), and it may be the case that these effects are also significant contributors to the differential sleep patterns found in solitary vs. cosleeping infants. To address the effect of physical proximity as a separate factor, I assessed various degrees of physical proximity (i.e., bedsharing, cosleeping, roomsharing, solitary in a separate room) during sleep.

It is also possible that previously uncovered relationships between breastfeeding and childhood outcomes are due to increased time and attention between mothers and their infants rather than the act of breastfeeding *per se*. This study differentiated these influences by asking about bottle feeding, including feeding breastmilk, as a separate category, and by asking about whether the mother conducted the bottle feeding herself.

A number of other factors are also known to affect both ADHD risk and cosleeping (Lozoff, Wolf, & Davis, 1984; Romano, Tremblay, Farhat & Cote, 2006; Schacter, Fuchs, Bijur, & Stone, 1989; Willinger, Ko, Hoffman, Kessler & Corwin, 2003). Thus, gender, maternal smoking, socio-economic status, and ethnicity were among the factors that were included. Finally, family history of ADHD and sleep apnea were included as proxies for potential genetic vulnerabilities, which may interact with the environmental factors assessed.

METHOD

Participants

Ninety-four participants responded to the recruitment advertisements (included in Appendix A) and agreed to take part in the survey. Of these initial respondents, 5 did not complete the initial eligibility questions, 12 discontinued the survey because they were not residents of the US, 2 discontinued the survey because their child was born prematurely, and 6 discontinued because the mother's usual sleep period was not at night. Of the 69 remaining participants, I removed data from 8 due to the child's age not fitting the study criteria, a further 6 failed to complete the entire survey, and I did not include data from 5 more due to the children having diagnosable disorders other than ADHD. The final sample consisted of 50 participants, with 49 (98%) of the respondents being the biological mothers of the children asked about in the survey and one being the biological father (2%). The children included in the final sample included 34 (68%) boys and 16 (32%) girls with an age range from 3 to 6.83 years ($m=4.43$ years). The sample tended toward higher income, educated, white families, with 47 (94%) of the children described as non-Hispanic white, 44 (88%) having at least one parent with a college degree, and 25 (50%) coming from families with incomes above \$100k per year as opposed to 7 (15.2%) from families with incomes of \$25K per year or less. Forty-three (86%) of the children's biological parents were married, and 47 (94%) of the children's biological

parents were living together. The mothers' ages at the birth of the child ranged from 19 to 42 years ($m=30$ years), 5 (10%) of the mothers smoked during their pregnancy, and 8 (16%) smoked during the child's first year. Thirty-eight (76%) of the children had no family history of ADHD, 5 (10%) had an aunt, uncle, cousin, or grandparent with ADHD, 7 (14%) had at least one parent with ADHD, and 5 (10%) had at least one parent as well as another relative with ADHD. Nine children (18%) were reported to have frequent difficulty sleeping and two (4%) of the children had been diagnosed with ADHD.

Design

I collected data over the course of three months via an anonymous interactive online survey using the Survey Monkey service (SurveyMonkey.com, LLC. (1999-2011)). I recruited potential participants via discussion groups on various parenting websites, parenting-related Facebook pages, and ADHD-related websites (a list of websites used for recruitment is included in Appendix B). Parents of children aged 3 to 6 years of age clicked on a provided link to be directed to the Survey Monkey website (http://www.surveymonkey.com/s/Infant_Feeding-Sleep_Practices_Hyperactivity) to access the survey and then provided informed consent by clicking on either an "agree" button or a button labeled "I do not wish to complete this survey."

Those who agreed to take part in the survey answered a series of required questions to determine eligibility to take part in the study. Respondents were considered ineligible to participate if they resided outside of the US, were not related to the child referred to in the questions, if the child in question was born prematurely (before 37-

weeks gestation), or if the mother's major sleep period did not occur at night. If an answer from a potential participant indicated that she was not eligible to participate in the study, the participant was redirected to a discontinue page and no further data were collected from her. Furthermore, I removed data from participants whose child was younger or older than the stated age limits, and from those whose child had a diagnosable disorder other than ADHD.

People with multiple children who fit the age criteria could complete separate surveys for each child. For those who fit eligibility criteria, the survey required between 10 and 30 minutes and could be completed over multiple sessions. The survey was anonymous and no identifying information was collected. This study was approved by the Institutional Review Board of American University.

Measures

I created a questionnaire measuring the variables of interest specifically for this study. Questions included those screening for eligibility to participate, demographic questions, questions pertaining to factors previously found to be associated with ADHD, questions about the child's temperament and about how the child was cared for during infancy (a summary of the questionnaire is included in Appendix C and the entire questionnaire is included in Appendix D).

The final section of the survey assessed the child's current behaviors and ADHD symptoms. Questions to assess ADHD symptoms were based on DSM-IV diagnostic criteria (American Psychiatric Association, 1994) and asked about the frequency of the occurrence of each behavior using the answer choices "Yes, often", "Yes, sometimes",

and “No, rarely or never”. A question about the degree of difficulty caused by these behaviors was also included. This format is similar to that of other widely used measures such as the Conners Rating Scale (Conners, 1997) and Chervin’s Inattention and Hyperactivity Scale (Chervin et al., 2002).

DATA ANALYSIS

I gave all nominal answer choices numerical designations. I used a sliding scale of 0-3 to indicate degree of family history of ADHD. I coded frequency or extent of a behavior with numerical designations of 0-2. These values were adjusted to half ($1=.5$, $2=1$) of their magnitude for several instances where questions were combined to assess a single DSM-IV symptom. In those cases, the sum of the two questions pertaining to a single symptom was used in the calculation of total ADHD symptoms. I summed the individual scores on the six questions that ask about the occurrence of DSM-IV hyperactivity symptoms to obtain the Hyperactivity score, and the individual scores on all of the DSM-IV symptoms questions to obtain the total ADHD symptom score. I computed the Kendall Tau-b correlations between 23 of the variables using SPSS 19 and used the Wessa.net (Wessa, 2011) online statistical software to perform the Wicoxon rank sum tests.

RESULTS

I computed Kendall Tau-b correlation coefficients to explore the relationships between 23 of the variables of greatest interest, resulting in 253 comparisons. The level of significance was set at .01 to account for the number of comparisons being made. Table 1 and Table 2 display strong, moderate, and weak correlations that were statistically significant. Appendix E lists all other comparisons that I did. As expected, there were strong positive correlations between all of the infant feeding variables. Duration of daytime breastfeeding was related to duration of nighttime breastfeeding ($\tau_b = .882$, $p < .001$, $N = 50$), indicating that mothers who breastfed their children typically continued to do so both day and night. The age at weaning was thus related to both the duration of daytime breastfeeding ($\tau_b = .798$, $p < .001$, $N = 50$) and the duration of night nursing ($\tau_b = .756$, $p < .001$, $N = 50$). Another strong correlation that emerged was between difficult temperament in infancy and age at the start of routine cosleeping ($\tau_b = .791$, $p = .003$, $n = 14$). Children whose parents rated them as having a difficult temperament when they were babies were more likely to have begun to cosleep earlier.

Table 1

Significant Positive Correlations

	Kendall's tau b	p	N
<u>Strong Correlations</u>			
Duration of daytime breastfeeding vs. duration night nursing	0.882	<.001	50
Duration of daytime breastfeeding vs. age at weaning	0.798	<.001	50
Difficult temperament in infancy vs. age at start of routine cosleeping	0.791	.003	14
Duration of night nursing vs. age at weaning	0.756	<.001	50
<u>Moderate Correlations</u>			
Duration of daytime breastfeeding vs. age at first bottle	0.519	<.001	50
Duration of night nursing vs. age at first bottle	0.486	<.001	50
Age at weaning vs. age at first bottle	0.457	<.001	50
Age at start of routine bedsharing vs. age at start of television viewing	0.450	.012	24
Current difficulty sleeping vs. symptoms of hyperactivity	0.413	<.001	50
<u>Weak Correlations</u>			
Age at start of solitary sleep vs. age at weaning	0.369	.001	44
Current difficulty sleeping vs. ADHD symptoms	0.334	.004	50
Age at start of solitary sleep vs. duration of night nursing	0.334	.003	44
Age at start of solitary sleep vs. duration of daytime breastfeeding	0.305	.006	44

Note: All ages and durations are in months.

Table 2

Significant Negative Correlations

	Strength	Kendall's tau b	p	N
Family history of ADHD vs. age at sleep training	Moderate	-0.549	.004	21
Family income (K) vs. age at start of solitary sleep	Weak	-0.359	.003	40

Note. Ages are in months.

I found moderate positive correlations between the age at which a child was first bottle fed and the durations of daytime ($\tau_b = 0.519$, $p < .001$, $N = 50$), and nighttime ($\tau_b = .486$, $p < .001$, $N = 50$) breastfeeding as well as with the age at weaning ($\tau_b = .457$, $p < .001$, $N = 50$). The later a bottle was introduced, the longer the nursing relationship continued. I also found three moderate correlations pertaining to sleep variables. Children with more symptoms of hyperactivity had greater difficulty sleeping ($\tau_b = .413$, $P < .001$, $N = 50$) and children with a family history of ADHD had been sleep trained earlier than those without ($\tau_b = -.549$, $p = .004$, $N = 21$). Interestingly, the age at which a child began to watch television was related to the age at which bedsharing began ($\tau_b = .45$, $p = .012$, $N = 24$) with earlier television viewing among early bedsharers.

Several weak correlations were also uncovered. Having a higher family income was weakly, but significantly correlated with younger age at the start of solitary sleep ($\tau_b = -0.359$, $p = .003$, $N = 40$). The age at which a child began to solitary sleep was also weakly related to the age at total weaning ($\tau_b = .369$, $p = .001$, $N = 44$), and to the ages at night weaning ($\tau_b = .334$, $p = .003$, $N = 44$) and day weaning ($\tau_b = .305$, $p = .006$, $N = 44$) separately.

Thus, children who began to sleep alone earlier were also breastfed for a shorter duration. Current difficulty sleeping and ADHD symptoms were also related ($\tau_b=.334$, $p=.004$, $N=50$), with children who had more symptoms of ADHD having greater difficulty sleeping.

I conducted Wilcoxon rank sum tests to test the hypothesis of a differential effect of early sleep arrangements on the development of sleep problems and ADHD. The ratings of ADHD symptoms and current sleep difficulties were compared between those who bedshared from birth, those who coslept from birth, and those who slept alone in a separate room from birth. There were no significant differences between groups, indicating no effect of initial sleep arrangement on later outcomes.

DISCUSSION

To my knowledge, this study was the first to attempt to examine the potential relationships between parenting practices during early infancy and later symptoms of ADHD. Despite having few participants, several potential relationships that deserve further investigation were revealed.

As expected, there was a high level of intercorrelation among the breastfeeding variables, with mothers tending to maintain breastfeeding both day and night until completely weaning their child. Earlier introduction of bottle feeding was also related to earlier weaning, indicating that parents generally did not use multiple feeding methods. This could be due to parents changing feeding methods due to returning to work and finding it too difficult to continue to breastfeed, or feeling overwhelmed by the time and effort required to breastfeed or due to a decreased milk supply following introduction of supplementation.

The results of this study also coincide with previous findings that parental behaviors, such as bedsharing, arise in response to difficulties in children (Simard et al. 2008). Children who were rated by their parents as having a difficult temperament in infancy tended to begin routinely cosleeping at earlier ages than those who had been more easy infants. On the other hand, relationships between both occasional and routine bedsharing and sleep difficulties and behavior variables did not reach statistical

significance. This lack of findings could be due to a lack of power due to low numbers of participants in each sleep group, as well as to greater variability in the reasons for bedsharing from birth. For example, among bedsharers, the age when bedsharing commenced coincided with parental recollections of the beginning of sleep difficulties in the child in 12 of 24 bedsharers and the decision to bedshare was attributed to the child's sleep problems by 14 of the bedsharing parents. Despite this, the correlation between difficulty sleeping and bedsharing was not significant.

Inspection of the data revealed that among those who bedshared and had sleep difficulty during infancy, most had begun to bedshare in response to sleep difficulty, but there were also 9 bedsharers who chose this sleeping arrangement without the presence of sleep difficulty. For these families, bedsharing was likely chosen to facilitate breastfeeding, as previous research has shown breastfeeding to be one of the common reasons for bedsharing (Hauck, 2008). In fact, breastfeeding mothers who bedshare get more sleep per night, and feel less tired, than those who sleep separately from their infants (Mosko et al., 1997b). In the current study, indirect evidence of the supportive effect of bedsharing/cosleeping on breastfeeding comes from the relationship between solitary sleep and feeding variables. Beginning to sleep alone at an earlier age was related to a shorter duration of both daytime and nighttime nursing as well as to earlier weaning. There was also direct evidence of a potential relationship between sleep arrangements and breastfeeding in this study, though the correlations between the variables did not reach a level of statistical significance.

It is also possible that mothers felt the need to both wean their child and move them to solitary sleeping due to their need to be well rested or due to returning to work. A

finding that seems to support the latter explanation is that families with a higher income tended to have children who slept alone at earlier ages.

Relationships were also uncovered between behavioral difficulties and other variables. Children who had greater current difficulty sleeping also had more symptoms of ADHD and an even stronger relationship was found between sleep difficulty and hyperactivity. This corresponds to previous reports of increased sleep difficulty in ADHD and provides additional support for Gruber's proposition that sleep difficulties could differentiate subtypes of ADHD (Cohen- Ziona & Ancoli-Israel, 2004; Gruber, 2009; Walters, 2008). Another interesting finding is that children with a family history of ADHD were sleep trained at younger ages. This was especially true for those who had a parent diagnosed with ADHD, perhaps indicating a difficulty with the disturbed sleep that may occur when sleeping in close proximity to the child for the parents of ADHD children. Thus, parents who have ADHD may respond differently to the sleep patterns of their child, and this may, in turn, affect the development of potential sleep difficulties in the child.

There was no evidence of a protective effect of early bedsharing on the development of sleep difficulties, nor ADHD symptoms. However, the fact that only eight families placed their newborn infants in separate rooms to sleep at night greatly limited the power to detect differences between the groups. It is also notable that respondents never chose difficulty sleeping with others present as a reason for placing a baby to sleep alone in a separate room. Thus, parents whose children have difficulties with sleep responded by instituting some form of sleep sharing, while those whose children are good sleepers can use either a sleep sharing-arrangement or solitary sleep.

The significant relationship found between early bedsharing and early television viewing is another important finding as it may also influence the relationship between symptoms of ADHD and bedsharing. People with television sets in their bedrooms may watch television before or after going to sleep for the night, which may expose their bedsharing young children to the impact of early television viewing. Some studies have found that early television viewing is related to attentional difficulties (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004), and thus early exposure to television could mediate any relationships found between bedsharing and later difficulties with attention. Any future studies on sleep arrangements and ADHD should include television viewing and activity levels as covariates.

The trends uncovered in this study corroborate the notion of a relationship between sleep difficulty and hyperactivity and symptoms of ADHD. However, taken together with previous research, the findings of this study support the hypothesis that pre-existing physiological differences drive the sleep difficulties that some ADHD children experience and that parental behaviors have little impact on the development of sleep difficulties or ADHD symptoms. The results of this study also demonstrate a number of relationships between extraneous variables that should be considered in further research on the subject of infant care and later behaviors.

This study had a number of limitations. The main limitation of the study was the unexpectedly low final sample size, which greatly reduced the study power. The low sample size precluded the use of the originally planned analysis and a Bonferroni correction. Due to the large number of comparisons undertaken and increased chance of a type I error, the results of this study should be viewed as tentative and exploratory.

Additionally, there were a number of moderate and weak correlations that did not reach statistical significance. While some of these are likely to be spurious findings, the correspondence of several of these correlations to the findings of previous research imply that they could reach statistical significance within a larger sample. Thus, there may be further relationships between variables explored in this study that were not discovered, and that deserve further exploration.

Another important limitation was the retrospective nature of the survey questions concerning early parenting practices. Respondents were asked to estimate retrospectively the ages their child initiated and/or stopped behaviors, and the accuracy of their recollections is uncertain. The fact that many parents experience stress and sleep deprivation themselves during their child's early life further decreases the precision of their estimates. The parents of children who have difficult temperaments, or difficulty sleeping, may be especially likely to experience stress and sleep deprivation. It is also likely that a child's current behaviors and habits influenced the parents' perception of the child's early life. A high number of current problematic behaviors may have had an especially significant influence on parental assessments of a child's early temperament and reasons behind decisions concerning sleep. A correlation that was statistically insignificant, between the child's current age and parental ratings of difficult temperament in infancy, may be an indication of such a bias. On the other hand, it may also be an artifact due to sample bias since, in this sample, children who were older tended to have a more extensive family history of ADHD.

A further limitation was the self-selecting nature of participant recruitment and internet-based research, which resulted in a sample biased toward White, better educated,

higher-income respondents. Ethnicity and parental education were left out of data analysis and the limited impact of income in this study was likely due to the lack of variability in these demographic variables. However, previous research that has used online survey methodology has had similar demographic characteristics of participants and has found that results are comparable to those collected via traditional methods (Sadeh et al., 2009). Moreover, use of the internet usually allows for a larger, more geographically distributed sample. The fact that more children bedshared from birth than slept alone in this sample is surprising given previous findings of a relationship between bedsharing and having lower SES or ethnicities other than Caucasians (Lozoff et al., 1984; Schachter et al., 1989; Willinger et al., 2003). However, contrary to past studies and similar to these data, recent studies on infant sleep patterns have demonstrated a trend toward increased bedsharing among whites due to a national drive to increase the rate and duration of breastfeeding (Hauck et al., 2008). On the other hand, the finding of a weak negative association between income and the age at which a child began to sleep alone is in line with previous findings.

Coupled with prior research, the results of this study indicate a need for further investigation of the influence of parental behaviors during early life on later behaviors. Longitudinal studies that follow children's experiences and behaviors from birth through childhood should be undertaken to increase the accuracy of measurements, and large samples should be used to allow for an accurate assessment of the interrelationships and relative influence of variables on outcome measures.

APPENDIX A
RECRUITMENT ADVERTISEMENT

Please contribute to the study of child development and help a graduate student complete her degree. If you are the parent of a child age 3-6 years, please complete the Feeding and Sleep Practices in Infancy and Hyperactivity survey. It is completely anonymous and takes 30 minutes or less, and can be completed over multiple sessions. You will be asked about your child's current behavior, and about how your child slept and was fed during infancy, as well as about your family's demographic characteristics. If you would like to participate, please click this link: http://www.surveymonkey.com/s/Infant_Feeding-Sleep_Practices_Hyperactivity

APPENDIX B
WEBSITES USED FOR RECRUITMENT

ADHD:
<http://www.facebook.com/profile.php?id=1050083417#!/pages/ADHD/104589312913751>

ADHD Aware: <http://www.facebook.com/#!/pages/ADHD-Aware/89574315351>

ADDitudeMag.com: <http://www.facebook.com/additudemag>

Ask Dr. Sears: <http://www.facebook.com/profile.php?id=1050083417#!/askdrsears>

Attachment Parenting: <http://www.facebook.com/#!/pages/Attachment-Parenting/20646286418>

Child-Psych.org - Child Psychology and Parenting Research:
<http://www.facebook.com/#!/pages/Child-Psychorg-Child-Psychology-and-Parenting-Research/61410998945>

Children & Adults with Attention-Deficit/Hyperactivity Disorder:
<http://www.facebook.com/chadd.org>

Co-Sleeping Makes Breastfeeding Possible: <http://www.facebook.com/#!/pages/Co-Sleeping-Makes-Breastfeeding-Possible/79759508684>

Kids with ADHD are not just naughty kids!: <http://www.facebook.com/#!/pages/Kids-with-ADHD-are-not-just-naughty-kids/257176424663>

National Resource Center on AD/HD: A Program of CHADD:
<http://www.facebook.com/profile.php?id=1050083417#!/help4adhd.org>

Parenting.com : <http://www.facebook.com/#!/Parenting>

Parents Magazine:
<http://www.facebook.com/profile.php?id=1050083417#!/parentsmagazine>

Peaceful parenting: <http://www.facebook.com/#!/peacefulparenting>

PsychCentral.com: <http://www.facebook.com/profile.php?id=1050083417#!/psychcentral>

APPENDIX C

QUESTIONNAIRE SUMMARY

Eligibility questions:

- whether the respondent currently resides in the US
- nature of respondent's relationship to the child about whom they would be responding
- whether the child was born premature
- whether the mother's major sleep period occurred during the night (between 7 in the evening and 7 in the morning).
- whether the child had been diagnosed with ADHD or any other developmental disorders or delays

Demographic questions about the child:

- age
- gender
- race/ethnicity

Demographic questions about the child's family:

- Income
- parental education
- parental marital status
- mother's age at the child's birth
- parental living arrangement

Factors that could affect the variables of interest:

- maternal smoking
- family history of ADHD
- family history of sleep apnea
- stressors the child has experienced
- early overnight separations from the mother
- television viewing
- current sleep difficulties
- sleep apnea
- current amount of physical activity

Questions about the child's infancy:

- whether the child had colic
- whether the child had a difficult temperament
- age at which the child began to walk

Questions about breastfeeding:

- duration of exclusive breastfeeding
- daytime and nighttime nursing
- age at weaning
- age at initiation of bottle feeding

Questions about bottlefeeding:

- who bottlefed the child during the night
- duration of nighttime bottle feeding

Questions about sleeping arrangements: For each sleep variable below,

respondents were asked about the child's age at initiation and discontinuation of the sleep arrangement, whether difficulty sleeping was the reason behind the initiation/change in a particular sleep arrangement, about the average sleep onset latency with that sleep arrangement and about what family members participated in sleeping arrangements other than solitary sleep.

- routine bedsharing, defined as "sleep in the parents' bed with at least one parent, for at least 4 hours per night at least 5 days per week"

- occasional bedsharing, defined as “sleep in the parents’ bed with at least one parent, for at least 4 hours, more often than 1 day per week”.
- Cosleeping, defined as sleeping next to the mother but on a different sleep surface at least 4 hours per night at least 5 days per week
- roomsharing was defined as “sleep in the same room, but on a completely separate sleep surface”
- solitary sleep, defined as sleeping alone in a separate room
- use of sleep training methods that involved periods of allowing the child to cry (CIO)

Questions about current behaviors: Based on DSM-IV symptoms

APPENDIX D

SURVEY QUESTIONS

Instructions: Your help is needed in determining whether there is a relationship between certain experiences during infancy and toddlerhood and certain behaviors and personality traits during later childhood. Please take part in this survey if you reside in the United States of America and are the parent of a child between the ages of 3 and 6 years old. Please answer the questions on the following pages of the survey about one of your children who is between the ages of 3 and 6 years old. If there is more than one child between the ages of 3 and 6 in your family, you may complete a separate survey for each child. Many of the questions will deal with your child's early life, and some ask about your child's age during a particular event. Please answer each question as well as you can. If you do not remember the exact ages that the question asks about, please give an estimate. Depending on your answers, you may be directed to different pages in the survey to answer follow-up questions. This survey is completely anonymous. You will not be asked for any identifying information or for any way to contact you. If you have any questions or concerns, please contact Maria Antoshina at bfsleepstudy@yahoo.com

Thank you for your time!

3. Residency

1. Do you currently live in the United States of America?

Yes

No

4. Relationship

1. Are you the biological parent of this child?

Yes, I am this child's biological mother

Yes, I am this child's biological father

No, I am this child's biological relative (grandparent, aunt, uncle, sibling)

No, I adopted this child

No, I am not related to this child and I did not adopt him/her

6. Adoption Question

1. How old was this child (in years and months) when
he/she was adopted by you?

Years

Months

5. Birth

1. Was this child born premature (before 37 weeks gestation)?

No

Yes

7. Sleep Period

1. Was this child's mother's major sleep period during night time (between 7 in
the evening and 7 in the morning)?

Yes

No

8. Demographic Information

The questions on this page ask about this child's family.

1. How old is this child?

Years

Months

2. What is this child's sex?

Male

Female

3. This child's race/ethnicity - please choose the category that best describes this child.

Non-Hispanic Black / African American

Non-Hispanic White

Hispanic

Asian

Other

4. What is the highest level of education this child's mother has attained?

Did not finish high school

High school

Some college

Associate or 2 year college degree

Bachelors or 4 year college degree

Master's degree

Doctorate or professional degree

5. What is the highest level of education this child's father has attained?

Did not finish high school

High school

Some college

Associate or 2 year college degree

Bachelors or 4 year college degree

Master's degree

Doctorate or professional degree

6. Income- Please choose how much this child's family earns per year.

Less than \$15K

\$26-50K

\$51-\$75K

\$76-\$100K

\$101-\$150K

greater than \$150

Prefer not to answer

7. Did the mother of this child smoke during her pregnancy with this child?

Yes

No

8. Did the mother of this child smoke during the child's first two years of life?

Yes

No

9. How old was this child's mother at the time of this child's birth?

Years

10. Are the biological parents of this child married to each other?

Yes

No

11. Do the biological parents of this child currently live together?

Yes

No

12. Was this child raised by a single parent at any time during his or her life?

Yes

No

13. Does this child have any first-degree relatives (parents, grandparents, siblings, aunts, uncles, cousins) who have been diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD)? If there is more than one relative with ADHD, please choose all answers that apply.

No

Yes: parent

Yes: grandparent

Yes: sibling (brother or sister)

Yes: aunt and/or uncle and/or cousin

14. Does this child have a sibling (brother or sister) who has been diagnosed with sleep apnea?

Yes

No

9. Life Events

The questions on this page ask about certain events in your child's life.

1. Has this child experienced an illness or accident in his/her family that caused the child to be very upset?

Yes

No

2. Has this child experienced a change in living arrangements (such as a move to a new house) that caused the child to be very upset?

Yes

No

3. Have this child's parents experienced marital/relationship problems that caused the child to be very upset?

Yes

No

4. Has this child experienced an overnight separation from his/her mother during the child's first year of life (from age 0 to 12 months)? Include child's or mother's hospital stays, vacations, travel for work, ect.

Yes

10. Separations I -Length

1. How many overnight separations from the mother did this child experience during the first year of life?

2. What was the length of the separation in nights? If there were multiple separations, please indicate the total length of all separations combined.

No

10. Life events- Separation II

The questions on this page ask about certain events in your child's life.

1. Has this child experienced an overnight separation from his/her mother during the child's second year of life (from age 12 to 24 months)? Include child's or mother's hospital stays, vacations, travel for work, ect.

Yes

12. Separations II-Length

1. How many overnight separations from the mother did this child experience during the second year of life?

2. What was the length of the separation in nights? If there were multiple separations, please indicate the total length of all separations combined.

No

13. Breastfeeding Questions

Questions on breastfeeding methods and duration.

1. Was this child ever breastfed?

Yes

14. Breastfeeding Questions II

Questions on breastfeeding methods and duration.

1. How long (in months) was this child exclusively breastfed (ie. Child was not concurrently fed formula, cows' milk, solid foods, ect.)? If the child was never exclusively breastfed, or exclusively breastfed for less than 1 month, please enter "0". If the child was exclusively breastfed past the age of 1 year, please enter "12".
2. How long (in months) did this child nurse (breastfeed at the breast) during the day (between 7 in the morning and 7 in the evening)? If the child never nursed during the day, or nursed during the day for less than 1 month, please enter "0". If the child nursed during the day past the age of 2 years, please enter "24".
3. How long (in months) did this child nurse (breastfeed at the breast) during the night (between 7 in the evening and 7 in the morning)? If the child never nursed during the night, or nursed during the night for less than 1 month, please enter "0". If the child nursed during the night past the age of 2 years, please enter "24".
4. How old was this child (in months) when bottle feeding was introduced (include feeding pumped breast milk or supplementation with formula or nonhuman milk)? If the

child was fed from a bottle beginning at birth, please enter “0”.

This child was never bottle fed.

This child was bottle fed from the age of:

15. Bottle Feeding Breastfed Babies

1. Who usually bottle fed this child?

Mother

Father

Grandparent or other adult

relative (such as an aunt or
uncle)

Nanny or babysitter

other

2. How long (until what age, in months) did this child bottle feed during the night (between 7 in the evening and 7 in the morning)? If the child never bottle fed during the night, or bottle fed during the night for less than 1 month, please enter “0”. If the child bottle fed during the night past the age of 2 years, please enter “24”.

3. Who usually bottle fed this child during the night?

Mother

Father

Grandparent or other adult relative (such as an aunt or uncle)

Nanny or babysitter

Other

16. Weaning

1. How old was this child (in months) when he/she was completely weaned (no longer received any breast milk)? If the child was weaned before the age of 1 month, please enter "0". If the child was weaned after the age of 2 years, please enter "24".

No

17. Bottle Feeding

Questions on bottle feeding methods and duration.

1. Who usually bottle fed this child?

Mother

Father

Adult family member other than the parents (grandparent, aunt, uncle)

Nanny or babysitter

Other

2. How long (in months) did this child bottle feed during the night (between 7 in the evening and 7 in the morning)? If the child never bottle fed during the night, or bottle fed during the night for less than 1 month, please enter “0”. If the child bottle fed during the night past the age of 2 years, please enter “24”.

3. Who usually bottle fed this child during the night?

This child was not bottle fed during the night.

Mother

Father

Adult family member other than the parents (grandparent, aunt, uncle)

Nanny or babysitter

other

18. Sleep Questions I

The following questions deal with the way this child usually slept during the night (between 7 in the evening and 7 in the morning) in infancy and toddlerhood.

1. Did this child ever routinely bedshare (sleep in the parents’ bed with at least one parent, for at least 4 hours per night at least 5 days per week)?

Yes

19. Routine BedSharing Questions

The questions on this page ask about routine bedsharing.

1. How old (in months) was this child when he/she began to routinely bedshare. If child began at birth, please answer “0”. If child began past the age of 3 years, please answer “36”.

2. How old (in months) was this child when he/she stopped routinely bedsharing. If child stopped within a month of being born, please answer “0”. If child was over the age of 3 years when he/she stopped, please answer “36”.

No

20. Sleep Questions II

The following questions deal with the way this child usually slept during the night (between 7 in the evening and 7 in the morning) in infancy and toddlerhood.

1. Did this child occasionally bedshare (sleep in the parents’ bed with at least one parent, for at least 4 hours, more often than 1 day per week) at any time during the first two years of life?

Yes

21. Occasional Bedsharing

1. How old (in months) was this child when he/she began to occasionally bedshare. If child began at birth please answer “0”. If child began past the age of 3 years, please answer “36”.

2. How old (in months) was this child when he/she stopped occasionally bedsharing. If child stopped within a month of being born, please answer “0”. If child was over the age of 3 years when he/she stopped, please answer “36”.

No

22. Sleep Questions III – Bedsharing (only for those who answered “Yes” to either of the bedsharing questions)

1. Did this child’s mother lie down or sleep with this child for at least 4 hours during the night while bedsharing?

Yes

No

2. Did people other than this child’s mother lie down or sleep with this child and his/her mother while bedsharing (choose any answers that apply)? No

Yes: Child’s father

Yes: Other children

Yes: Adults other than the parents

3. Did this child begin to bedshare because of difficulty falling asleep or staying asleep alone?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep alone? If difficulty began at birth,

please answer “0”. If difficulty began past the age of 3 years, please answer “36”.

4. Did this child stop bedsharing because of difficulty falling asleep or staying asleep with others?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep with others? If difficulty began less than a month after birth, please answer “0”. If difficulty began past the age of 3 years, please answer “36”.

5. Did this child choose to stop bedsharing (ie. Child decided to stop bedsharing without parental interference)?

Yes

No

6. What was the average length of time, in minutes, that was needed for this child to fall asleep when bedsharing?

23. Sleep Questions IV - Cosleeping

The following questions deal with the way this child usually slept during the night (between 7 in the evening and 7 in the morning) in infancy and toddlerhood.

1. Did this child ever routinely (at least 4 hours per night at least 5 days per week) cosleep with his/her mother (sleep next to the mother but on a different sleep surface, such as a bassinet placed within the adult bed or a cosleeper or a sidecared crib placed directly next-to the adult bed)?

Yes

24. Cosleeping Questions

1. How old (in months) was this child when he/she began to routinely cosleep? If child began at birth, please answer "0". If child began past the age of 3 years, please answer "36".

2. How old (in months) was this child when he/she stopped routinely cosleeping? If child stopped within a month of being born, please answer "0". If child was over the age of 3 years when he/she stopped, please answer "36".

3. Did this child begin to cosleep because of difficulty falling or staying asleep alone?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep alone? If difficulty began at birth, please answer "0". If difficulty began past the age of 3 years, please answer "36".

4. Did this child stop cosleeping because of difficulty falling or staying asleep with others?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep with others? If difficulty began within a

month of birth, please answer "0". If difficulty

began past the age of 3 years, please answer "36".

5. What was the average length of time, in minutes, that was needed for this child to fall asleep when cosleeping?

No

25. Sleep Questions V

The following questions deal with the way this child usually slept during the night (between 7 in the evening and 7 in the morning) in infancy and toddlerhood.

1. Did this child ever roomshare with his/her mother (sleep in the same room, but on a completely separate sleep surface, such as a crib or toddler bed)?

Yes

26. Sleep Questions- Roomsharing

1. How old (in months) was this child when he/she began to roomshare. If child began at birth, please answer "0". If child began past the age of 3 years, please answer "36".

2. How old (in months) was this child when he/she stopped roomsharing. If child stopped within a month of being born, please answer "0". If child was over the age of 3 years when he/she stopped, please answer "36".

3. Did this child begin to roomshare because of difficulty falling or staying asleep alone?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep alone? If difficulty began at birth, please answer "0". If difficulty began past the age of 3 years, please answer "36".

4. Did this child stop roomsharing because of difficulty falling or staying asleep with others?

No

Yes: How old (in months) was this child when he/she began having difficulty falling or staying asleep with others? If difficulty began within a month of birth, please answer "0". If difficulty began past the age of 3 years, please answer "36".

5. What was the average length of time, in minutes, that was needed for this child to fall asleep when roomsharing?

No

27. Sleep Questions VI

The following questions deal with the way this child usually slept during the night (between 7 in the evening and 7 in the morning) in infancy and toddlerhood.

1. Did this child ever sleep alone in a separate room? No Yes: How old (in months) was this child when he/she began to sleep alone in a separate room. If

child began at birth, please answer "0". If child began past the age of 3 years, please answer "36".

2. Did this child ever routinely bedshare or cosleep (as defined in previous questions) with a person/people other than his/her mother? Do Not include instances where the mother was also present, or instances that were unusual, such as vacations. Please choose all answers that apply.

Yes, with the father

Yes, with an adult other than the father

Yes, with other children

No

3. Did this child ever routinely roomshare (as defined in previous questions) with a person/people other than his/her mother? Do Not include instances where the mother was also present, or instances that were unusual, such as vacations. Please choose all answers that apply.

Yes, with the father

Yes, with an adult other than the father

Yes, with other children

No

4. Was this child sleep trained (taught to fall or stay asleep independently) using a method that involved any period of crying on the part of the child?

No

Yes: How old was this child, in months, when sleep training was first done. If sleep training was first done within a month of birth, please enter "0", if it was first done past the age of 3 years, please enter "36".

28. Sleep Training Questions

These questions ask about the method of sleep training used with this child.

1. Was this child ever left alone (no one else within sight of the child) while crying?

No

Yes: What was the average length of time (in minutes) during which this child was allowed to cry alone before being comforted by an adult?

2. What was the longest length of time (in minutes) during which this child was allowed to cry alone before being comforted by an adult? If child was never allowed to cry alone, please enter "0". If child was allowed to cry alone for more than two hours, please enter "120".

3. What was the longest length of time (in minutes), during sleep training, that the child spent crying before falling asleep? Please include the time spent with a parent comforting the child in your estimate.

4. Did this child learn to sleep independently following sleep training?

No

Yes: How many days were required for this child to learn to sleep independently? If sleep training was attempted multiple times, please estimate the total number of days that sleep training was used.

29. Behavior Questions -Infancy

The following questions ask about this child's infancy. Please answer each question as accurately as you can.

1. How old was this child (in months) when he/she began to walk?

This child is handicapped and cannot walk.

This child walked at the age of:

2. Was this child a colicky infant (cried inconsolably for at least 3 hours per day at least 3 days per week during the first 3 months of life)?

Yes

No

3. Did this child have a difficult temperament during infancy (was this child a fussy baby who cried often and/or was difficult to comfort during the first year of life)?

Yes, often

Yes, sometimes

30. Temperament

1. How old was this child (in months) when he/she began to be fussy.

No

31. Behavior Questions- Childhood

The following questions ask about this child's current behavior. Please answer each question, as it relates to this child's behavior during the past two weeks.

1. Does this child currently have difficulty falling or staying asleep?

Yes, often

Yes, sometimes

No, rarely or never

2. How often does this child typically play outdoors or participate in sports?

Several times per day every day

once a day every day

several days per week

once a week

less than once per week

3. Would you describe this child as hyperactive?

Yes, often

Yes, sometimes

No, rarely or never

4. Would you describe this child as impatient?

Yes, often

Yes, sometimes

No, rarely or never

5. Would you describe this child as forgetful?

Yes, often

Yes, sometimes

No, rarely or never

6. Does this child make careless mistakes in school work or other activities?

Yes, often

Yes, sometimes

No, rarely or never

7. Does this child have difficulty staying focused during activities?

Yes, often

Yes, sometimes

No, rarely or never

8. Does this child have trouble listening when you or another adult is speaking to him?

Yes, often

Yes, sometimes

No, rarely or never

9. Does this child have difficulty finishing projects, chores or schoolwork?

Yes, often

Yes, sometimes

No, rarely or never

10. Does this child have difficulty following directions?

Yes, often

Yes, sometimes

No, rarely or never

11. Does this child lose things such as toys, books, or other things he/she needs to complete tasks or activities?

Yes, often

Yes, sometimes

No, rarely or never

12. Does this child have difficulty figuring out how to do activities or projects?

Yes, often

Yes, sometimes

No, rarely or never

13. Would you describe this child as being easily distracted?

Yes, often

Yes, sometimes

No, rarely or never

14. Does this child try to avoid doing tasks or assignments that require a lot of time and effort?

Yes, often

Yes, sometimes

No, rarely or never

15. Does this child have difficulty paying attention to tasks, projects, or games?

Yes, often

Yes, sometimes

No, rarely or never

16. Does this child have trouble staying seated when he/she is required to do so?

Yes, often

Yes, sometimes

No, rarely or never

17. Does this child fidget with his/her fingers or squirm when sitting?

Yes, often

Yes, sometimes

No, rarely or never

18. Does this child run or climb in situations where this is not appropriate behavior?

Yes, often

Yes, sometimes

No, rarely or never

19. Does this child have difficulty playing quietly?

Yes, often

Yes, sometimes

No, rarely or never

20. Would you describe this child as being “on the go” or “driven by a motor”?

Yes, often

Yes, sometimes

No, rarely or never

21. Does this child talk too much?

Yes, often

Yes, sometimes

No, rarely or never

22. Does this child have difficulty waiting for his/her turn?

Yes, often

Yes, sometimes

No, rarely or never

23. Does this child interrupt others (butts into conversations or activities)?

Yes, often

Yes, sometimes

No, rarely or never

24. Does this child answer questions before hearing the entire question?

Yes, often

Yes, sometimes

No, rarely or never

25. Does this child's behavior cause difficulty for him/her at home or at school?

Yes, often

Yes, sometimes

No, rarely or never

26. Has this child been diagnosed with Sleep Apnea?

Yes

No

27. Has this child been diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD)?

Yes

32. ADHD Follow-up

1. What type of ADHD has this child been diagnosed with?

ADHD Combined type

ADHD Inattentive type

ADHD Hyperactive-Impulsive type

ADHD Not Otherwise Specified (ADHD NOS)

No

33. Behavior-Childhood II

1. Has this child been diagnosed with a developmental disorder or delay other than ADHD?

No

Yes: Please state the name of the disorder that this child suffers from.

34. Discontinue Page (Only for those whose answers indicated that they were not eligible for this survey)

Thank you for trying this survey. Unfortunately, your previous answers indicate that your information cannot be used for this research study. Thank you for your time! If you have any questions about this research, please contact Maria Antoshina at :

bfsleepstudy@yahoo.com.

35. End Page

This is the end of the survey. Thank you for taking part in this research study. If you have any questions or comments, please contact Maria Antoshina at :

bfsleepstudy@yahoo.com.

APPENDIX E

LIST OF NON-SIGNIFICANT COMPARISONS

* indicates positive correlations that approach statistical significance

** indicates negative correlations that approach statistical significance

ADHD symptoms vs. current age

ADHD symptoms vs. hours of television watched per week

ADHD symptoms vs. age when television viewing began

ADHD symptoms vs. daytime breastfeeding duration

ADHD symptoms vs. nighttime breastfeeding duration

ADHD symptoms vs. age when bottle feeding introduced

ADHD symptoms vs. age at weaning

ADHD symptoms vs. age at start of routine bedsharing

ADHD symptoms vs. age at start of occasional bedsharing

ADHD symptoms vs. age at start of difficulty solitary sleeping

ADHD symptoms vs. age at start of routine cosleeping

ADHD symptoms vs. age at start of solitary sleeping*

ADHD symptoms vs. age at start of sleep training

ADHD symptoms vs. average length of time crying alone during sleep training

ADHD symptoms vs. longest time spent crying during sleep training

ADHD symptoms vs. longest time spent crying before falling asleep during sleep training

ADHD symptoms vs. household income

ADHD symptoms vs. age at beginning to walk**

ADHD symptoms vs. family history of ADHD

ADHD symptoms vs. difficult temperament during infancy*

Hyperactivity vs. current age

Hyperactivity vs. hours of television watched per week

Hyperactivity vs. age when television viewing began

Hyperactivity vs. daytime breastfeeding duration

Hyperactivity vs. nighttime breastfeeding duration

Hyperactivity vs. age when bottle feeding introduced

Hyperactivity vs. age at weaning

Hyperactivity vs. age at start of routine bedsharing

Hyperactivity vs. age at start of occasional bedsharing

Hyperactivity vs. age at start of difficulty solitary sleeping

Hyperactivity vs. age at start of routine cosleeping

Hyperactivity vs. age at start of solitary sleeping*

Hyperactivity vs. age at start of sleep training

Hyperactivity vs. average length of time crying alone during sleep training

Hyperactivity vs. longest time spent crying during sleep training

Hyperactivity vs. longest time spent crying before falling asleep during sleep training

Hyperactivity vs. household income

Hyperactivity vs. age at beginning to walk**

Hyperactivity vs. family history of ADHD

Hyperactivity vs. difficult temperament during infancy

Age at start of solitary sleeping vs. current age

Age at start of solitary sleeping vs. hours of television watched per week

Age at start of solitary sleeping vs. age when television viewing began

Age at start of solitary sleeping vs. age at beginning to walk

Age at start of solitary sleeping vs. age when bottle feeding introduced

Age at start of solitary sleeping vs. age at start of occasional bedsharing

Age at start of solitary sleeping vs. age when difficulty solitary sleeping began

Age at start of solitary sleeping vs. age at start of routine cosleeping

Age at start of solitary sleeping vs. age at start of routine bedsharing**

Age at start of solitary sleeping vs. longest time spent crying during sleep training

Age at start of solitary sleeping vs. longest time spent crying before falling asleep during sleep training

Age at start of solitary sleeping vs. family history of ADHD

Age at start of solitary sleeping vs. difficult temperament in infancy

Age at start of solitary sleeping vs. current difficulty sleeping

Age at start of solitary sleeping vs. average length of time crying alone during sleep training

Age when difficulty solitary sleeping began vs. current age

Age when difficulty solitary sleeping began vs age when television viewing began*

Age when difficulty solitary sleeping began vs. hours of television watched per week

Age when difficulty solitary sleeping began vs. age at beginning to walk

Age when difficulty solitary sleeping began vs. daytime breastfeeding duration

Age when difficulty solitary sleeping began vs. nighttime breastfeeding duration

Age when difficulty solitary sleeping began vs. age when bottle feeding introduced

Age when difficulty solitary sleeping began vs. age at weaning

Age when difficulty solitary sleeping began vs. age at start of routine bedsharing (total sample)

Age when difficulty solitary sleeping began vs. age at start of occasional bedsharing

Age when difficulty solitary sleeping began vs. age at start of routine cosleeping

Age when difficulty solitary sleeping began vs. age at start of sleep training

Age when difficulty solitary sleeping began vs. difficult temperament in infancy**

Age when difficulty solitary sleeping began vs. average length of time crying alone during sleep training

Age when difficulty solitary sleeping began vs. longest time spent crying during sleep training

Age when difficulty solitary sleeping began vs. longest time spent crying before falling asleep during sleep training

Age when difficulty solitary sleeping began vs. household income

Age when difficulty solitary sleeping began vs. family history of ADHD

Age when difficulty solitary sleeping began vs. current difficulty sleeping**

Age at start of routine bedsharing vs. age at start of difficulty solitary sleeping*

Age at start of routine bedsharing vs. current age

Age at start of routine bedsharing vs. hours of television watched per week

Age at start of routine bedsharing vs. age at beginning to walk

Age at start of routine bedsharing vs. daytime breastfeeding duration

Age at start of routine bedsharing vs. nighttime breastfeeding duration

Age at start of routine bedsharing vs. age at weaning

Age at start of routine bedsharing vs. age when bottle feeding introduced**

Age at start of routine bedsharing vs. age at start of occasional bedsharing

Age at start of routine bedsharing vs. age at start of routine cosleeping

Age at start of routine bedsharing vs. average length of time crying alone during sleep training

Age at start of routine bedsharing vs. longest time spent crying during sleep training

Age at start of routine bedsharing vs. longest time spent crying before falling asleep during sleep training

Age at start of routine bedsharing vs. household income

Age at start of routine bedsharing vs. age at beginning to walk**

Age at start of routine bedsharing vs. family history of ADHD

Age at start of routine bedsharing vs. current difficulty sleeping

Age at start of routine bedsharing vs. difficult temperament in infancy

Age at start of routine cosleeping vs. current age

Age at start of routine cosleeping vs. hours of television watched per week

Age at start of routine cosleeping vs. age when television viewing began

Age at start of routine cosleeping vs. age at beginning to walk

Age at start of routine cosleeping vs. daytime breastfeeding duration

Age at start of routine cosleeping vs. nighttime breastfeeding duration

Age at start of routine cosleeping vs. age when bottle feeding introduced

Age at start of routine cosleeping vs. age at weaning

Age at start of routine cosleeping vs. age at start of occasional bedsharing

Age at start of routine cosleeping vs. household income

Age at start of routine cosleeping vs. family history of ADHD

Age at start of routine cosleeping vs. current difficulty sleeping

Age at start of occasional bedsharing vs. current age

Age at start of occasional bedsharing vs. hours of television watched per week

Age at start of occasional bedsharing vs. age when television viewing began

Age at start of occasional bedsharing vs. age at beginning to walk

Age at start of occasional bedsharing vs. daytime breastfeeding duration**

Age at start of occasional bedsharing vs. nighttime breastfeeding duration

Age at start of occasional bedsharing vs. age when bottle feeding introduced

Age at start of occasional bedsharing vs. age at weaning

Age at start of occasional bedsharing vs. household income

Age at start of occasional bedsharing vs. family history of ADHD

Age at start of occasional bedsharing vs. current difficulty sleeping

Age at start of occasional bedsharing vs. difficult temperament in infancy

Age at start of sleep training vs. nighttime breastfeeding duration *

Age at start of sleep training vs. current age

Age at start of sleep training vs. hours of television watched per week

Age at start of sleep training vs. age when television viewing began

Age at start of sleep training vs. age at beginning to walk

Age at start of sleep training vs. daytime breastfeeding duration

Age at start of sleep training vs. age when bottle feeding introduced

Age at start of sleep training vs. age at weaning

Age at start of sleep training vs. age at start of routine bedsharing

Age at start of sleep training vs. age at start of solitary sleep*

Age at start of sleep training vs. household income

Age at start of sleep training vs. current difficulty sleeping

Age at start of sleep training vs. difficult temperament in infancy

Average length of time crying alone during sleep training vs. current age

Average length of time crying alone during sleep training vs. household income

Average length of time crying alone during sleep training vs. hours of television watched per week

Average length of time crying alone during sleep training vs. age when television viewing began

Average length of time crying alone during sleep training vs. daytime breastfeeding duration

Average length of time crying alone during sleep training vs. age at beginning to walk

Average length of time crying alone during sleep training vs. nighttime breastfeeding duration

Average length of time crying alone during sleep training vs. age when bottle feeding introduced

Average length of time crying alone during sleep training vs. age at weaning

Average length of time crying alone during sleep training vs. current difficulty sleeping

Average length of time crying alone during sleep training vs. difficult temperament in infancy

Average length of time crying alone during sleep training vs. family history of ADHD

Daytime breastfeeding duration vs. current age

Daytime breastfeeding duration vs. hours of television watched per week

Daytime breastfeeding duration vs. age when television viewing began

Daytime breastfeeding duration vs. age at beginning to walk

Daytime breastfeeding duration vs. longest time spent crying during sleep training

Daytime breastfeeding duration vs. longest time spent crying before falling asleep during sleep training

Daytime breastfeeding duration vs. household income

Daytime breastfeeding duration vs. family history of ADHD

Daytime breastfeeding duration vs. current difficulty sleeping

Daytime breastfeeding duration vs. difficult temperament in infancy

Nighttime breastfeeding duration vs. current age

Nighttime breastfeeding duration vs. hours of television watched per week

Nighttime breastfeeding duration vs. age when television viewing began

Nighttime breastfeeding duration vs. age at beginning to walk

Nighttime breastfeeding duration vs. longest time spent crying during sleep training

Nighttime breastfeeding duration vs. longest time spent crying before falling asleep during sleep training

Nighttime breastfeeding duration vs. household income

Nighttime breastfeeding duration vs. family history of ADHD

Nighttime breastfeeding duration vs. current difficulty sleeping

Nighttime breastfeeding duration vs. difficult temperament in infancy

Age when bottle feeding introduced vs. household income

Age when bottle feeding introduced vs. current age

Age when bottle feeding introduced vs. hours of television watched per week

Age when bottle feeding introduced vs. age when television viewing began

Age when bottle feeding introduced vs. age at beginning to walk

Age when bottle feeding introduced vs. longest time spent crying during sleep training

Age when bottle feeding introduced vs. longest time spent crying before falling asleep during sleep training

Age when bottle feeding introduced vs. family history of ADHD

Age when bottle feeding introduced vs. current difficulty sleeping

Age when bottle feeding introduced vs. difficult temperament in infancy

Age at weaning vs. current age

Age at weaning vs. hours of television watched per week

Age at weaning vs. age when television viewing began

Age at weaning vs. age at beginning to walk

Age at weaning vs. longest time spent crying during sleep training

Age at weaning vs. longest time spent crying before falling asleep during sleep training

Age at weaning vs. household income

Age at weaning vs. family history of ADHD

Age at weaning vs. current difficulty sleeping

Age at weaning vs. difficult temperament in infancy

Household income vs. current age

Household income vs. hours of television watched per week

Household income vs. age when television viewing began

Household income vs. age at beginning to walk*

Household income vs. longest time spent crying during sleep training

Household income vs. longest time spent crying before falling asleep during sleep training

Household income vs. family history of ADHD

Household income vs. current difficulty sleeping

Household income vs. difficult temperament in infancy

Longest time spent crying during sleep training vs. current age

Longest time spent crying during sleep training vs. hours of television watched per week

Longest time spent crying during sleep training vs. age when television viewing began

Longest time spent crying during sleep training vs. age at beginning to walk

Longest time spent crying during sleep training vs. family history of ADHD

Longest time spent crying during sleep training vs. current difficulty sleeping

Longest time spent crying during sleep training vs. difficult temperament in infancy

Longest time spent crying before falling asleep during sleep training vs. current age

Longest time spent crying before falling asleep during sleep training vs. hours of television watched per week

Longest time spent crying before falling asleep during sleep training vs. age when television viewing began

Longest time spent crying before falling asleep during sleep training vs. age at beginning to walk

Longest time spent crying before falling asleep during sleep training vs. family history of ADHD

Longest time spent crying before falling asleep during sleep training vs. current difficulty sleeping

Longest time spent crying before falling asleep during sleep training vs. difficult temperament in infancy

Hours of television watched per week vs. current age

Hours of television watched per week vs. age at beginning to walk

Hours of television watched per week vs. family history of ADHD

Hours of television watched per week vs. current difficulty sleeping

Hours of television watched per week vs. difficult temperament in infancy

Age when television viewing began vs. current age

Age when television viewing began vs. hours of television watched per week**

Age when television viewing began vs. age at beginning to walk

Age when television viewing began vs. family history of ADHD

Age when television viewing began vs. current difficulty sleeping

Age when television viewing began vs. difficult temperament in infancy

Current age vs. age at beginning to walk

Current age vs. current difficulty sleeping

Current age vs. family history of ADHD*

Current age vs. difficult temperament in infancy

Age at beginning to walk vs. family history of ADHD

Age at beginning to walk vs. current difficulty sleeping

Age at beginning to walk vs. difficult temperament in infancy*

Family history of ADHD vs. current difficulty sleeping

Family history of ADHD vs. difficult temperament in infancy

Current difficulty sleeping vs. difficult temperament in infancy*

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