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Attachment representations, sleep quality and adaptive functioning in preschool age children

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Both the attachment system and sleep are considered to be important biopsychosocial regulators of development and of adaptive functioning in children, and there is a substantial literature suggesting that the two systems may be mutually influencing. To date, however, the bulk of research attempting to link these systems has focused on infancy and the results of empirical studies are mixed. Thirty-nine preschool children participated in this study (valid sleep data for 34 cases). Attachment representations were assessed using the Attachment Story Completion Task (ASCT) and sleep was assessed using objective (i.e., actigraphy) measures. Analyses revealed that the coherence of child narratives and security scored from the ASCT were related to sleep quality indices (e.g., Sleep Activity, Wake Minutes after Sleep Onset, Sleep Efficiency). Additional analyses examined external correlates of attachment representations and tested possible interactions of attachment and sleep. No significant mediated interactions across attachment and sleep domains were found. Although the direction of effects cannot be determined, the results suggest that parent–child relationship and sleep organization are intertwined for preschool age children and the joint effects of these biopsychosocial regulators should be studied further.

Keywords: attachment security; sleep quality; sleep duration; preschool children

Introduction

Both the attachment system and sleep are understood to be important biopsychosocial organizers during development and a substantial amount of conceptual and empirical work has considered how these systems may relate to and/or influence each other (e.g., Anders, 1994; Mikulincer, Shaver, & Avihou-Kanza, 2011; Morrell & Steele, 2003; Scher, 2001). Anders (e.g., 1994) offered a conceptual framework suggesting that that parenting qualities antecedent to attachment insecurity induce anxiety, perhaps over the nightly separations of infants and parents, and thereby undermine sleep duration and/or sleep quality. This model assumes a pathway of influence from parenting and subsequent attachment quality (i.e., insecurity to sleep) and it is this model that has been implicit in most attachment and sleep research during infancy. More recently, this directional association between attachment anxiety and a specific feature of sleep (i.e., dream content) has been studied for adults, with some provocative results suggesting that high attachment anxiety

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predicts aspects of dream content (e.g., McNamara, Pace-Schott, Johnson, Harris, & Auerbach, 2011; Mikulincer et al., 2011).

Links between attachment security and sleep during infancy and toddlerhood have been pursued from two distinct pathways; one assuming that infant attachment security *per se* is antecedent to sleep problems and the other assuming that maternal attachment status (or related maternal qualities) lead to infant/toddler sleep problems. Both approaches have yielded mixed results.

Representative studies from the first perspective include McNamara, Belsky, and Fearon, (2003) and Morrell and Steele (2003) who found links between insecure-resistant attachments, as assessed from the Strange Situation, and maternal reports of infants' sleeping problems. However, these results did not replicate in two studies reported by Scher and associates (e.g., Scher, 2001; Scher & Asher, 2004), who studied samples of healthy infants and their mothers in Israel. In the Scher (2001) study, attachment classifications were assessed using the Strange Situation and she explicitly tested the insecure-resistant vs. other classifications. Indeed, this study is informative because Scher examined the B4 type infants, who share some of the behavioral features of insecure resistant infants, separately from the other secure infants. In the Scher and Asher (2004) study, the Attachment Q-Sort (Waters, 1995) was used as the attachment measure and the relation between sleep difficulties and attachment security was not significant. In another study, Nolte, Pott, and Pauli-Pott (2006) reported results that contradict the McNamara et al. (2003) and Morrell and Steele (2003) studies. Nolte et al. (2006) found that mothers of securely attached infants/toddlers reported more sleep disturbances in their children than did mothers of insecurely attached children. Higley and Dozier (2009) studied the nighttime interactions of mothers and infants, using both maternal report and video records taken at night. Although there were no significant attachment-related differences in the categories of nighttime infant behavior in this study, mothers of securely attached infants were more likely to pick up and soothe their infants if they woke up and signaled their desire for contact (i.e., usually by crying) than were mothers of insecurely attached infants. Finally, there is some recent evidence (Simard, Bélanger, Bernier, Carrier, & Paquet, 2010) suggesting that mothers of insecure-avoidant infants are less accurate as reporters on their infant's sleep quality than are mothers of infants classified differently in the Strange Situation.

Fewer studies have considered relations between maternal attachment status and infant or toddler sleep. Benoit, Zeanah, Boucher, and Minde (1992) found that mothers with non-autonomous (i.e., insecure) attachment representations from the Adult Attachment Interview tended to report that their children had more sleeping problems than did mothers who had autonomous attachment representations. Other studies have reported somewhat similar results but have not explicitly tested maternal attachment status. Hsu (2004) and Scher (2008) both reported that maternal anxiety over separation was a significant predictor of infant sleep difficulties and Teti, Kim, Mayer, & Countermine (2010) have recently found that maternal emotional availability was a significant (inversely related) predictor of both observed maternal behavior at the child's bedtime and maternal reports of child night waking and her overall perception of child sleep problems.

These results do not lend themselves to a succinct summary or reconciliation. One difficulty arises from the nearly exclusive use of subjective parent reports of sleep problems in this research (however, Scher used both objective data from actigraphy and subjective parent reports in her studies). Although parent reports/

sleep diaries have been widely used in both archival and recent sleep research with children (e.g., Crowell, Keener, Ginsburg, & Anders, 1987; Iglowstein, Jenni, Molinari, & Largo, 2003; Jenni, Molinari, Caffisch, & Largo, 2007; Touchette, Petit, Paquet, Boivin, Japel, Tremblay, et al., 2005), and have merits (Sadeh, 2011), parent reports tend to underestimate many parameters of sleep quality and organization (e.g., nighttime activity, number of night wakings, duration of wake time at night, overall sleep efficiency) and to overestimate total sleep durations (Sadeh, 1996; Sadeh, Acebo, Seifer, Aytur, & Carskadon, 1995), when compared to more objective measurements collected with actigraph monitors. Furthermore, with respect to attachment, recent findings suggest that mothers of insecure-avoidant infants may be less accurate reporters of infant sleep parameters than are mothers of other insecure and securely attached infants (Simard et al., 2010). Perhaps of greater concern here is the failure of parent report/sleep diary results to replicate when objective (i.e., actigraph) data concerning sleep parameters were used to contrast secure and insecure-resistant children (e.g., Scher, 2001).

Scher and Asher (2004) found that maternal assessments of infant attachment security using the Attachment Q-Sort (AQS; Waters, 1995) also failed to correlate significantly with sleep parameters measured using actigraphy (as well as parent reports, see above). But interpreting the results of this study poses problems because AQS descriptions from maternal Q-sort descriptions may reflect children's temperamental attributes rather than attachment security (van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). Indeed, in the Scher and Asher study, infant dependency (also scored from the AQS) was associated with maternal reports of sleep problems (but, again, not with the actigraph measures of sleep) and with a maternal report of fussy temperament. Consequently, it is not clear that this study should be considered a failure to replicate previous findings that insecurely attached infants may have more sleep problems than infants who enjoy secure attachments.

It is notable that studies of attachment and sleep have focused on infancy and toddlerhood rather than on early childhood because sleep organization undergoes rapid developmental changes during infancy (e.g., So, Adamson, & Horne, 2007) and early difficulties usually are resolved before the end of the first year. Furthermore, a considerable research effort has gone into the study of attachment beyond infancy (e.g., Crowell, Fraley, & Shaver, 1999; Greenberg, Cicchetti & Cummings, 1990; Kerns, Cole, & Andrews, 1998). In one study that examined relations between both self-reported and objective sleep measures and child representations of attachment relationships for a sample of children in elementary school, Keller, El-Sheikh, & Buckhalt (2008) reported that children's self reports of secure attachments with either parent were related to their own perceptions of having fewer sleep-wake problems and feeling less sleepy than children who self-described as insecurely attached. The attachment measure was not related directly to objective (actigraph) measures of sleep quality, but the combination of insecure attachment and actigraph measures of poor sleep quality uniquely predicted some school achievement test scores such that children with both an insecure attachment and poor sleep tended to have the lowest test scores. In a second study, El-Sheikh, Buckhalt, Cummings, and Keller (2007) attempted to link sleep and an attachment relevant construct (i.e., emotional security; Davies, Winter, & Cicchetti, 2006). They found that emotional insecurity mediated effects of parental conflict on sleep quality (e.g., percent of time in bed actually sleeping, minutes awake after sleep onset) in the

expected direction. Further, sleep quality variables mediated effects of emotional insecurity on both parent-rated and teacher-rated child emotional and academic problems; sleep problems were a pathway of effects linking emotional insecurity with child problems. These results indicate that studies of relations between attachment and sleep after the infant/toddler periods can yield useful information and it is these findings that prompted our study of attachment and sleep in a sample of preschool age children.

The preschool period is an important transition period with respect to both attachment security and sleep. For many children, entry to preschool is the first major transition from the familiar family milieu to a more public and less intrinsically supportive setting in which the needs of peers are as salient for adult caregivers as those of the individual child. This transition poses a challenge to the attachment system, perhaps especially for children with insecure attachments who may find the separations from attachment figures very distressing. This age period is also characterized by cognitive and linguistic achievements that make internal models of attachment accessible to verbal probes and assessments (e.g., Bretherton, Ridgeway, & Cassidy, 1990). Finally, the preschool period is the life stage at which sleep schedules characteristically shift from the *ad libitum* schedules (i.e., sleep whenever one is tired enough) characteristic of infancy and toddlerhood to the *socialized* sleep schedules imposed by adult habits and group care routines. Accordingly, we used a modified version of the Attachment Story Completion Task (Bretherton et al., 1990) to assess attachment and measured sleep quality and sleep duration objectively with actigraph watches (Sadeh et al., 1995).

Participants in this study were recruited from the third wave of a longitudinal study of affect expression, social competence, and friendships that included a variety of demographic, social, emotional, and behavioral measures. We used these external measures to determine whether participating children were representative of the sample as a whole.

Methods

Participants

Thirty-nine children (12 girls, 27 boys) attending an early education center accredited by the National Association for the Education of Young Children in a large Southeastern metropolitan area in the US participated in the study. Children were recruited from a larger study concerning affect expression, emotion understanding, and social competence (N for study cohort = 107). Classrooms in the center were organized by age-level at the start of the academic year, with children > 36 months to < 48 months in separate classrooms from children \geq 48 months. Sleep data were collected from November to March during the academic year but for clarity we refer to children who started the academic year < 48 months as “younger” ($n = 20$) and those who started the academic year \geq 48 months as “older” ($n = 19$). The center from which participants were recruited serves an ethnically diverse but largely middle-class population, by the standards of the local community. Approximately 36% of children in this sample were from ethnic minority groups, predominantly African American, and all but three of the remaining participants were European American. We did not have access to education or income levels for parents of children in this sample, however, in previous samples from this center the median

annual family income was USD >75K (modal level USD >100K) and the median years of education was 16 +.

A parent or legal guardian provided written consent for child participants for both the larger study and separately for the sleep assessments, prior to data collection. Families participating in the sleep assessments were compensated for their time and effort. Children were also asked to assent to their participation for all tasks that required an individual interview (e.g., Attachment Story Completion Task). All data were collected in accordance with the prevailing ethical standards for psychologists.

Procedures

Attachment Story Completion Task (ASCT)

The ASCT (Bretherton et al., 1990) is a series of vignettes depicting aspects of family life that are presented using a set of dolls (ethnicity matched). Each child is interviewed individually outside of the classroom, to avoid distractions. The researcher begins the story up to a specific point and then asks, “tell me and show me what happens next.” A warm-up story-stem (a birthday party) is presented first, followed by seven story-stems designed to elicit an attachment-relevant response. For example, in one vignette the mother, father, and grandmother are leaving on a trip but the child and a sibling are being left at home in the care of an aunt. The story is presented up to the point at which the car begins to leave and then the child is asked to complete the story. The child was permitted to move the doll figures and other props (e.g., bed in the child’s bedroom) as she/he narrates the continuation of the story. The task took about 30 minutes to administer to each child. The session was video recorded and the audio track was transcribed *verbatim* for later scoring.

Sleep assessments. Researchers demonstrated placing an actigraph watch on the child’s non-dominant wrist while the parent was present in the classroom. Parents were instructed to allow the child to wear the watch continuously for seven consecutive days (except during baths or water play). During the week of actigraphy, parents were asked to keep a record of their child’s regular sleep routine, record sleep and wake times, and document child sickness or use of medications.

External variables. As part of the larger study from which these children were recruited, observation and interview measures relevant to peer social competence had been collected for all children. These included direct observation of interaction frequencies and visual attention received from peers, general observations summarized using two different Q-sets (California Child Q-set, Block & Block, 1980; Preschool Q-set, Bronson’s adaptation of a Q-set originally described by Baumrind, 1967), and two sociometric interviews scored for peer acceptance. Teachers also rated the temperament and social behavior of the children using items from six different measures. These measures and their psychometric properties have been presented elsewhere in detail (e.g., Shin, Vaughn, Kim, Krzysik, Bost, McBride, et al., 2011; Vaughn, Shin, Kim, Coppola, Krzysik, Santos, et al., 2009) and are only briefly described below. Finally, children included in the sample for this report were interviewed individually regarding their emotion knowledge using an adaptation of Denham’s (1998) emotion understanding protocol and were also tested (on a different day) using the Peabody Picture Vocabulary Test (Dunn & Dunn, 2007).

Measures

Attachment security. The attachment-relevant transcripts from the ASCT were scored according to a protocol adapted from Bretherton et al. (1990) by Heller (2000). Although Bretherton et al. (1990) described multiple scales that could be scored from the transcribed stories, we chose two scales as most closely related to attachment as a secure base phenomenon (Coherence, Security). Coherence refers to children's ability to address or resolve the conflict in the story in an elaborated manner (i.e., with relevant detail). Children's security ratings are based on children's awareness of emotion states appropriate to the story theme, constructiveness of resolution, quality of interaction with the interviewer, and story coherence. All 39 children provided ASCT stories. Bretherton et al. (1990) and Waters, Rodrigues, and Ridgeway (1998) have shown that the security and coherence scores are significant correlates of behavioral assessments of attachment security (e.g., Strange Situation classifications). Five different raters (three undergraduate assistants, two post-doctoral research associates) coded the transcripts. The senior research associate had been trained to reliability on the Heller (2000) adaptation and was responsible for training the remaining coders. Training was conducted by coding four transcripts together from a sample of children who did not participate in the current study. Disagreements of more than one scale point were discussed until consensus was reached. After training, each coder worked independently to code assigned transcripts (all transcripts were coded by at least four different raters). Rater agreements, calculated as intraclass correlations, were .87 for Coherence and .89 for Security. Coherence and Security are structurally related (in this sample $r = .96$) because the scoring rules require a high Coherence score in order to receive a high Security score and so the two variables were aggregated to create a single attachment composite for subsequent analyses.

Actigraphy. The children wore an actigraph watch (Motionlogger Octagonal Basic, Ambulatory Monitoring, Inc., Ardsley, NY) to assess indices of sleep duration and quality. The device records movement in one-minute epochs and scores each epoch as sleep or awake using an algorithm developed and validated by Sadeh and colleagues (Sadeh, Alster, Urbach, & Lavie, 1989). Sleep onset was defined as the first three consecutive minutes scored as sleep. Wake time was defined as the last of five consecutive minutes scored as sleep before high activity counts (i.e., > than 100) (Acebo, Sadeh, Seifer, Tzischinsky, Wolfson, Hafer, et al., 1999). The parents' documentation of children's sleep and wake times were used to corroborate actigraph data. The actigraphy variables used in analyses were the participant's average sleep parameters over the week.

Most children had valid actigraphy data for seven (49%; $n = 19$) or for six (28%; $n = 11$) nights. Four (10.3%) had five nights of data and two had two or three nights. Because Acebo et al. (1999) suggested that a minimum of five nights of actigraphy data are needed to obtain reliable estimates for most sleep parameters, we excluded children with fewer than five nights of data from subsequent analyses. Three participants had no valid actigraphy data. Reasons for missing data included actigraph malfunction, the use of allergy medicine, or forgetting to put the watch back on after bathing. This rate of data loss for actigraphy is consistent with the findings for preschool children reported by Acebo et al. (1999). Thus, 34 participants were used in analyses involving the sleep parameters.

Indices of sleep duration derived from actigraph data were: Sleep Duration (minutes in bed) and Total Sleep Minutes (# of minutes scored as sleep). Sleep quality indices derived from the actigraph data included: Sleep Episodes (total # of sleep episodes per night); Longest Wake Episode (duration of the longest wake episode in minutes); Sleep Activity Mean (average of activity counts from sleep onset to wake time); Overall Activity Index (% of epochs with greater than 0 activity score); Wake Minutes after Sleep Onset (average # of minutes scored as wake after sleep onset); Sleep Efficiency (% of minutes scored as sleep compared to overall time spent in bed); and Sleep Latency (# of minutes from 1st activity count below 100 to sleep onset i.e., the amount of minutes it takes the child to fall asleep). Although the actigraphy literature suggests that these sleep amount and quality variables are often significantly inter-correlated, it is recommended that multiple sleep parameters be examined simultaneously (Sadeh, 2008). Retention of the full set of variables also allows us to characterize relations with attachment security in greater detail than would be possible with a reduced dataset.

External measures for testing representativeness of this sample. The social competence variable set has acceptable levels of rater agreement and internal consistence and yields seven indicator scores that collapse to three first-order composites in confirmatory factor analyses (see Vaughn et al., 2009). These are called Social Motivation/Engagement, Q-sort profiles, and Peer Acceptance. As part of the larger project, children's emotion knowledge had been assessed using an adaptation of an interview protocol described by Denham (1998). Children were interviewed individually, away from the classroom. The interviewer presented the child with an array of photographs showing specific emotional expressions that had been posed by children. Basic emotion expressions (i.e., happy, sad, angry, fear, surprise) and social emotion expressions (embarrassment, guilt) were presented and the child was asked first "how does this child feel?" (as interviewer points to photos in succession). The child's score for this aspect of the task (labeling emotion states) was the number of photos correctly identified. After all photos had been queried, they were re-arranged and the experimenter stated, "Now, show me the happy child." The photographs were left on the table for all queries so as not to bias the child's subsequent choices. Scores for this aspect of the task (recognition of emotion expressions when given a label) were the number of times the child matched a face with the named emotion label. After going through all emotion states depicted in the photos, the interviewer posed questions to the child about why the photographed child might be feeling the named emotion. Scores for this aspect of the task (plausible causes of emotion states) were the number of emotion states for which the child could provide appropriate rationales for the feeling state of the photographed child. Children's receptive vocabulary had also been assessed using the PPVT-IV (Dunn & Dunn, 2007). This test is often used as a proxy measure for IQ and we treat the PPVT standard score as a measure of the child's verbal intelligence.

Both classroom teachers provided ratings of the child's temperament (Children's Behavior Questionnaire-Short form, CBQ, Putnam & Rothbart, 2006; 44 items). Scores were created for three temperament scales (Attention Focusing, Inhibitory Control, and Low Intensity Pleasure) that are used to create scores for a higher level construct (i.e., Effortful Control) intended to capture the child's capacity to regulate thought, behavior, and affect (see Putnam & Rothbart, 2006). Cross-teacher correlations for these scores were significant and were averaged for subsequent

analyses. The three primary and the single derived temperament variables were included in the external correlates dataset.

Both teachers also rated the behavior of children in their classrooms using items from six widely used instruments (*Child Characteristics Questionnaire*, CCQ, an age-appropriate extension of the *Infant Characteristics Questionnaire*, Bates, Freeland, & Lounsbury, 1979; 32 items; *Social Competence and Behavior Evaluation Scale-Short Form*, SCBE, LaFreniere & Dumas, 1996; 30 items; *Interpersonal Competence Scale*, ICS, Cairns, Leung, Gest, & Cairns, 1995; 18 items; *Teacher Rating of Social Skills*, TRSS, Dodge & Somberg, 1987; 17 items; *Social Behavior Scale*, SBS, Cairns et al., 1995; seven item negative social engagement list; *Penn Interactive Peer Play Scale*, PIPPS, Fantuzzo, Coolahan, Mendez, McDermott, & Sutton-Smith, 1998; 32 items). Vaughn et al. (2009) reported that items from the first five of these instruments could be reduced to two broadly implicative summary factors that they labeled Peer Acceptance/positive mood and Negative Engagement. Fantuzzo et al. (1998) reported that the PIPPS yields three orthogonal dimensions (i.e., Disruption, Disconnection, and Play interaction) and we calculated scores for each dimension (averaged over all items with significant loadings on each factor as reported by Fantuzzo et al., 1998). As with the temperament scores, teachers' scores were significantly correlated and were averaged to create the final scores for each child on each scale. Subsequent analyses contrasted children in this sample with the remaining children from their cohort to determine whether children with sleep and ASCT data differed from their peers on the social competence, temperament, emotion knowledge, and classroom adjustment variables.

Results

Plan of analyses

Initial analyses tested whether children with attachment and sleep data differed systematically from children from the larger study in terms of the external variables. Next, we tested relations among the sleep and attachment variables. We then tested for relations between the attachment composite variable and a subset of the external variables that have been associated with measures of attachment security in previously published research (e.g., peer acceptance) and/or which have a theoretical relation to attachment security (e.g., behavioral and affect regulation). Finally, when appropriate statistical criteria were met, mediated interactions between the attachment and sleep variable sets were tested.

Initial analyses

The sample mean for the attachment Coherence/Security composite was 5.44 ($SD = .80$). Participants with attachment and sleep data were contrasted to the rest of their cohort with respect to classroom observation/interview variables, PPVT and emotion knowledge scores, and teacher ratings for temperament, behavior, and classroom adjustment (22 separate t -tests). Only one of the 22 tests reached significance (recognition of emotion expression faces after being given the label, $t(107) = 2.17, p < .05$). Finding one difference in 22 tests is less than chance and we interpret these results to mean that the children with sleep and attachment representation data do not differ from the larger cohort from which they were recruited with respect to their social and cognitive functioning in the classrooms. As

further checks on possible effects on the attachment composite score, a two factor ANOVA (sex, ethnic status) with child age as a covariate was calculated. No main or interaction effects were significant. Finally, correlation analyses tested for possible verbal ability (i.e., PPVT-IV standard score) influences on the Security/Coherence composite, $r(35) = .01$, ns. Consequently, data for all participants with both sleep and attachment measures were used in subsequent analyses.

Attachment and sleep parameters

Correlations between the attachment composite and sleep variables are presented in the first data column of Table 1. In general, attachment was positively associated with sleep quantity variables (e.g., Sleep Duration, Total Sleep Minutes), but, these correlations were modest in magnitude and only one approached the conventional level of significance. Attachment security/coherence was positively and significantly associated with Sleep Efficiency and was also negatively and significantly correlated with variables reflecting the poor quality sleep (e.g., Number of Sleep Episodes, Sleep Activity Index, Wake Minutes after Sleep Onset). We recognize that our sample size is modest and that differences in the absolute magnitudes of these values are not themselves significant; nevertheless, these results suggest that attachment quality, as reflected by the Security/Coherence composite score from the ASCT, has greater implications for the quality of children's sleep rather than for the amount of sleep they are getting in the average night.

It is also clear from Table 1 that many of the sleep parameters have substantial overlap, both positively and negatively (e.g., the Activity Mean is positively associated, $r = .95$, with Minutes Awake after Sleep Onset, and negatively associated, $r = -.95$, with Sleep Efficiency). To reduce the redundancy in the sleep parameters, we used hierarchical cluster analysis (i.e., Complete Linkage analysis using between-item Pearson correlations as the distance measure) to identify subsets of variables that were positively related to each other. Cluster analysis has advantages over other aggregation techniques (e.g., principal components analysis) for exploratory analyses such as ours because the algorithms group objects (in this case sleep variables) together on the basis of their similarity. Consequently, the procedure generally does not produce bi-polar dimensions and it becomes possible to examine whether different aspects of sleep (in our case) are differentially related to the outcome variable(s).

In these analyses, the four-cluster solution was retained because it separated those variables with positive associations to the attachment composite from those with negative associations. In this analysis, Sleep Duration was retained as a single item (cluster 4) because it was the last variable to be joined to an existing cluster and it did not improve the reliability of the final cluster score. Cluster 1 (Sleep Fragmentation) grouped the Sleep Activity Mean, Minutes Awake after Sleep Onset, and Longest Wake Episode variables. Cluster 2 (Efficient Sleep) joined the Sleep Efficiency and Total Sleep Minutes variables. Cluster 3 (Activity/Latency) was composed of the Activity Index (i.e., % of intervals with activity >0), Sleep Latency, and Number of Sleep Episodes variables. Scores for each cluster were averages of the standardized scores for each variable included in the cluster. Correlations between the three multi-variable clusters and the attachment composite were $-.39$, $.38$, and $-.24$, for Clusters 1 to 3, respectively. Correlations for Sleep Fragmentation and Efficient Sleep were significant ($p < .05$) and are consistent with the results reported

Table 1. Correlations among the attachment coherence/security and sleep parameters ($N = 34$).

	1	2	3	4	5	6	7	8	9	10
1. Attachment Security-Coherence	..									
2. Sleep Duration (in minutes)	.12	..								
3. Total Sleep Minutes	.29	.79***	..							
4. Sleep Episodes	-.32 ^a	.15	-.34*	..						
5. Longest Wake Episode	-.36*	-.38*	-.79***	.38*	..					
6. Activity Mean	-.41*	-.26	-.77***	.57***	.90***	..				
7. Activity Index	-.34*	-.02	-.44**	.52**	.43*	.66***	..			
8. Minutes Awake after Sleep Onset	-.34*	-.16	-.73***	.72***	.85***	.95***	.69***	..		
9. Sleep Efficiency	.37*	.32 ^a	.83***	-.67***	-.87***	-.95***	-.67***	-.98***	..	
10. Sleep Latency	.07	.39*	-.05	.52**	.20	.42*	.45**	.47**	-.36*	..
Mean	5.44	531.01	462.00	32.51	4.13	14.27	67.54	47.39	87.07	10.59
SD	(0.84)	(40.38)	(56.50)	(15.09)	(2.26)	(5.09)	(32.35)	(10.11)	(6.43)	(6.07)

^a $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

in Table 1. However, a regression of these two sleep clusters on attachment did not yield a significant increase in predicted variance of the attachment composite, $R^2 = .155$ (vs. $.148$ for single sleep variable), suggesting that the predictive variance for the sleep variables with respect to attachment is redundant across these two clusters.

To further explore the role of attachment in children's adaptive functioning and potential interactions of sleep and attachment, we selected a set of representative measures from our external dataset that were empirically and/or theoretically related to attachment. These included aspects of social competence assessed from the classroom observation/interview battery (i.e., peer acceptance from sociometric data) and teacher report (i.e., three PIPPS scales, peer acceptance/positive mood [summary teacher rated scale]), understanding the causes of emotion states, and regulatory capacity for behavior, thought, and emotion (i.e., Effortful Control from the CBQ scales). Table 2 displays the correlations between the attachment composite and these external variables. Correlations with the two sleep-variable clusters associated with attachment are presented for reference in Table 2. The attachment composite was significantly and positively associated with teacher-rated peer competence (PIPPS scales, peer acceptance/positive mood), emotion knowledge, and Effortful Control.

The sleep cluster scores had a different pattern of associations with the external variable set but for the emotion knowledge score, the magnitudes were similar and afford the possibility of testing potential mediating interactions with the attachment composite (i.e., variables associated significantly with each other and jointly with an external variable; Barron & Kenny, 1986). To test whether the attachment by emotion knowledge association was mediated by sleep variables, a hierarchical regression analysis was computed. The attachment variable was entered at step 1 and accounted for 21% of the variance in the emotion knowledge variable. The two sleep cluster scores were entered at the second step and accounted for a significant increase in overall variance predicted (final $R^2 = .37$, $\Delta R^2 = .16$). At the final step, both the attachment composite and the cluster 3 scores made unique contributions to the prediction, $p < .10$ for both beta values. Thus, although both the attachment and the sleep cluster variable sets are related, they each contributed uniquely to the

Table 2. Attachment correlates in adaptive functioning variable set.

	Attachment composite	Sleep Fragmentation	Efficient Sleep
Observation/Test variables			
Peer Acceptance (sociometric)	.15	-.31 ^a	.33 ^a
Emotion Knowledge (causes)	.46**	-.46**	.54***
Teachers' Ratings			
Effortful Control	.42**	.02	-.02
Peer acceptance-positive mood	.38*	-.06	.10
Negative engagement	-.42*	-.04	.11
Play Interaction (PIPPS)	.41*	-.05	.06
Disruptive (PIPPS)	-.34*	-.01	.13
Disconnected (PIPPS)	.31 ^a	.20	-.15

^a $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

prediction of emotion knowledge and one set did not mediate the relation of the other set in this sample.

Discussion

We have argued that most previous research attempting to link security of attachment with sleep parameters was focused on the infant/toddler period and tended to rely on subjective reports of sleep duration and quality. Perhaps because the focus was on the early months or years, when sleep patterns are only beginning to become organized with regard to circadian rhythms and the child is usually permitted to wake and sleep *ad libitum* (i.e., without a specific schedule), or because the subjective reports provided by parents may have as much to do with their own attachment status as it does with child behavior (e.g., Simard et al., 2010), results reported in the currently available literature are neither consistent nor clear. We are not the only, or even the first, team to recognize the need for more objective measures in studies of sleep and attachment (e.g., Scher & Ascher, 2004); even so, attachment researchers have been slow to respond.

Although attachment is well established as an organizer of adaptation for infants and toddlers (Sroufe & Waters, 1977), Bowlby intended that attachment theory would apply to the organization of behavior beyond toddlerhood; indeed, he anticipated that attachment security would be a major part of the foundation for positive adaptation over the lifespan. Research reported over the past 20 + years has supported his intuition (e.g., Greenberg et al., 1990; Sroufe, Egeland, Carlson, & Collins, 2005). Importantly, there are evidence-based tools for assessing the child's mental representations of attachment security that can be used for children beyond infancy (e.g., Bretherton et al., 1990). Consequently, we searched for links between attachment and sleep during the preschool years, after children have established more stable patterns of sleep and wakefulness. We recognize that the preschool period is also one of transition with respect to sleep; that is, the child is expected to shift from the *ad libitum* schedules of the early years to *socialized* schedules organized around the demands of adult lives and institutional (e.g., preschool) agendas. Thus, the preschool period poses a challenge to the child's typical pattern of sleeping and is, therefore, an ideal time to consider potential relations with attachment quality. Our results suggest that attachment quality is associated with objectively recorded sleep parameters from actigraph data and that these relations do not simply reflect individual differences in child verbal ability (i.e., $r = .01$ between the attachment variable and the PPVT-IV standard score).

We found that a substantial number of the sleep variables tested had significant associations with attachment Security/Coherence. It is interesting to us that significant correlates tended to come from the variable set dealing with how *well* the child sleeps after first falling asleep rather than from the set of variables indicating how *much* sleep the child gets on the average night. Children with more secure attachment representations were less active at night and also slept more efficiently (i.e., percentage of the minutes spent in bed that were sleep minutes). In contrast, children with less secure representations tended to spend more minutes awake after first falling asleep, tended to stay awake longer in their longest night waking episode, and were more active at night. This pattern of relations was also present when the sleep data were reduced using cluster analysis. These findings suggest that insecurely attached children sleep less soundly than do children with

secure attachments. This conclusion is consistent with some attachment/sleep studies reported for infants (e.g., McNamara et al., 2003; Morrell & Steele, 2003), but fails to reproduce Scher's (i.e., Scher, 2001; Scher & Asher, 2004) findings using actigraphy. It is also interesting to consider our results in light of recent findings relating attachment insecurity to dream contents in adults. Both McNamara et al. (2011) and Mikulincer et al. (2011) recently have reported that adults higher in attachment anxiety recall more distressing personal and/or interpersonal content from their dreams than do adults with lower attachment anxiety, and this may imply generally lower quality sleep with more frequent wakings and nighttime activity (see also Csóska, Simor, Szabo, Kopp, & Bódizs, 2011, for a discussion of early separations and distressing dream activity in adults). Although these studies did not report analyses on the topography of sleep *per se*, as we have done here, the results offer a provocative parallel to our findings that could serve as guides to future research.

Our data also suggest that attachment security is implicated in the adaptive functioning of preschool children across several adaptive domains (e.g., social competence, emotion knowledge, regulatory capacity). Sleep quality was also associated with emotion knowledge but the effects of attachment and sleep on emotion knowledge appear to be additive, rather than interactive (i.e., we could not detect mediation effects and both variable sets made unique contributions to the prediction of emotion knowledge). We are reluctant to offer a strong interpretation of these results because the sample size here is small, making the detection of small effects difficult, and because our primary purpose was to establish relations between the attachment and sleep domains rather than to examine joint and interactive effects of these domains on external outcomes. Nevertheless, having found additive effects of attachment and sleep quality, we believe that additional, targeted research to explore both additive and interactive (e.g., moderated and/or mediated) effects on child adaptive functioning seems warranted.

This last point underscores another problem with the existing conceptual framework underlying most published research on attachment and sleep. That is, from Anders' (1994) early conceptualization forward, there has been the presumption that the direction of effects flows from attachment insecurity to sleep problems. This pathway may be consistent with attachment theory, but it is equally plausible to anticipate a reversed flow of influence from sleep to attachment security (see Keller, 2011). For example, during early infancy, infant sleep disturbances may become a problem for the parent (e.g., keeping the parent awake at night leading to sleep deprivation) that undermine parent wellbeing, interfere with parenting quality, and subsequently influence attachment security. The full pathway for this route of possible effects has not been mapped but some research suggests that the irregular sleep schedules characteristic of early infancy can induce fatigue in parents (e.g., Dennis & Ross, 2005), which could, in turn, undermine the quality of parenting. From the perspective of our own results, it seems plausible to suggest that poor quality sleep interferes with the child's capacity to organize thoughts in response to the story stems presented in the ASCT, which in turn could lead to narratives with less coherence (and therefore scored as less secure). In future research it will be important to assess the coherence of children's stories that are not attachment-relevant to determine whether this association is specific to attachment or is a more general characteristic of children who do not sleep well. Finally, because the data collected here were collected concurrently, we cannot address questions of causal

direction directly. Consequently, we suggest that future studies should be longitudinal with repeated assessments of both attachment and sleep to disentangle the causal links between these two biopsychosocial organizers.

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