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Sleep Items in the Child Behavior Checklist: A Comparison With Sleep Diaries, Actigraphy, and Polysomnography

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Abstract

Objective—The Child Behavior Checklist is sometimes used to assess sleep disturbance despite not having been validated for this purpose. This study examined associations between the Child Behavior Checklist sleep items and other measures of sleep.

Method—Participants were 122 youth (61% female, aged 7 through 17 years) with anxiety disorders (19%), major depressive disorder (9%), both anxiety and depression (26%), or a negative history of any psychiatric disorder (46%). Parents completed the Child Behavior Checklist and children completed a sleep diary, wore actigraphs for multiple nights, and spent 2 nights in the sleep laboratory. Partial correlations ([pr], controlling for age, gender and diagnostic status) were used to examine associations.

Results—Child Behavior Checklist sleep items were associated with several other sleep variables. For example, "trouble sleeping" correlated significantly with sleep latency assessed by both diary (pr(113) = 0.25, $p = .008$) and actigraphy (pr(105) = 0.21, $p = .029$). Other expected associations were not found (e.g., "sleeps more than most kids" was not significantly correlated with EEG-assessed total sleep time: pr(84) = 0.12, $p = .258$).

Conclusions—Assessing sleep using the Child Behavior Checklist exclusively is not ideal. Nonetheless, certain Child Behavior Checklist items (e.g., "trouble sleeping") may be valuable. Although the Child Behavior Checklist may provide a means of examining some aspects of sleep from existing datasets that do not include other measures of sleep, hypotheses generated from such analyses need to be tested using more rigorous measures of sleep.

Keywords

actigraphy; CBCL; poly somnography; sleep diary

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Parent reports are often used to assess sleep broadly in multi-method studies of developmental psychopathology. The Child Behavior Checklist (CBCL)[1,2] is a widely used parent-report measure of behavioral difficulties in children. This measure contains items assessing aspects of sleep (e.g., questions about whether one's child sleeps less or more than others and has trouble sleeping). To tap into rich datasets such as epidemiologic studies of development, researchers have used the CBCL sleep items to investigate links between sleep and other variables.[3,4] As the CBCL was not designed to assess sleep, this current investigation explores associations between CBCL sleep items and other, more traditional measurements of sleep, namely, sleep diaries, actigraphy, and polysomnography.

Paucity of Sleep Measures in Studies of Development

It is increasingly apparent that different aspects of sleep (e.g., length, quality) are associated with development. For example, sleep measurements in childhood and adolescence have been associated with a range of difficul-ties, including anxiety and depression[5] as well as attention problems,[6] family functioning,[7] obesity,[8] and neuropsychological functioning.[9-11] Such information underscores the need to thoroughly assess sleep in large-scale longitudinal studies of child development to further establish these links and to elucidate mechanisms underlying such associations. Despite this, studies of child and adolescent development (such as the Zuid-Holland study)[4] often do not thoroughly assess sleep disturbances but at best include a handful of sleep-related items in measures designed to assess other aspects of functioning (e.g., the CBCL).

Using the CBCL to Assess Sleep

Using the sleep items in the CBCL (grouped in various ways) has led to important findings. For example, sleep assessed using the CBCL items has been associated with anxiety disorders,[3] severe traumatic brain injuries,[12] as well as affective illness in mothers.[13] CBCL-assessed sleep disturbances have also been shown to be common in individuals with Tourette syndrome and chronic tic disorder[14] and have been found to predict both behavioral and emotional difficulties longitudinally.[4,15] Furthermore, CBCL sleep items have been used in twin studies examining genetic and environmental influences on sleep disturbance.[16]

Concerns With Use of the CBCL

Despite opportunities provided by using the CBCL to assess sleep, there is scepticism as to what exactly the CBCL is measuring. Sleep items in this measure include “overtired”; “sleeps less than most kids”; “sleeps more than most kids during day and/or night”; and “trouble sleeping.” Criticisms of the use of CBCL items to assess sleep include the absence of reference points (for example, parents may be unaware of the extent to which most children sleep, so may have difficulties reporting whether their child sleeps more or less than other children). Furthermore, responses to the CBCL items could reflect issues other than sleep in children (such as parental sleep patterns/psychopathology or child temperament). A wider issue concerns the use of parents as compared with children when reporting children's sleep disturbances. Indeed, previous research focusing on nonclinical samples has suggested that children appear to have more sleep disturbances when they report on this themselves as compared with when parent reports are focused upon,[17,18] perhaps reflecting lack of parental awareness of their children's sleep problems or that children are not accurate at reporting their own sleep disturbances.[18] Interestingly, this pattern of results has not been found when focusing on youth with clinical anxiety.[19]

To obtain a better understanding of the correspondence between sleep assessed by the CBCL and more traditional measures of children's sleep, a comparison of different measures is beneficial.

Traditional Measurements of Sleep

No measure of sleep is without limitations, but sleep diaries are sometimes considered the most reliable self-report measures to quantify sleep. Sleep diaries typically involve participants (or caregivers) documenting timings related to going to sleep and waking up, as well as perceptions of sleep quality, assessed over multiple consecutive days and nights. These measures are typically completed just before bed and first thing in the morning.

Sleep diaries are sometimes used in conjunction with actigraphy, a technique that involves recording movement (via a watch-like device) and from which it is possible to make inferences about sleep patterns and disturbances (for a discussion of the role of actigraphy in sleep medicine, see Sadeh and Acebo[20]).

Although impractical for use in large-scale studies, polysomnography is often considered the gold standard for assessing sleep. This technique typically involves obtaining physiological measures of brain activity (electroencephalography [EEG]), eye movements (electrooculography [EOG]), muscle activity (electromyography [EMG]) and heart rhythm (electrocardiography [ECG]). Previous research has highlighted good correspondence between polysomnography and sleep-diary report combined with actigraphy.[21] To assess the CBCL as a measure of sleep, we examined a dataset that included CBCL, sleep diary, actigraphy and polysomnography in a large sample of children and adolescents. We focused on four items from the CBCL (“overtired,” “sleeps less than most kids,” “sleeps more than most kids during day and/ or night,” and “trouble sleeping”), which we considered to be most likely to correspond with the other measures included in the study.

Research Questions

Given that previous research has not clarified what exactly the CBCL sleep-related items are assessing, hypotheses were based on our own research experience, clinical observation and the face content of each item. In particular, we expected “overtired” to be associated with other measures of reduced sleep length and quality. We expected “sleeps less than most kids” and “sleeps more than most kids during day and/or night” to be associated with variables indicative of shorter and longer sleep length respectively. Finally, we expected “trouble sleeping” to be associated with variables indicating reduced sleep quality, and in particular, longer sleep latency.

METHOD

Participants

Participants were children and adolescents enrolled in a multidisciplinary study of neurobehavioral characteristics of pediatric affective disorders. Data from this large-scale study have been published previously,[5,22,23] although this is the first study to compare the CBCL sleep-related items with other measures of sleep. The current article focuses on 122 youth (61% female; aged 7-17 years) whose parents completed the Child Behavior Checklist.[1,2] As the participants in the current analyses were all enrolled in an ongoing study, the sample size was predetermined. However, power estimates using G*Power 3[24] with the sample size available (N = 122) and an α error probability of 0.05 revealed that we had 0.92 power to detect a moderate correlation of 0.3 and 0.60 power to detect a small/ moderate correlation of 0.2 (two-tailed). Participants were 90% white, 7% African American, 2% Hispanic, and 1% biracial. Mean socioeconomic status (measured by the

Hollinghead index) was 41.68 (standard deviation [SD] = 12.30, range 9-66). Participants were from both nonclinical (without a history of a psychiatric disorder, 46%) and clinical (19% anxiety disorders; 9% major depressive disorder; 26% both anxiety and depression) populations. Both clinical and nonclinical participants were included in analyses for two main reasons: first, to make the sample representative of those typically studied in investigations including the CBCL; and second, to increase power to investigate our research questions. Participants were recruited by radio and newspaper advertisements. Participants with anxiety and depressive disorders were also recruited from the Child and Adolescent Depression Program at Western Psychiatric Institute and Clinic in Pittsburgh. Diagnoses were determined through administration of the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version.[25] Each participant and a parent/guardian was interviewed separately by a bachelor's degree–level research specialist trained according to local diagnostic reliability standards. Reliability for depressive and anxiety diagnoses was >90% and was maintained through monthly diagnostic reviews. A child and adolescent psychiatrist provided best estimate diagnoses. Participants in the depression and anxiety groups were in a current episode (they met diagnostic criteria for that disorder at the time of assessment).

Participants were excluded for use of medication with central nervous system or hypothalamic–pituitary effects within the past 2 weeks; use of fluoxetine within the past 6 weeks; significant medical illness; extreme obesity (defined as a body mass index of >97% as compared with the U.S. population norms); IQ < 70; eating disorder; developmental disorder (i.e., mental retardation, pervasive developmental disorder; and genetic disorders influencing neuro-development); schizophrenia; phobia of intravenous needles; learning disabilities; and use of nicotine, drugs, or alcohol. For participants who had taken medication during the current episode, medication was tapered under the guidance of the participant's psychiatrist. The exclusions made were related to psychiatric, medical, and pharmacological issues that could have significant effects on imaging and hormonal measures also included in the multidisciplinary study.

Measures and Procedure

Ethics and Consent—The study protocol was approved by the University of Pittsburgh Institutional Review Board. Participants' parents/guardians were told about the procedures of the study and signed an informed consent form. Participants 14 years or older provided their own consent, and participants younger than 14 years provided verbal assent.

Child Behavior Checklist/4-18 (CBCL[1,2])—Parents completed the CBCL between 31 months before and 2 months after going into the laboratory for the first night of assessment. Of note, the CBCL was completed within 4 months of the laboratory visit for 80% of the sample. The CBCL is an 118-item, widely used measure of behavioral and emotional difficulties in children. The reliability and validity of this measure to assess behavioral and emotional difficulties is well documented (see Achenbach[2]).

The CBCL includes six items that may tap into sleep disturbance: "overtired," "sleeps less than most kids," "sleeps more than most kids during day and/or night," "trouble sleeping," "nightmares," and "talks or walks in sleep." We did not have a priori expectations as to how the latter two (parasomnia) items would correspond with the sleep diary, actigraphy, and EEG variables included here, so these variables are not included in the current report. As with other items on the CBCL, parents were asked to describe their child now or within the past 6 months (0 = not true; 1 = somewhat or sometimes true; 2 = very true or often true).

Sleep Diary—For 6 consecutive days before their laboratory assessment and on the 2 mornings in the laboratory, children completed a sleep diary each morning.[22] This diary includes questions about time to bed, estimated time to fall asleep (sleep latency), and wake time. Participants were also asked to estimate how many times they woke up in the night and the total duration of time awake between going to bed and getting up. In addition, they were asked to rate their sleep quality and ease of waking using a visual analogue scale. The following four variables were included in analyses: sleep latency (minutes between bedtime and sleep time); total awake time (minutes); sleep quality (higher score indicates superior sleep quality); and ease of waking (higher score signifies greater ease of waking). Here we focus on the mean of days 2 to 6 (baseline week).

Actigraphy

Actigraphy was conducted for 1 week using Octagonal Basic Motionlogger Actigraphs (Ambulatory Monitoring, Ardsley, NY). Participants were required to wear an actigraph on the nondominant wrist for the full week (it was stipulated that the actigraph could be removed only for contact sports, swimming, or bathing). Participants pressed a button on the actigraph to indicate that they were attempting to sleep or had awakened (this information was also noted on the actigraph record). Sleep scoring was conducted in 60-second epochs using Action W 2.5. Data were processed using the Cole–Kripke procedure.[26] Raters were trained by scoring records collectively, after which they individually scored identical records (this allowed discussion of discrepancies). The mean of the 7 nights are focused upon here (for further information about actigraphic monitoring in youth, see Acebo et al.[27]). We focused on four commonly used variables assessing sleep patterns: total time awake during down interval (minutes); total sleep during down time (minutes); sleep latency (minutes to start of first 20-minute block of sleep); and wake after sleep onset (total wake minutes during down interval).

EEG

Participants were admitted to the Child and Adolescent Sleep and Neurobehavioral Laboratory at the Western Psychiatric Institute and Clinic for a neurobiological assessment that included 2 consecutive nights of standard polysomnography. Here we report the mean of these 2 nights.

Sleep scoring was conducted in 30-second epochs using standard criteria.[28] Scorers were blinded to diagnosis and achieved adequate interrater reliability. The following four variables were computed and have been used in previous analyses,[5] and are focused upon here: total sleep time (minutes); number of arousals; time awake after sleep onset (minutes), and sleep latency. Sleep onset was defined as the first of 10 consecutive minutes of stage 2 or deeper sleep. Total sleep time was computed within the total sleep period. Time awake was computed as wakefulness after sleep onset and before waking time. Sleep latency was computed as the difference between bedtime (i.e., lights out) and sleep onset.

Data Preparation and Analyses

Certain variables from the CBCL (i.e., “sleeps more than most kids during day and/or night”), sleep diary (i.e., sleep latency and total time awake), actigraphy (i.e., wake after sleep onset) and EEG (i.e., sleep latency) were skewed (skewness > 2). It is an assumption of correlations that the data are approximately normally distributed, so log transformations (a common procedure for reducing positive skew) were used. After transformations, the skewness of all variables was reasonable (skewness < 2). We ran partial correlations (pr), which controlled for age of child (at which parents completed the CBCL), gender, and clinical status (diagnostic versus control group). These three variables were included as controls because they have all been associated with CBCL responses[3,15,29] as well as objective measures of sleep.[5,30] We then ran zero-order correlations (i.e., those that ignore the influences of other variables) to examine the unadjusted associations between the CBCL and other sleep variables. Partial correlations are presented in the Results section of this article (although tables also include zero-order correlations). Two-tailed tests were used for analyses. Although numerous correlations were run, we did not adjust for multiple testing, as such adjustments are conservative and arguably inappropriate for novel research such as that reported here.[31]

RESULTS

CBCL Items: Frequencies

The majority of parents did not consider their children to experience sleep problems. Specifically, having an “overtired” child was not considered to be true for 69% participants (parents considered this item to be somewhat true and very true for 18% and 13% of the sample, respectively). Of the parents, 79% did not consider their child to “sleep less” than others (14% and 7% considered this item to be somewhat true and very true, respectively). Most parents (82%) did not consider their children to “sleep more” than others (11% and 8% considered this item to be somewhat true and very true, respectively). Finally, most children were not considered by their parents to have “trouble sleeping” (69%). A smaller proportion of parents considered this item to be somewhat true (17%) or very true (14%).

CBCL Item “Overtired” as a Correlate of Traditional Sleep Variables

Tables 1, 2, and 3 show partial and zero-order correlations between CBCL and sleep diary, actigraphy and EEG sleep items, respectively. The CBCL item “overtired” correlated significantly with the sleep-diary item sleep latency (pr(114) = 0.19, $p = .039$). Reports of being “overtired” were also associated with fewer arousals (pr(86) = –0.22, $p = .039$) as assessed using EEG.

CBCL Item “Sleeps Less” as a Correlate of Traditional Sleep Variables

There was a trend for the parent-reported CBCL item “sleeps less” to be correlated with the sleep-diary item sleep latency (pr(111) = 0.16, $p = .089$). There was an association between parent reports of “sleeps less” and less EEG assessed total sleep time (pr(84) = –0.23, $p = .032$). There was also a trend for “sleeps less” to be associated with fewer arousals (pr(84) = –0.21, $p = .055$) as assessed by EEG.

CBCL Item “Sleeps More” as a Correlate of Traditional Sleep Variables

The CBCL item “sleeps more” than others was negatively correlated with sleep diary total awake time (pr(111) = –0.18, $p = .052$) and ease of waking (pr(109) = –0.25, $p = .009$). “Sleeping more” than others was associated with a shorter sleep latency as assessed by actigraphy (pr(104) = –0.21, $p = .034$).

CBCL Item “Trouble Sleeping” as a Correlate of Traditional Sleep Variables

Finally, the CBCL item “trouble sleeping” significantly correlated with sleep latency assessed by sleep diary (pr(113) = 0.25, $p = .008$). There was also a significant association between this item and longer sleep latency (pr(105) = 0.21, $p = .029$) assessed using actigraphy. There was a trend for parent-reported “trouble sleeping” to be associated with less total sleep time as assessed using EEG (pr(85) = –0.19, $p = .073$).

DISCUSSION

The aim of this work was to examine the extent to which sleep items in the CBCL correspond to variables obtained from more traditional measures of sleep. We expected “overtired” to be associated with other measures of sleep length and quality, and found that although “overtired” was not associated with sleep length, it was associated with certain indices of sleep quality (i.e., sleep-diary–rated sleep latency). Not all associations were in the expected direction (see the correlation between “overtired” and EEG-assessed arousals). We expected “sleeps less than most kids” and “sleeps more than most kids during day and/ or night” to be associated with sleep length variables but found little support for this, although there was a link between the CBCL item “sleeps less” and shorter sleep duration as measured using polysomnography. Finally, we expected “trouble sleeping” to be associated with sleep quality variables, in particular, sleep latency. As expected, we found that “trouble sleeping” was associated with sleep latency assessed by both sleep diary and also actigraphy, although not polysomnography. This finding corresponds with unpublished clinical observations by some of us that even short periods of sleeplessness when attempting to fall asleep appear to result in an overall sense of “trouble sleeping” in patients, even if sleep during the night is adequate.

Despite the many strengths of this study including the use of multiple subjective and objective measures of sleep, certain limitations must be acknowledged. First, whereas the reporting period for the CBCL is 6 months, all other measures refer to a period shorter than 1 week, and the latter measures therefore fail to capture long-term patterns of sleep with which parents are familiar. Related to this issue, it is noteworthy that there was a time lag between parents completing the CBCL and sleep being assessed in other ways. Although long time lags between parents completing the CBCL and sleep being assessed in other ways may help to explain the lack of correspondence between measures, unreported analyses involved re-running all correlations after splitting the sample into two parts depending on length of time lag between completion of the CBCL and the first night in the laboratory. Correlations between the CBCL and other measures were not systematically greater in the shorter (shortest 50%; 0-42 days between CBCL and first night in the laboratory) as compared with the longer (longest 50%; >42 days between CBCL and first night in the laboratory) time-lag group. For example, the partial correlations between the CBCL item “trouble sleeping” and sleep diary “sleep latency” were 0.22 for the short time-lag group and 0.33 for the long time-lag group. The partial correlations between “trouble sleeping” and actigraphy assessed sleep latency were 0.21 for the short time-lag group and 0.24 for the long time-lag group. Finally, the partial correlations between “trouble sleeping” and EEG-assessed sleep latency were 0.23 for the short time-lag group and 0.12 for the long time-lag group. This chimes well with the notion that the CBCL data are likely to capture the parent's subjective sense of the child's usual sleep over long (averaged) periods of time, rather than reflecting specific subtle differences in temporal resolution. This notion also sits well with previous research highlighting some stability of sleep disturbances assessed using the CBCL throughout childhood.[15]

Second, it is important to note that none of the sleep measures included in the study was without limitation. Although polysomnography is often considered the gold standard for assessing sleep, it is possible that sleep during the 2 nights in the laboratory was not reflective of sleep patterns experienced in the home, and further use of portable polysomnography devices could have been valuable.[32] This point emphasizes the importance of multi-method measures in studies, as no single measure is able to capture the full complexity of sleep.

A final point is that the participants of this study were not representative of either the general population or of clinical samples (they included participants who had anxiety and depressive disorders or who had not experienced psychiatric illness, and various exclusions were made that could have influenced the results). Nonetheless, clinical status was statistically adjusted in certain analyses, to reduce the influence of clinical status on the associations reported here. To further address whether the CBCL items are valid to use in different populations, future research should use larger samples than that used here, so that it is possible to examine associations in clinical versus nonclinical groups separately. Indeed, power estimates suggest that had we split our sample into clinical (n = 66) versus nonclinical (n = 56) groups before running analyses, we would have just 0.62 power to identify moderate correlations of 0.3, and 0.32 power to identify a small/moderate correlation of 0.2 at an α error probability level of 0.05 in our smallest group (two-tailed, see G*Power 3[24]). Despite these limitations, the results of this study have potential implications for research. Although there were some significant associations between CBCL items and other measures of sleep, many associations were not significant, and it is clear that when designing a study of sleep disturbance in children, the CBCL should not be selected as the measure of choice to assess sleep. Instead, when selecting a questionnaire measure in a sleep study, inclusion of a widely used and well-validated measure such as the Child Sleep Habits Questionnaire[33] would be preferable. Furthermore, the relatively low rates of correspondence between the CBCL and other sleep variables suggest that caution should be taken when interpreting results from studies measuring sleep using the CBCL exclusively. Future revisions of the CBCL should consider revising sleep items in more precise terms that demonstrate better correspondence with objective measures of sleep.

Although the CBCL is clearly not the measure of choice to assess sleep, the correspondence between the CBCL sleep items and other measures of sleep lends preliminary support to the notion that the CBCL may be tapping certain aspects of sleep. In particular, responses to the item “trouble sleeping” may correspond to sleep latency assessed in various ways. This suggests that if this CBCL item is endorsed by parents, it may be worth following up with enquiries about difficulties initiating sleep. Furthermore, the finding that some other CBCL variables (e.g., those focusing on sleep length) are also associated with certain measures of sleep latency, suggests that the CBCL may be most useful as a measure of sleep onset problems (which are likely to be more apparent to parents than other aspects of sleep). Overall, these data provide preliminary support for the use of the CBCL to assess sleep in existing rich datasets (and when no alternative is available) to generate hypotheses that then require testing in well-designed future studies of sleep. *&*

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TABLE 1

Correlations Between Sleep Diary Variables and Child Behavior Checklist Sleep Items (Before and After Controlling for Age, Gender, and Diagnostic Status)

Sleep Diary Variables	**Child Behavior Checklist Sleep Items**			
	Overtired	**Sleeps Less**	**Sleeps More**	**Trouble Sleeping**
Sleep latency	**pr(114) = 0.19, *p* = .039**	**pr(111) = 0.16, *p* = .089**	pr(112) = –0.06, *p* = .552	**pr(113) = 0.25, *p* = .008**
	[r(117) = 0.34, *p* < .001]	**[r(114) = 0.30, *p* = .001]**	[r(115) = 0.10, *p* = .295]	**[r(116) = 0.37, *p* <.001]**
Total time awake	pr(113) = –0.13, *p* = .162	pr(110) = –0.06, *p* = .554	**pr(111) = –0.18, *p* = .052**	pr(112) = 0.07, *p* = .495
	[r(116) = 0.06, *p* = .510]	[r(113) = 0.09, *p* = .337]	[r(114) = 0.02, *p* = .824]	**[r(115) = 0.19, *p* = .042]**
Sleep quality	pr(111) = –0.11, *p* = .243	pr(108) = –0.03, *p* = .729	pr(109) = –0.11, *p* = .240	pr(110) = –0.11, *p* = .268
	[r(114) = –0.29, *p* = 0.002]	**[r(111) = –0.22, *p* = .02]**	**[r(112) = –0.27, *p* = .004]**	**[r(113) = –0.27, *p* = .003]**
Ease of waking	pr(111) = –0.13, *p* = .167	pr(108) = .09, *p* = .327	**pr(109) = –0.25, *p* = .009**	pr(110) = –0.04, *p* = .699
	[r(114) = –0.30, *p* = .001]	[r(111) = –0.12, *p* = .227]	**[r(112) = –0.37, *p* < .001]**	**[r(113) = –0.21, *p* = .024]**

*Note: Degrees of freedom are provided in brackets following zero-order correlation (r). Boldface type is used to highlight correlations which are significant (*p *< .05) or approaching significance (*p *< .10). Certain variables were transformed prior to analyses in order to reduce skevs. The discrepancy in numbers reported in the table is caused by missing data, p = probability value; pr = partial correlation (controlling for age; gender, and diagnostic status).*

TABLE 2

Correlations Between Actigraphy Sleep Variables and Child Behavior Checklist Sleep Items (Before and After Controlling for Age, Gender, and Diagnostic Status)

	Child Behavior Checklist Sleep Items			
Actigraphy Variables	**Overtired**	**Sleeps Less**	**Sleeps More**	**Trouble Sleeping**
Total awake minutes	pr(106) = 0.05, *p* = .594	pr(103) = 0.04, *p* = .706	pr(104) = 0.01, *p* = .890	pr(105) = 0.04, *p* = .660
	[r(109) = 0.03, *p* = .762]	[r(106) = 0.05, *p* = .612]	[r(107) = –0.02, *p* = .805]	[r(108) = 0.05, *p* = .601]
Total sleep minutes	pr(106) = –0.02, *p* = .811	pr(103) = –0.07, *p* = .461	pr(104) = –0.08, *p* = .431	pr(105) = –0.04, *p* = .702
	[r(109) = 0.00, *p* = .997]	[r(106) = –0.05, *p* = .646]	[r(107) = –0.10, *p* = .303]	[r(108) = 0.03, *p* = .795]
Sleep latency	pr(106) = 0.00, *p* = .984	pr(103) = 0.15, *p* = .118	**pr(104) = –0.21, *p* = .034**	**pr(105) = 0.21, *p* = .029**
	[r(109) = 0.04, *p* = .643]	**[r(106) = 0.19, *p* = .050]**	**[r(107) = –0.18, *p* = .065]**	**[r(108) = 0.25, *p* = .009]**
Wake after sleep onset	pr(106) = 0.06, *p* = .508	pr(103) = 0.07, *p* = .501	pr(104) = 0.00, *p* = .968	pr(105) = 0.01, *p* = .913
	[r(109) = –0.02, *p* = .849]	[r(106) = 0.04, *p* = .709]	[r(107) = –0.08, *p* = .429]	[r(108) = –0.03, *p* = .783]

Note: Degrees of freedom are provided in brackets following zero-order correlation (r). Boldface type is used to highlight correlations that are significant (p < .05) or approaching significance (p < .10). Certain variables were transformed prior to analyses to reduce skew. The discrepancy in numbers reported in the table is due to missing data. p = probability value; pr = partial correlation (controlling for age, gender, and diagnostic status).

TABLE 3

Correlations Between EEG Sleep Variables and Child Behavior Checklist Sleep Items (Before and After Controlling for Age, Gender, and Diagnostic Status)

	Child Behavior Checklist Sleep Items			
EEG Variables	**Overtired**	**Sleeps Less**	**Sleeps More**	**Trouble Sleeping**
Total sleep time	pr(86) = –0.12, *p* = .252	**pr(84) = –0.23, *p* = .032**	pr(84) = 0.12, *p* = .258	**pr(85) = –0.19, *p* = .073**
	[r(89) = –0.08, *p* = .465]	[r(87) = –0.14, *p* = .183]	[r(87) = 0.06, *p* = .551]	[r(88) = –0.07, *p* = .529]
Number of arousals	**pr(86) = –0.22, *p* = .039**	**pr(84) = –0.21, *p* = .055**	pr(84) = –0.17, *p* = .109	pr(85) = –0.04, *p* = .707
	[r(89) = –0.26, *p* = .012]	**[r(87) = –0.24, *p* = .025]**	**[r(87) = –0.22, *p* = .042]**	[r(88) = –0.09, *p* = .386]
Time awake after sleep onset	pr(86) = –0.15, *p* = .154	pr(84) = –0.12, *p* = .291	pr(84) = –0.12, *p* = .283	pr(85) = –0.13, *p* = .233
	[r(89) = –0.12, *p* = .258]	[r(87) = –0.07, *p* = .493]	[r(87) = –0.11, *p* = .291]	[r(88) = –0.07, *p* = .510]
Sleep latency	pr(86) = –0.02, *p* = .868	pr(84) = 0.07, *p* = .518	pr(84) = –0.06, *p* = .560	pr(85) = 0.14, *p* = .188
	[r(89) = 0.02, *p* = .864]	[r(87) = 0.10, *p* = .330]	[r(87) = –0.04, *p* = .681]	**[r(88) = 0.18, *p* = .096]**

*Note: Degrees of freedom are provided in brackets following zero-order correlation (r). Boldface type is used to highlight correlations which are significant (*p *< .05) or approaching significance (*p *< .10). Certain variables were transformed prior to analyses in order to reduce skew. The discrepancy in numbers reported in the table is due to missing data. p = probability value. pr = partial correlation (controlling for age, gender, and diagnostic status).*