Pre-Sleep Arousal and Sleep Problems of Anxiety-Disordered Youth

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Abstract The current study examined sleep problems and pre-sleep arousal among 52 anxious children and adolescents, aged 7–14 years, in relation to age, sex, ethnicity, and primary anxiety disorder. Assessment included structured diagnostic interviews and parent and child completed measures of sleep problems and pre-sleep arousal. Overall, 85% of parents reported clinically-significant child sleep problems, whereas 54% of youth reported trouble sleeping. Young children, those with primary generalized anxiety disorder, and Latino youth experienced the greatest levels of sleep disturbance. Additionally, greater levels of pre-sleep cognitive rather than somatic arousal were found and pre-sleep thoughts were associated with decreased total sleep duration and greater sleep problems. Findings suggest that attention to sleep should be part of assessment procedures for anxious children in both research and clinical settings.

Keywords Child · Adolescent · Anxiety disorders · Sleep · Pre-sleep arousal

Introduction

Growing interest in the sleep of children with anxiety disorders is fueled by several, overlapping lines of research. Most notably, a growing body of research documents a high prevalence of sleep problems among clinically-anxious youth [1–4]. Across studies, data indicate up to 90% of children and adolescents experience at least one type of sleep problem and a majority (55%) report several sleep-related difficulties [2, 4]. Difficulty initiating and/or maintaining sleep, nightmares and refusal to sleep independently are among the most common problems. Additionally, clinically anxious youth go to bed later and receive significantly less sleep on weekdays than their non-anxious peers [5].

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The presence of sleep disruption also is associated with a more severe form of anxiety illness and independently predicts impairments in daytime functioning beyond anxiety symptomatology [2, 4].

Although the disruption of sleep is a common consequential feature of anxiety, longitudinal data reveal a relationship that is far more complex. Several epidemiological investigations provide evidence that persistent sleep problems early in life are a unique predictor for the development of anxiety and anxiety disorders during adolescence and adulthood [6–9]. Findings from experimental studies are equally compelling. Both cumulative and acute sleep loss result in increased levels of anxiety and fear the next day among adults and children [10–12]. Experimental data also have important implications for the effectiveness of behavioral treatments for anxiety. Exposure therapy, aimed at extinguishing anxiety/fear, is a central component of treatment and there is now evidence that adequate sleep promotes generalization from extinguished (i.e., within the treatment setting) to unextinguished (i.e., real world settings) fears [13]. Thus, it is evident that sleep and anxiety are both intrinsically and reciprocally related.

Despite the implications of these collective data, only a handful of studies have examined the sleep of clinically-anxious youth. Several studies have relied on non-structured assessment of generically defined sleep problems, such as an insomnia item derived from a measure of psychopathology. Other research has examined the sleep of youth with heterogeneous anxiety disorders [3, 5] or based analyses on the presence/absence of certain anxiety diagnoses [2]. The former approach limits the specificity of findings for any individual disorder [see 14 for a review] while the latter increases the possibility of spurious associations between secondary diagnoses and sleep behaviors. It also is generally unknown whether parental reports of sleep correspond with the reports of anxious children. Although, in general, parents tend to underestimate their children's sleep problems [15, 16], Storch et al. [4] found that 56% of parents and 44% of children with obsessive compulsive disorder (OCD) reported "trouble sleeping". Thus, it is possible that parents of anxious youth may be more aware of problems with their children's sleep compared to parents of non-anxious youth.

Investigations aimed at identifying specific mechanisms underlying the common co-occurrence of anxiety and sleep disruption are even more limited. Research points toward the role of both biological and environmental mechanisms and suggests the presence of parallel underlying risk factors [6, 17]. Similar to anxiety disorders, both physiologic and cognitive arousal represent important dimensions of sleep disruption in adults [18, 19]. Adults with anxiety disorders report higher levels of cognitive activity and worry at bedtime compared to both insomniacs and good sleepers and rate their pre-sleep worries as less controllable and more interfering [20]. A heightened state of physiological (somatic) arousal also has been found to contribute to problems initiating and/or maintaining sleep [21], however pre-sleep cognition is commonly cited as the most significant factor in persistent sleep disturbance [22, 23]. Preliminary data suggest important associations between sleep and cognitive factors in anxious youth as well [24, 25]. In a community-based study of 123 children aged 8–10 years, Gregory and colleagues [26] found pre-sleep cognitive and, to a lesser extent, somatic arousal to predict parent and child reported sleep problems; however associations with anxiety were not examined. A better understanding of these pre-sleep phenomena may help to inform research and practice by identifying specific targets for intervention among anxious youth.

The current study had three aims. First, using a validated measure of parent-reported sleep, total sleep duration and the specific types of sleep problems of children with anxiety disorders were examined as a function of age, sex, and ethnicity. Consistent with previous

research, we expected younger children and females to exhibit greater sleep problems than older and male children [2, 4]. We also examined sleep variables based on primary anxiety diagnosis, anticipating the greatest sleep problems in youth with generalized anxiety disorder (GAD), separation anxiety disorder (SAD), and OCD [2, 4]. Second, parent and child report of sleep problems and daytime fatigue were examined and compared. Based on findings reported by Storch et al. [4], we expected overall correspondence between informants. Lastly, cognitive and somatic dimensions of pre-sleep arousal and their association with specific types of sleep problems were evaluated. Because children over the age of 7 years experience a worry process similar to that found among adults [27, 28], we hypothesized that anxious youth would report greater levels of cognitive than somatic arousal and that pre-sleep cognitive arousal would be associated with sleep onset problems and decreased total sleep duration.

Method

Participants

Participants were 52 youth, ages 7–14 years, [$M = 9.6$, SD $= 2.1$; 24 (46%) females] referred to a childhood anxiety specialty clinic at either the Arizona State University (ASU) in Tempe, AZ ($n = 29$) or Children's National Medical Center (CNMC) in Washington, DC ($n = 23$). Children and adolescents were referred by mental health providers, school counselors, or pediatricians. Youth met DSM-IV criteria for a primary diagnosis of GAD ($n = 16$), SAD ($n = 10$), social phobia (SP; $n = 13$) or OCD ($n = 13$). About 79% ($n = 41$) of the sample met criteria for at least one other disorder. The most common comorbid diagnoses were Attention Deficit/Hyperactivity Disorder ($n = 18$), GAD ($n = 17$), SP ($n = 13$), SAD ($n = 11$), Dysthymia ($n = 6$) and Oppositional Defiant Disorder ($n = 4$). Exclusion criteria included bipolar diagnoses, psychosis, suicidal ideation, or mental retardation.

Since data were drawn from two sites, comparative analyses were conducted along socio-demographic and clinical characteristics. There were no significant differences between sites with exceptions of ethnicity and income. Consistent with geographic characteristics, a greater proportion of Latino children presented to ASU [χ^2 (4) = 14.90, $p < .005$]. Families from DC had higher family incomes [χ^2 (2) = 7.11, $p < .029$]. For the total sample, participants were 58% Caucasian, 29% Latino, 4% African American, and 9% other. Most of the Latino youth were of Mexican-origin (87%). In terms of annual family income, 31% reported household incomes under $40K, 33% between $40 and 80K, and 36% had incomes above $80K.

Measures

Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (*ADIS-C/P*) [29]. The ADIS-C/P was administered to youth and parents separately (by the same clinician) to assess for anxiety and related disorders. Interviewers assigned diagnoses rated by the child and/or parent as impairing. In cases of discrepancy or disagreement, the interviewer considered both informants' report to derive a final composite diagnosis. In cases of multiple diagnoses, the relative interference of each disorder was determined by assigning interference ratings and prioritizing each disorder from most (primary) to least impairing. All cases were discussed with a doctoral level psychologist prior to finalizing

diagnoses. The interview has excellent reliability for anxiety diagnoses as well as strong correspondence with child self ratings of anxiety [30].

Children's Sleep Habits Questionnaire (*CSHQ*) [31]. The CSHQ is a 38-item parent-completed scale designed to assess child sleep behavior over the past week. Parents rate sleep behaviors using a 3 point scale. The CSHQ yields a total sleep problem score and scores corresponding to several problem areas including bedtime resistance, sleep anxiety, sleep onset delay, parasomnias, night wakings, sleep-disordered breathing, and daytime sleepiness. Total sleep problem scores ≥41 are suggestive of clinically significant sleep problems. Scores differentiate clinical from community samples and correlate significantly with child reported sleep [31]. Internal consistency estimates for the CSHQ among the current sample are provided in Table 1.

Pre-Sleep Arousal Survey for Children (*PSAS-C*) [18]. The PSAS-C is a 16-item child-completed measure designed to assess arousal prior to sleep onset. Children rate items using a 5 point scale. Since the PSAS was developed and validated in adults and there is no comparable measure for children, some items on the PSAS-C were reworded using age appropriate language (e.g., "*When I try to fall asleep at night, I review or ponder the events of the day*" was changed to "*When I try to fall asleep at night, I think about things that happened during the day.*"). The PSAS yields a total score and cognitive and somatic subscale scores. PSAS scores differentiate clinical from community samples and correlate significantly with anxiety and sleep measures. Internal consistency estimates are presented in Table 1.

Child Sleep Report. Two questions were used to assess child report of sleep: "*Do you usually have trouble sleeping?*" and "*Do you usually have trouble waking in the morning?*". These items were answered dichotomously.

Procedures

Study procedures were approved by Institutional Review Boards at ASU and CNMC. After participants provided informed consent/assent, an assessment battery including the ADIS-C/P, CSHQ, and PSAS-C was administered. A trained research assistant either read aloud the questions to younger children or monitored completion of the questionnaires to ensure understanding.

Statistical Approach

Preliminary analyses were conducted to identify influential cases and associations that might have masked basic trends and relationships in the dataset. Missing data were tested for bias by creating a dummy variable for each case, which was then correlated with child demographic and clinical variables [32]. To examine whether secondary anxiety diagnoses were associated with sleep problems, bivariate correlations were conducted. For primary analyses, differences in sleep variables as a function of child age, sex, and ethnicity were examined using a single degree of freedom data analytic framework [33, 34]. For these and subsequent analyses, income was used as a covariate. When multiple tests were conducted, the alpha level was adjusted to minimize Type I errors using Holm's modified Bonferroni correction [35] retaining $p < .05$ as the experiment-wise error rate. Lastly, a *t*-test was used to compare levels of pre-sleep cognitive and somatic arousal (as each subscale is comprised of 9-items using the same response metric).

Table 1 Means, standard deviations, reliabilities, and zero-order correlations for parent and child-completed measures

Variable	M	SD	α	1	2	3	4	5	6	7	8	9	10	11	12	13
1. CSHQ: Sleep duration (minutes)	526.18	75.05	–	–												–
2. Total sleep disturbance	49.58	10.20	.69	-.46**	–											
3. Bedtime resistance	9.56	3.46	.36	-.43**	.80**	–										
4. Sleep onset delay	6.92	2.63	–	-.17	.73**	.74**	–									
5. Sleep anxiety	4.79	1.74	.74	-.59**	.71**	.55**	.38**	–								
6. Night wakings	8.92	2.10	.77	-.08	.68**	.36**	.42**	.37**	–							
7. Parasomnias	4.21	1.72	.57	-.19	.55**	.31*	.45**	.34*	.49**	–						
8. Sleep disordered breathing	3.33	0.88	.60	-.29*	.39**	.29*	.10	.20	.45**	.32*	–					
9. Daytime sleepiness	13.46	3.24	.69	-.25	.70**	.43**	.32*	.38**	.33*	.19	.12	–				
10. PSAS-C: Total pre-sleep arousal	30.62	11.52	.90	-.25	.24	.15	.06	.23	.19	.04	.02	.21	–			
11. Pre-sleep somatic arousal	12.30	4.22	.74	-.07	.10	.10	.10	.11	.06	-.07	-.05	.08	.91**	–		
12. Pre-sleep cognitive arousal	18.32	7.90	.87	-.32*	.29*	.17	.04	.27	.27	.24	.09	.06	.97**	.79**	–	

Since CSHQ sleep duration and sleep onset delay scores are based on one item, reliabilities are not computed

CSHQ Children's Sleep Habits Questionnaire, PSAS-C Pre-Sleep Arousal Survey for Children

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

Results

Preliminary Analyses

Missing data were identified at the item level for 3.7% of items (2.8% of items were missing for the PSAS-C and 0.9% for the CSHQ). Correlations among the study variables suggested that missingness was random [32]. No meaningful outliers were evident. Data for child and parent completed measures were not highly skewed or kurtotic, with one exception: CSHQ sleep disordered breathing (SDB) subscale. A log transformation was therefore used to bring scores on this subscale closer to a normal distribution [36]. Bivariate correlations used to assess the relation between total number of anxiety diagnoses (range 1–4 for current sample) and CSHQ total and subscale scores revealed no significant relations, indicating that the presence of secondary diagnoses was not associated with greater levels of sleep disturbance.

Relations among Sleep Indicators

Table 1 shows correlations among parent-report of sleep and child report of pre-sleep arousal. As shown, significant correlations were found among most of the CSHQ and PSAS-C subscale scores. PSAS-C pre-sleep cognitive arousal was significantly negatively correlated with total sleep duration ($r = -.32$, $p < .05$) and significantly positively correlated with total sleep disturbance scores ($r = .29$, $p < .05$).

Variations in Sleep as a Function of Child Age, Sex, and Ethnicity

Age differences were evaluated by comparing data for younger (7–10 years) and older (11–14 years) children. Age groups were derived on the basis of population-based research examining normal developmental changes in sleep from childhood through adolescence [cf. 37]. Significant differences were found for CSHQ total sleep disturbance (parameter estimate [PE] = 7.51, SE = 3.13, $t = 2.40$, $p = .022$, partial $\eta^2 = .138$), bedtime resistance (PE = 2.17, SE = .93, $t = 2.32$, $p = .03$, partial $\eta^2 = .13$), sleep anxiety (PE = 2.21, SE = .78, $t = 2.84$, $p = .01$, partial $\eta^2 = .18$), and parasomnias scores (PE = 1.98, SE = .74, $t = 2.70$, $p = .01$, partial $\eta^2 = .17$) with younger children having more problems than older children across these scales. The two age groups did not differ according to parent report of total sleep duration or child report of sleep.

In terms of sex, significant differences were found on the CSHQ bedtime resistance (PE = 3.05, SE = .93, $t = 3.26$, $p = .002$, partial $\eta^2 = .23$) and sleep anxiety subscales (PE = 2.07, SE = .78, $t = 2.66$, $p = .01$, partial $\eta^2 = .17$) with girls showing more problems than boys. Differences in total sleep duration by sex were non-significant as were differences based on child report of sleep.

Based on the ethnic composition of our sample, we focused on data corresponding to Caucasian and Latino youth specifically. Significant differences were found for total sleep duration (PE = 64.81, SE = 22.95, $t = 2.82$, $p = .01$, partial $\eta^2 = .19$) indicating a significantly greater amount of nightly sleep among Caucasian than Latino youth [558 min (SD = 63.69) and 486 min (SD = 62.49), respectively]. Significant differences for CSHQ total sleep disturbance (PE = 7.87, SE = 3.13, $t = 2.51$, $p = .02$, partial $\eta^2 = .15$), bedtime resistance (PE = 3.29, SE = .94, $t = 3.52$, $p = .01$, partial $\eta^2 = .26$), sleep onset delay (PE = .66, SE = .27, $t = 2.48$, $p = .02$, partial $\eta^2 = .15$), and SDB (PE = .17, SE = .07, $t = 2.30$, $p = .03$, partial $\eta^2 = .13$) also were found, revealing greater problems among Latino youth. See Table 2.

Table 2 Means and standard deviations for CSHQ sleep variables by age group, sex and ethnicity

	Age group				Sex				Ethnicity			
	Ages 7–10 ($n = 34$)		Ages 11–14 ($n = 18$)		Females ($n = 24$)		Males ($n = 28$)		Latino ($n = 15$)		Caucasians ($n = 30$)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Total sleep duration (min)	542.27	80.79	496.67	53.44	509.38	82.45	541.11	65.77	489.64$_g$	59.31	558.00$_g$	63.69
Total sleep disturbance	50.38$_a$	11.10	48.06$_a$	8.34	52.08	8.43	47.43	11.22	52.47$_h$	11.53	47.30$_h$	8.88
Bedtime resistance	9.76$_b$	3.57	9.17$_b$	3.29	11.17$_e$	3.49	8.18$_e$	2.82	11.13$_i$	3.93	8.60$_i$	2.91
Sleep anxiety	7.41$_c$	2.49	6.00$_c$	2.72	7.92$_f$	2.19	6.07$_f$	2.72	6.73	2.76	6.97	2.50
Sleep onset delay	1.59	0.74	1.83	0.86	1.71	0.81	1.64	0.78	2.07$_j$	0.80	1.43$_j$	0.68
Parasomnias	9.47$_d$	2.21	7.89$_d$	1.45	8.92	1.98	8.93	2.24	9.07	2.87	8.93	1.78
Night wakings	4.26	1.86	4.11	1.45	3.92	1.25	4.46	2.03	4.40	2.20	4.13	1.59
Sleep disordered breathing	3.35	1.01	3.28	0.58	3.17	0.57	3.46	1.07	3.80$_k$	1.37	3.17$_k$	0.53
Daytime sleepiness	13.38	3.34	13.61	3.13	14.17	3.42	12.86	3.00	13.60	2.17	12.97	3.25

CSHQ Children's Sleep Habits Questionnaire

Means sharing the same subscript are significantly different from each other at the $p < .05$ level

Variations in Sleep as a Function of Primary Anxiety Diagnosis

According to child report, 54% reported trouble sleeping overall. A significantly greater proportion of youth with GAD (87%) reported difficulty sleeping compared to youth with all other primary anxiety diagnoses (60% SAD, 27% SP and 54% OCD) [$\chi^2(3) = 9.45$, $p = .02$]. Although rates of difficulty waking in the morning were similar (87% GAD, 70% SAD, 36% SP, and 64% OCD) this result failed to reach statistical significance [$\chi^2 (3) = 7.25$, $p = .06$]. Based on parent-report, 85% of all anxious youth had CSHQ total sleep disturbance scores in the clinical range. Children with primary GAD had significantly higher scores on the CSHQ parasomnias scale ($M = 9.73$, SD = .53) than children with primary SP ($M = 7.46$, SD = .62) [$F (1, 42) = 3.23$, $p = .03$]. Children with primary SAD also had significantly higher parasomnias scores than children with primary SP (PE = 2.18, SE = .85, $t = 2.58$, $p = .013$, partial $\eta^2 = .13$).

Pre-Sleep Arousal

The *t*-test comparing PSAS-C pre-sleep cognitive and somatic arousal for the entire sample was statistically significant [$t(47) = 7.83$, $p < .01$]. Youth reported greater levels of pre-sleep cognitive ($M = 18.32$, SD = 7.90) than somatic ($M = 12.30$, SD = 4.22) arousal. No statistically significant differences were found as a function of age, sex or ethnicity for PSAS-C pre-sleep arousal dimensions.

Discussion

One of the most robust associations between early sleep disruption and emotional functioning involves the role of anxiety. Although the presence of sleep problems among children with anxiety disorders is well-documented, several gaps in exist. The current study aimed to address some of these limitations by using structured assessment of sleep among a developmentally and ethnically-diverse sample of youth with different primary anxiety disorders. Consistent with previous reports, 85% of all anxious youth scored in the clinical range for total sleep problems based on parent reports. Although a less rigorous assessment of sleep was used among children, only 54% endorsed the presence of a sleep problem. However, differences in sleep variables emerged as a function of age, sex, ethnicity and primary diagnosis. These findings are discussed in detail below.

Building on previous studies which have found nightmares and refusal to sleep independently to be more common among younger children [2], greater bedtime resistance, sleep anxiety and parasomnias were reported by parents of younger anxious children. Differences on these three particular subscales reflect normal developmental changes in sleep-related behaviors in addition to anxiety surrounding sleep. Surprisingly, a significant difference in total sleep duration did not emerge despite a greater sleep need in younger children. Children 7–10 years averaged approximately 9 hours of sleep per night whereas 10–14 year olds averaged little more than 8 h. While it is important to highlight the fact that sleep duration was based on parental estimations rather than objective assessment, overall, both age groups accrued less sleep than is recommended [38]. Insufficient sleep may be particularly problematic for anxious youth in view of the documented negative impact on the regulation of behavior and emotion [39].

Sex comparisons did not indicate an overall difference in total sleep problems or sleep duration but did reveal significantly higher rates of bedtime resistance and sleep anxiety

among females. Other research, using non-structured assessments, has reported greater nightmares among girls [2]. While anxious girls may be more prone to certain types of sleep problems, these results may also be illustrative of generally higher rates of anxiety and fear found among girls compared to boys [e.g., 40, 41]. Sleep differences also were found based on ethnicity. A significant difference in total sleep duration between Caucasian and Latino youth was found with the latter averaging approximately an hour less sleep per night. Latino children also had more sleep problems including greater bedtime resistance, sleep onset latencies and SDB. Although lower socioeconomic status (SES) is frequently associated with environmental conditions compromising sleep quality, findings were significant after controlling for household income.

While samples sizes for sleep comparisons based on ethnicity were small, results are consistent with limited data comparing sleep across these ethnic groups. Specifically, Latino children in a large population-based study were found to experience more frequent symptoms of SDB than Caucasians [42]. Roberts, Robert and Chen [43] also found higher rates of insomnia and hypersomnia in Latino compared to Caucasian youth. While the current study did not include information on body-mass-index (BMI) which is relevant for the study of SDB, snoring is more common among Latinos independent of obesity [44]. It is well established that racial and ethnic minorities have significant health disparities compared to the rest of the population and the current results likely reflect differences in knowledge about sleep, access to, and quality of care. Other considerations requiring further attention include possible differences in craniofacial anatomy (e.g., hard and soft tissue structures), other indicators of SES, and proximity of parents and children during sleep (i.e., the likelihood that parents will hear or witness snoring/apnea).[1]

Rates of parent-reported sleep problems were similar overall across the diagnostic groups with the exception of parasomnias; children with primary GAD and SAD scored significantly higher on this measure than children with primary SP. Parasomnias may include a range of behaviors occurring during sleep including sleep walking, night terrors, bedwetting, sleep talking, and bruxism. Insufficient total sleep, irregular sleep schedules, pre-sleep stress and anxiety each increase the likelihood that such events will occur [45]. Thus, consistent with previous findings [2], children with primary GAD and SAD may experience the highest levels of stress and anxiety surrounding sleep.

We also examined child report of sleep disturbance and difficulty waking in the morning. About 54% of all youth endorsed difficulty sleeping while 60% reported trouble waking, though findings varied based on primary diagnosis. A higher rate of sleep problems endorsed by parents may be explained by the use of a structured, comprehensive measure of sleep (CSHQ). However, other factors to be considered in future studies include the specific types of sleep problems experienced (e.g., bedtime resistance and nighttime arousals may be more disruptive for parents) and children's awareness of their own sleep. On the other hand, 87% of children with primary GAD endorsed difficulty sleeping; a rate significantly higher than all other diagnostic groups. While insomnia is a well-established feature of GAD in adulthood [14], the current results suggest that persistent sleep problems occur early in the course of the disorder. Objective assessments of sleep among children with GAD are lacking, but, in light of these data, may reveal important information about the role of early sleep dysregulation in the disorder's chronicity and pathophysiology.

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[1] Decisions to co-sleep are influenced by numerous factors, some of which may be pragmatic in nature such as number of beds and family members in the home. In other cases co-sleeping behaviors may be based on parental preferences, cultural traditions or child sleep problems. Unfortunately, because we did not adequately assess the frequency or basis for co-sleeping behaviors, these variables were not examined.

Since sleep and anxiety are considered opposing processes in a larger system of arousal regulation [46], the current study also examined the presence of two types of pre-sleep arousal. Anxious children reported significantly higher levels of pre-sleep cognitive than somatic arousal. The presence of pre-sleep cognitive arousal was associated with shorter sleep duration and greater overall sleep problems. Although we did not find a specific association between cognitive arousal and sleep onset delay as expected, parents rather than children provided reports of sleep onset latency, which may be more difficult to estimate than total sleep time. Although relatively little is known about the specific content of anxious children's pre-sleep thoughts and worries, our findings converge with other data to suggest that pre-sleep cognition plays an important role in sleep disruption among school-aged children with anxiety disorders.

Findings should be considered in view of some limitations. Data were collected from a relatively small sample of youth presenting for the treatment of anxiety and it cannot be assumed that sleep behaviors are representative of all anxious youth. It also is important to note that sample size likely impacted power for some analyses (e.g., comparisons across diagnostic and ethnic groups). For this reason, non-significant effects should be interpreted with caution. Although a validated parent-report measure of sleep was used, child report was based on two individual questions, which is a limitation of our study. Moreover, although the PSAS is validated in adults and items were modified to be age appropriate, more research is needed to establish the reliability of the PSAS-C in youth. Analyses comparing pre-sleep cognitive and somatic arousal should be interpreted cautiously as two subscales from the same measure were used. In addition, retrospective reports of sleep and pre-sleep arousal may have been somewhat biased. We regret that we did not collect information on BMI and co-sleeping behaviors as findings, particularly ethnicity-based differences in SDB, require a better understanding of factors associated with sleep-related differences.

Summary

Despite the documented high rates of sleep disturbance among youth with anxiety disorders, data based on the use of structured assessments aimed at better understanding the specific nature of these problems are limited. Moreover, most research has examined sleep problems among children with heterogeneous anxiety disorders, limiting the specificity of findings for any individual diagnosis. The current study examined sleep problems and pre-sleep arousal among 52 anxious youth aged 7–14 years in relation to age, sex, ethnicity, and primary anxiety disorder, including GAD, SAD, SP and OCD. Assessments included structured diagnostic interviews as well parent and child questionnaires regarding sleep. According to parents, 85% of anxious youth experienced clinically-significant sleep problems with few differences based on primary anxiety diagnosis. Although only 54% of anxious youth reported sleep problems, close to 90% with primary GAD endorsed trouble sleeping. Other comparisons indicated young children and Latino youth to experience more sleep problems than older and Caucasian youth, respectively. Collectively, results suggest that sleep disruption is highly prevalent among children with anxiety disorders, with certain subgroups at increased risk. Certainly, numerous factors in addition to anxiety influence a child's sleep (e.g., developmental changes, family sleep practices, cultural norms) and the extent to which parents and clinicians may consider sleep within these contexts varies considerably. For this reason, structured assessments may best serve to determine the nature and severity of sleep problems as well as whether treatment may be

necessary. Along these lines, findings revealing an association between pre-sleep cognition and sleep disturbance highlight an avenue for future research and possible intervention.

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