HHS Public Access

Author manuscript

J Anxiety Disord. Author manuscript; available in PMC 2017 March 07.

Published in final edited form as:

J Anxiety Disord. 2015 May ; 32: 66–72. doi:10.1016/j.janxdis.2015.03.009.

Anxiety Sensitivity and Sleep-Related Problems in Anxious Youth

Courtney L. Weiner, Ph.D.[a], **Meredith Elkins, M.A.**[b], **Donna Pincus, Ph.D.**[b], and **Jonathan Comer, Ph.D.**[c]

[a]University of Pennsylvania, Child and Adolescent OCD, Tic, Trich, and Anxiety Group, 3535 Market Street, Suite 600, Philadelphia, PA 19104

[b]Boston University, Center for Anxiety and Related Disorders, 648 Beacon Street, 6th Floor, Boston, MA 02215

[c]Florida International University, Mental Health Interventions and Technology (MINT) Program, Center for Children and Families, 11200 S.W. 8th Street, Miami, FL 33199

Abstract

Anxiety disorders constitute the most common mental health disturbance experienced by youth. Sleep-related problems (SRPs) are highly prevalent among anxious youth and encompass a variety of problems including nighttime fears, insomnia, and refusal to sleep alone. Given that chronic sleep disturbance is associated with a range of behavioral and physical problems in youth and predicts future psychopathology, it is important to elucidate the nature of SRPs in anxious youth. The present study investigated the relationship between sleep problems and anxiety sensitivity in a sample of 101 anxious youth, ages 6–17. Heightened anxiety sensitivity significantly predicted prolonged sleep onset latency across the sample, even after accounting for severity of anxiety, depression, and age. Results support previous research indicating that SRPs are common among anxious youth and suggest that anxiety sensitivity may play a particularly important role in sleep onset latency.

Keywords

child; child anxiety; sleep; anxiety sensitivity

1. Introduction

Anxiety disorders constitute the most common class of mental health disturbance in childhood, affecting roughly 12 to 20% of youth (Achenbach, Howell, McConaughy, & Stranger, 1995; Gurley, Cohen, Pine, & Brook, 1996; Merikangas et al., 2010). Anxiety

Correspondence: Jonathan S. Comer, Ph.D., Mental Health Interventions and Technology (MINT) Program, Center for Children and Families, Department of Psychology, Florida International University, 11200 S.W. 8th Street, Miami, FL 33199; telephone: 305-348-7580; jocomer@fiu.edu.

disorders are associated with pronounced functional impairments and reduced quality of life across the lifespan (e.g., Comer et al., 2011; Langley et al., 2004), and importantly are linked with sleep-related problems (SRPs) in youth populations (Alfano, Ginsburg, & Kingery, 2007). Researchers have proposed a reciprocal relationship between sleep difficulties and anxiety, whereby disturbed sleep increases a child's vulnerability to developing anxiety, while anxiety, in turn, interferes with sleep (Dahl, 1996). Research suggests that the majority of anxious youth and their parents report significant sleep difficulties (Alfano, Pina, Zerr, & Villalta, 2010). For example, in one study, 88% of anxious children were reported to experience at least one SRP, and 55% experienced three or more (Alfano et al., 2007).

Quality sleep in childhood is critical for optimizing cognitive development, academic performance, and physical and emotional health. Inadequate sleep is associated with a range of difficulties in children, including daytime sleepiness, inattention, impulsivity, disruptive behavior, impaired cognitive functioning and academic performance, and social difficulties (Aronen, Paavonen, Fjällberg, Soininen, & Törrönen, 2000; Dahl, 1996; Fallone, Owens, & Deane, 2002; Fredriksen, Rhodes, Reddy, & Way, 2004; Mindell, 1999; Wolfson & Carskadon, 1998). Insufficient sleep can also negatively affect the immune system and metabolic processes, and has been associated with lower health-related quality of life in children (Hart, Palermo, & Rosen, 2005). Furthermore, persistent sleep difficulties in early childhood predict future psychopathology (Gregory, Eley, O'Connor, & Plomin, 2004; Gregory & O'Connor, 2002).

Despite emerging findings linking impaired sleep and pediatric anxiety, very little research has focused on patterns and predictors of SRPs in children presenting with formal anxiety disorders. Given the high prevalence of sleep difficulties in this population, it is important to empirically clarify the nature and correlates of SRPs in clinically anxious children. Despite overall impressive outcomes associated with established treatments for child anxiety (e.g., Beidel et al., 2000; Kendall et al., 2008; Silverman et al., 2008; Walkup et al., 2008), rates of only partial remission or non-response are also high (Ginsburg et al., 2011), and it may be that children with co-occurring anxiety and sleep difficulties require more tailored interventions specifically targeting sleep symptoms. Research elucidating patterns and predictors of SRPs in anxious youth is needed to inform such targeted and tailored treatment.

The very small but growing empirical work in this area suggests that anxiety sensitivity may be a key factor linking pediatric anxiety and SRPs. Anxiety sensitivity refers to the perception that physiological sensations related to anxiety are uncontrollable and are harmful or threatening (Reiss, Peterson, Gursky, & McNally, 1986). Individuals with high anxiety sensitivity are hypersensitive to and fearful of internal cues of anxiety, such as a racing heart, breathlessness, or stomach discomfort (Reiss & McNally, 1985). Anxiety sensitivity is a well-established risk factor for the development and maintenance of anxiety symptoms (e.g., Reiss, 1991; Silverman & Weems, 1998), and in other work researchers have proposed that heightened physiological arousal associated with anxiety sensitivity may contribute to difficulties initiating sleep (Morin, Rodrigue, & Ivers, 2003; Tang & Harvey, 2004). There is some empirical evidence supporting this hypothesis in adults, based on

research with adults suffering with insomnia (Vincent & Walker, 2001). Babson and colleagues (2008) further investigated the role of anxiety sensitivity in SRPs among adults and found that it moderated the relationship between sleep anticipatory anxiety and sleep onset latency. Specifically, for adult participants with high anxiety sensitivity, sleep anticipatory anxiety was significantly associated with longer sleep onset latency. Gregory and Eley (2005) investigated this phenomenon in a community sample of children, ages 8 to 11, using both parent- and child-report measures. Indeed, findings revealed that community children's anxiety sensitivity was a unique predictor of overall sleep problems. Research has yet to examine the link between anxiety sensitivity and SRPs in clinically referred anxious youth.

Much remains to be learned about the links between anxiety sensitivity and pediatric SRPs in youth diagnosed with formal anxiety disorders. The present study evaluated SRPs (i.e., sleep duration, total sleep disturbance, bedtime resistance, sleep onset latency, sleep anxiety, night wakings, parasomnias, sleep disordered breathing, and daytime sleepiness) in treatment-seeking anxious youth, and examined the extent to which anxiety sensitivity plays a unique role in sleep disturbance. Given previous research in the adult literature, we hypothesized that anxiety sensitivity predicts longer sleep onset latency in anxious youth. Since anxiety sensitivity is characterized by hyperawareness of bodily sensations, it is likely to be experienced while awake and when one's attention is not focused elsewhere. Therefore, individuals may be particularly vulnerable to focusing inward while lying in bed without external distractions. Children with longer sleep onset latency, in turn, would expectedly show shorter sleep duration, higher total sleep disturbance, greater bedtime resistance, and more daytime sleepiness. Lastly, given research showing that both SRPs and anxiety sensitivity vary by age (Alfano et al., 2010; Alfano et al., 2007; Walsh, Stewart, McLaughlin & Comeau, 2002), we further broke down analyses across younger and older youth, and also examined links between anxiety sensitivity and SRPs after controlling for age.

2. Methods

2.1 Participants

Study participants included 101 children and adolescents, ages 6 to 17 years, inclusive (M = 11.17, SD = 2.67), and their mothers, seeking outpatient treatment for childhood anxiety disorders at a large clinic in Boston, Massachusetts specializing in the treatment of childhood internalizing disorders. Children were included if they were diagnosed via the Anxiety Disorders Interview Schedule for Children and Parents (ADIS-C/P; Silverman & Albano, 1996) with a principal DSM-IV anxiety disorder diagnosis of social anxiety disorder, separation anxiety disorder, generalized anxiety disorder (GAD), specific phobia, obsessive-compulsive disorder, panic disorder, or anxiety disorder not otherwise specified. Children were excluded if they had a positive diagnosis of a pervasive developmental disorder, autism spectrum disorder, organic brain syndrome, mental retardation, or active suicidal ideation. Children were also excluded from the present study if they had a positive diagnosis of an organic or medical condition linked with established SRPs (e.g., restless leg syndrome, obstructive sleep apnea). For children on psychotropic medications, medication

stabilization criteria had to be met prior to study inclusion (i.e., 1 month for benzodiazepines, 3 months for SSRIs or tricyclics). Twenty-three (22.8%) participants were taking a psychotropic medication at the time of the study including antidepressants (n = 15; 14.9%), stimulants (n = 5; 5.0%), benzodiazapines (n = 2; 2.0%), and atypical antipsychotics (n = 1; 1%). The sample was comprised of 51 males (50.5%) and 50 females (49.5%). Regarding race/ethnicity 85% of the sample self-identified as Caucasian, 2% Latino, 1% African-American, 1% Asian, and 11% biracial or other. Participants met DSM-IV criteria for a principal diagnosis of either GAD (n = 24; 23.8%), separation anxiety disorder (n = 14; 13.9%), social anxiety disorder (n = 10; 9.9%), obsessive-compulsive disorder (n = 11; 10.9%), panic disorder (n = 11; 10.9%), specific phobia (n = 11; 10.9%), anxiety disorder not otherwise specified (n = 16; 15.8%), or co-principal anxiety diagnoses (n = 4, 4.0%). Thirty-seven percent (n = 37) of the sample was diagnosed with a comorbid disorder. The most common comorbid diagnoses included specific phobia (n = 14; 13.9%), GAD (n = 13; 12.9%), and social anxiety disorder (n = 7; 6.9%). Three participants (2.9%) were diagnosed with a comorbid mood disorder. No participating youth had PTSD.

2.2 Procedures

Study procedures were conducted under the approval of the Institutional Review Board of Boston University Charles River Campus. During a baseline diagnostic evaluation at the Center for Anxiety and Related Disorders, structured diagnostic interviews were conducted and self-report questionnaire data were collected from families who met inclusion criteria and consented to participate in research at the Center. All assessments were conducted at the Center for Anxiety and Related Disorders (CARD) at Boston University by doctoral students in clinical psychology specializing in the study of pediatric anxiety disorders. Following completion of the diagnostic interview, the evaluator collected all self-report forms from participants. All assessments were completed under the supervision of licensed clinical supervisors of the Child and Adolescent Fear and Anxiety Treatment Program at CARD.

2.3 Measures

2.3.1 Demographic data—A parent questionnaire was completed to provide descriptive information about the child and family.

2.3.2 Diagnostic status—The Anxiety Disorders Interview Schedule-Child and Parent Versions (ADIS-IV-C/P; Silverman & Albano, 1997) was used to assess the presence of DSM-IV anxiety disorders, mood disorders, and externalizing disorders of childhood, and to screen for other selected disorders (e.g., psychotic disorders, eating disorders, and somatization disorders). The ADIS-IV-C/P is a child adaptation of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994). The ADIS-IV-C/P includes visual prompts depicting thermometers to obtain child ratings of fear, worry, distress/interference, and occurrence of physical sensations. Parents and children are asked to provide ratings, ranging from 0 to 8, of the child's fear and avoidance of various situations, as well as the level of interference the symptoms cause in the child's daily functioning. In addition to diagnostic information, the ADIS-IV-C/P provides a 0 to 8 clinical severity rating (ADIS-CSR), assigned by the interviewer, based on the degree of distress and functional interference that is reportedly caused by the disorder. A CSR of 4 or

above on this measure indicates a clinical level of distress or impairment. To generate a composite diagnosis on the ADIS-IV-C/P, reports are pooled across informants (parents/children). The ADIS-C/P has demonstrated strong psychometric properties, including strong validity and adequate reliability, in samples of comparable age range to the present sample (e.g., Silverman, Saavedra, & Pina, 2001; Wood et al., 2002; see also Silverman & Ollendick, 2005). Among diagnosticians on the present study, the ADIS-IV-C/P has demonstrated strong inter-rater agreement on principal diagnosis (κ = .87) and clinical severity (Pearson product-moment r = .62).

2.3.3 Anxiety sensitivity—The Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991) is an 18-item scale modified by Silverman and colleagues from the adult Anxiety Sensitivity Index (Peterson & Reiss, 1987), the most widely used instrument for assessing anxiety sensitivity in adults. The CASI measures anxiety sensitivity in children by asking them to rate how aversively they view anxiety symptoms (e.g., “it scares me when my heart beats fast”) by endorsing “none”(1), “some”(2), or “a lot”(3) in response to each item. The total anxiety sensitivity score is defined as the sum of the child’s endorsements, and ranges from 18 to 54. The total anxiety sensitivity score is defined as the sum of the child’s endorsements, and ranges from 18 to 54. There is no specific clinical cutoff for this measure, but a higher score indicates higher levels of anxiety sensitivity. The CASI has demonstrated sound psychometric properties, including adequate test-retest reliability of .79 in a clinical sample (Silverman et al., 1991). Silverman and colleagues (1991) reported that item-total correlations produced a standardized alpha of .87 for both a clinical and nonclinical sample, reflecting good inter-item reliability, suggesting that the scale is assessing a single trait. Internal consistency was strong in the present sample (Cronbach α = .87).

2.3.4 Sleep-related problems—The Children’s Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn, 2000) is a 45-item parent-report measure of children’s sleep habits. The CSHQ served as the measure of sleep-related problems and total sleep disturbance in the present study. Items on the CSHQ cover a range of clinical sleep domains. Subscales include: Bedtime Resistance, Sleep Onset Latency, Sleep Duration, Sleep Anxiety, Night Wakings, Parasomnias, Sleep Disordered Breathing, and Daytime Sleepiness. These subscales encompass the most common sleep complaints among this age group. Responses to items are made on a three-point scale: 1 or “rarely” (one or no times in a week), 2 or “sometimes” (two to four times in a week), and 3 or “usually” (the sleep behavior occurred anywhere from five to seven times a week). Items are grouped into one of the eight subscales and all items within a subscale are added to calculate a subscale score. Total sleep problem scores range from 33 to 99, with a score of 41 or greater indicating clinically significant sleep disturbance. The CSHQ has been shown to have adequate reliability and validity in community and clinical samples (Owens et al., 2000). Scores on this measure have also been found to differentiate clinical from community school-aged children (Owens et al., 2000). Internal consistency of the CSHQ within the current sample was strong (Cronbach α = .78).

2.3.5 Anxiety severity—The Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, & Stallings, 1997) is a 39-item questionnaire that assesses anxiety

in children and adolescents. The MASC presents anxiety-related statements (e.g., “I get dizzy or faint”, “I worry about other people laughing at me”) and asks the child to circle the number from 0 to 3 indicating how often the statement is true for him or her (i.e., 0 = “never true about me”, 1= “rarely true about me”, 2= “sometimes true about me”, and 3= “often true about me”). The MASC offers several subscales assessing key dimensions of anxiety. The total score was used for the present purposes to assess total anxiety severity. MASC has shown strong psychometric properties in clinical samples and community samples of youth (Baldwin & Dadds, 2007; March et al., 1997). Internal consistency was strong in the present sample (α = .90).

2.3.6 Depressive symptoms—The Children’s Depression Inventory (CDI; Kovacs, 1992) is a widely used self-rating scale of depressive symptomatology in children. For each item, the child is asked to endorse one of three statements that best describes how he or she has typically felt over the past 2 weeks (e.g., “I am sad once in a while,” I am sad many times,” or “I am sad all the time”). Each response is scored as either 0 (asymptomatic), 1 (somewhat symptomatic), or 2 (clinically symptomatic), contributing to an overall CDI score that can range from 0 to 54 with a recommended cut-off score of 13 in clinical populations. The scale has demonstrated excellent internal consistency and acceptable test-retest reliability identified in both clinical and non-clinical samples (Finch et al., 1985, 1987; Kazdin, 1987; Nelson & Politano, 1990; Ollendick & Yule, 1990; Smucker et al., 1986). Internal consistency was high in the present sample (Cronbach α = .89). Research supports the use of the CDI as a continuous measure of depressive symptomatology in anxious youth (Comer & Kendall, 2005).

2.4 Data Analysis

The Statistical Package for Social Sciences for Windows version 15.0 was used for all data analyses (SPSS 15.0 Command Syntax Reference, 2006). Means and standard deviations for CSHQ subscales were calculated, and the percentage of anxious youth showing clinically significant sleep disturbance (i.e., CSHQ total sleep problems score > 41) was computed. Next, t-tests were conducted to examine age-related differences across the CSHQ subscales by splitting the sample into younger (ages 6–11) and older (ages 12–17) age groups. Hierarchical linear regression models then evaluated the contributions of anxiety sensitivity to overall sleep disturbance and to each ofhte SRP subscales. Given research showing that SRPs and anxiety sensitivity vary by age, for each regression analysis age was entered into the model first. This method of entry afforded examination of the unique variance in SRPs accounted for by anxiety sensitivity above and beyond that accounted for by age. Further analyses added anxiety severity (MASC score) and depressive symptoms (CDI score) as covariates to evaluate the specificity of the link between anxiety sensitivity and sleep problems.

3. Results

3.1 Sleep Disturbance in Anxious Youth

CSHQ scores (Kolmogorov-Smirnov Test = .074, *ns*) and CASI scores (Kolmogorov-Smirnov Test = .086, *ns*) were both normally distributed. Table 1 provides means, standard

deviations, and zero-order correlations for the CSHQ subscales. The majority of the present sample (76.2%) showed clinically significant sleep disturbance, as evidenced by CSHQ total sleep disturbance scores > 41.

Age analyses showed that younger anxious children (6–11 years) exhibited significantly more nighttime wakings, $t(99) = 3.13$, $p < .01$, $d = .64$, and sleep anxiety, $t(99) = 3.31$, $p < .01$, $d = .69$, than older anxious youth (12–17 years). In contrast, older anxious youth experienced significantly greater daytime sleepiness than younger anxious children, $t(99) = -3.58$, $p < .01$, $d = -.72$.

3.2 Anxiety Sensitivity and Sleep Disturbances in Anxious Youth

Analyses revealed that heightened anxiety sensitivity predicted longer sleep onset latency but did not significantly predict overall sleep disturbance. In the first analysis evaluating the contribution of anxiety sensitivity to overall sleep disturbance (controlling for anxiety severity and depression symptoms), age was not found to be a significant predictor in step 1, $F(3, 89) = 0.76$, $p = ns$ ($R^2 = .025$). Similarly, CASI total score (added in step 2) did not significantly add to the prediction of total sleep disturbance, $F_{Change}(1, 88) = 0.12$, $p = ns$ ($R^2 = .001$) (see Table 3). In a second model looking specifically at the prediction of sleep onset latency (controlling for anxiety severity and depression symptoms), age (entered into step 1) was not a significant predictor, $F(3,89) = 1.41$, $p = ns$ ($R^2 = .045$), but anxiety sensitivity (entered into step 2) was found to significantly predict sleep onset latency, $F_{Change}(1, 88) = 5.88$, $p = .017$ ($R^2 = .064$), even after accounting for anxiety severity and depression symptoms (see Table 4). Specifically, anxiety sensitivity accounted for 6.4% of the variance in sleep onset latency among anxious youth. Notably, parallel models predicting the other CSHQ subscales found that anxiety sensitivity did not add to the prediction of bedtime resistance [step 2 $F_{Change}(1, 88) = 0.87$, $p = ns$ ($R^2 = .009$)], sleep anxiety [step 2 $F_{Change}(1, 88) = 3.75$, $p = ns$ ($R^2 = .036$)], night wakings [step 2 $F_{Change}(1, 88) = 3.56$, $p = ns$ ($R^2 = .034$)], parasomnias [step 2 $F_{Change}(1, 88) = 1.22$, $p = ns$ ($R^2 = .013$)], sleep disordered breathing [step 2 $F_{Change}(1, 88) = 0.96$, $p = ns$ ($R^2 = .01$)], nor daytime sleepiness [step 2 $F_{Change}(1, 88) = 0.97$, $p = ns$ ($R^2 = .01$)].

4. Discussion

Previous research has established that sleep-related problems are common among anxious youth (Alfano et al., 2007, 2010). Findings from the present study lend further support to this growing body of literature, indicating that the majority of anxious children and adolescents (76.2%) experience clinically significant sleep disturbance. Findings from our study also provide further evidence that the nature of these sleep problems tends to vary by age. We found younger children exhibited significantly more nighttime wakings and sleep anxiety than adolescents whereas adolescents were more prone to daytime sleepiness.

In previous studies, a significant association has been found between anxiety sensitivity and sleep disturbance in both adults (Vincent & Walker, 2001) and community children (Gregory & Eley, 2005), but previous work had not examined this relationship in anxious youth. The present findings suggest that whereas anxiety sensitivity does not predict overall sleep disturbance in clinically anxious youth, it is significantly linked to prolonged sleep onset

latency, accounting for 6.4% of the variance in sleep onset among anxious youth. This finding is consistent with empirical work with adults on the association between sensitivity and sleep onset latency (Babson et al., 2008).

The present findings also support our hypothesis that heightened anxiety sensitivity specifically interferes with one's ability to fall asleep but may not be as relevant to other sleep difficulties commonly experienced by anxious youth. Indeed, we conducted parallel analyses to examine relationships between anxiety sensitivity and other sleep variables such as bedtime resistance, parasomnias, and night wakings, but none of these analyses reached statistical significance, suggesting that anxiety sensitivity is uniquely related to sleep onset latency. Given that anxiety sensitivity is characterized by heightened focus on bodily sensations, anxious youth may be particularly susceptible to this phenomenon at bedtime when competing environmental stimuli are less prominent, which in turn may delay the ability to fall asleep in a timely manner. Future research examining fluctuations in anxiety sensitivity throughout the day and in the face of competing stimuli would be informative, as would experimental research in which youth are randomly instructed to focus on their bodily sensations versus not focus on their bodily sensations as they fall asleep. It may be that focusing on bodily sensations directly interferes with sleep onset. While previous research (Morin et al., 2003; Tang & Harvey, 2004) and the present study indicate that higher levels of anxiety sensitivity may be implicated in difficulties in the initiation of sleep, future research utilizing objective measures of both physiological arousal and sleep structure are needed.

It is important to note that while sleep disturbance is common among all anxious youth, previous work shows the nature of these sleep problems tends to vary by age. Our finding that age did not predict overall sleep disturbances or sleep onset latency was not consistent with existing literature, and may speak to unique characteristics of a treatment-seeking sample of anxious youth. Findings from our sample did, however, reveal that younger children exhibited significantly more nighttime wakings and sleep anxiety than adolescents, whereas adolescents were more prone to daytime sleepiness (see Table 2). No significant differences were found as a function of gender. Future work would do well to consider whether age and gender might moderate links between anxiety sensitivity and sleep onset latency.

The results of this study shed new light on the nature of sleep difficulties in anxious youth and, thus, have important clinical implications. First, clinicians would do well to include valid measurement of SRPs, such as the CSHQ, when assessing anxious youth in order to clarify the broadened range of impairment associated with anxiety symptoms. Second, anxious youth with co-occurring SRPs may require a treatment plan that specifically targets sleep difficulties. Due to its large body of empirical support, CBT is considered the standard of care in the treatment of child anxiety. Generally, however, comorbidities can mitigate treatment outcome (Lewinsohn, Rhode, & Seeley, 1995). A small number of studies have examined the effect of anxiety treatment on sleep problems and findings have been mixed. While some research indicates that child sleep problems improve after undergoing anxiety treatment (Storch et al., 2009), other findings suggest that this is not necessarily the case (Stepanski & Rybarczk, 2005). Furthermore, even if traditional anxiety treatment does lead

to reductions in co-occurring sleep problems, the addition of a treatment component specifically targeting sleep may amplify these effects.

Results from the present study also suggest that, while the majority of anxious youth experience clinical sleep disturbance, the most appropriate sleep intervention may vary by age of the patient. For instance, younger children are reported to experience greater sleep anxiety and bedtime resistance, while adolescents experience more daytime sleepiness. Consistent with cognitive-behavioral treatment techniques more generally, sleep anxiety and bedtime resistance may be targeted through graduated exposure and the application of reinforcement principles. Conversely, education about the importance of sleep and sleep hygiene may be more valuable for anxious adolescents who experience significant daytime sleepiness. While teenagers are often inclined and allowed to go to bed later than younger children, school schedules prevent them from offsetting this with later wake times. Therefore, the inclusion of a sleep hygiene component focusing on how to arrange one's schedule to allow for optimal sleep duration may result in less daytime sleepiness and associated interference.

Clinicians working with anxious youth would also do well to systematically include assessment of children's anxiety sensitivity, given its links not only with anxiety symptoms, but also with sleep onset latency. Moreover, given the role of anxiety sensitivity in delayed sleep onset, inclusion of interoceptive exposure techniques, which teach patients to induce physical symptoms of anxiety in order to learn to better tolerate them, may be beneficial when treating anxious youth with co-occurring sleep disturbance. In cognitive behavioral therapy for panic disorder, avoidance of physical symptoms of anxiety is often targeted through interoceptive exposure, in which patients are repeatedly exposed to feared bodily sensations until habituation occurs (e.g., Pincus et al., 2000). Interoceptive exposure has been supported as a strategy for decreasing anxiety sensitivity (Beck, Shipherd, & Zebb, 1997; Bouchard et al., 1996; Bouton, 2002; Carter, Marin, & Murrell, 1999; Hecker, Fink, Vogeltanz, Thorpe, & Sigmon, 1998), and is indicated in the treatment of panic disorder (Craske & Barlow, 2008). Given that 88% of anxious children experience at least one SRP, and 55% experience three or more (Alfano et al., 2007), including sleep onset latency, the present findings suggest that there may be clinical utility in systematically incorporating interoceptive exposure strategies across all child anxiety diagnoses, not simply for the management of panic disorder.

The present study has several limitations that should be considered when interpreting results. First, given that the study took place in a university-based outpatient clinic specializing in the treatment of anxiety disorders in a major metropolitan city, the findings may not be representative of youth presenting for treatment in other settings or in the general population. Second, the cross-sectional nature of this study limits the ability to make any causal inferences. In future studies, longitudinal methods would enable researchers to determine causal pathways and the directionality of relationships among predictors and correlates of sleep disturbance in anxious youth. Third, child sleep habits data were drawn from parent-reports, which may be subject to biases and misperceptions. For example, although parents may be heavily involved in younger children's bedtime routines, they may be less involved in—and therefore less knowledgeable about—adolescents' sleep habits and

related difficulties. In fact, the CSHQ was originally developed for school aged children and, while it has been used as a tool for collecting information about the sleep habits of youth of all ages (e.g., Becker et al., 2015; Hart et al., 2005), the measure has not been well-validated for older adolescents. Future work examining anxiety sensitivity and SRPs should also incorporate multimodal measurement strategies such as polysomnography and actigraphy. Furthermore, child-reports of sleep habits, which have been found to differ significantly from parent-report, were not included in the present study. Alfano and colleagues (2010), for example, found that 54% of anxious youth reported trouble sleeping, whereas parent-reports of sleep difficulties reached 85%. Future research incorporating multiple informants of sleep as well as objective measures is needed to evaluate the accuracy of parent-versus child-reports of sleep difficulties among anxious youth and their relationships with children's anxiety sensitivity. Moreover, we did not assess SRP differences across anxiety diagnoses, given that the high comorbidity among the anxiety disorders in our sample did afford large enough "pure" diagnostic groups for such tests. Although comorbidity is typically high among the anxiety disorders (Verduin & Kendall, 2003), future work conducted in larger samples would do well to test for differences in SRPs across disorders. In addition, roughly one-fifth of the sample was taking various psychotropic medications. Children managed on psychotropic medications were included to optimize the generalizability of findings to the larger population of children with anxiety disorders seeking treatment, although psychotropic medications may have influenced sleep and anxiety sensitivity among the subset of medicated youth. Finally, the present study did not include a comparison group. As such, the present study was unable to examine whether diagnostic status (anxiety disorder youth versus community youth) moderates the relationship between anxiety sensitivity and sleep onset latency. In future studies the inclusion of healthy controls and/or youth experiencing other forms of psychopathology (e.g. mood disorders, externalizing disorders) may shed light on the extent to which relationships between anxiety sensitivity and SRPs are unique to anxious youth.

Acknowledgments

Funding/support: Funding for this work was provided by the Clara Mayo Memorial Fund, and by the NIH (K23 MH090247).

References

Achenbach TM, Howell CT, McConaughy SH, Stanger C. Six-year predictors of problems in a national sample of children and youth: I. Cross-informant syndromes. Journal of the American Academy of Child and Adolescent Psychiatry. 1995; 34:336–347. DOI: 10.1097/00004583-199503000-00020 [PubMed: 7896676]

Alfano CA, Ginsburg GS, Kingery JN. Sleep-related problems among children and adolescents with anxiety disorders. Journal of the American Academy of Child and Adolescent Psychiatry. 2007; 46:224–232. DOI: 10.1097/01.chi.0000242233.06011.8e [PubMed: 17242626]

Alfano CA, Pina AA, Zerr AA, Villalta IK. Pre-sleep arousal and sleep problems of anxiety-disordered youth. Child Psychiatry and Human Development. 2010; 41:156–167. DOI: 10.1007/s10578-009-0158-5 [PubMed: 19680805]

Aronen ET, Paavonen EJ, Fjällberg M, Soininen M, Törrönen J. Sleep and psychiatric symptoms in school-age children. Journal of the American Academy of Child and Adolescent Psychiatry. 2000; 39:502–508. DOI: 10.1097/00004583-200004000-00020 [PubMed: 10761353]

Babson KA, Trainor CD, Bunaciu L, Feldner MT. Anxiety sensitivity as a moderator of the relation between sleep anticipatory anxiety and sleep onset latency. Journal of Cognitive Psychotherapy. 2008; 22:258–270. DOI: 10.1891/0889-8391.22.3.258

Baldwin JS, Dadds MR. Reliability and validity of parent and child versions of the Multidimensional Anxiety Scale for Children in community samples. Journal of the American Academy of Child and Adolescent Psychiatry. 2007; 46:252–260. DOI: 10.1097/01.chi.0000246065.93200.a1 [PubMed: 17242629]

Beck JG, Shipherd JC, Zebb J. How does interoceptive exposure for panic disorder work? An uncontrolled case study. Journal of Anxiety Disorders. 1997; 11:541–556. DOI: 10.1016/S0887-6185(97)00030-3 [PubMed: 9407272]

Becker SP, Ramsey RR, Byars KC. Convergent validity of the Child Behavior Checklist sleep items with validated sleep measures and sleep disorder diagnoses in children and adolescents referred to a sleep disorders center. Sleep Medicine. 2015; 16:79–86. DOI: 10.1016/j.sleep.2014.09.008 [PubMed: 25454985]

Beidel DC, Turner SM, Morris TL. Behavioral treatment of childhood social phobia. Journal of Consulting and Clinical Psychology. 2000; 68(6):1072–1080. DOI: 10.1037/0022-006X.68.6.1072 [PubMed: 11142541]

Bouchard S, Gauthier J, LaBerge B, French D, Pelletier M, Godbout C. Exposure versus cognitive restructuring in the treatment of panic disorder with agoraphobia. Behaviour Research and Therapy. 1996; 34:213–224. DOI: 10.1016/0005-7967(95)00077-1 [PubMed: 8881091]

Bouton ME. Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. Biological Psychiatry. 2002; 52:976–986. DOI: 10.1016/S0006-3223(02)01546-9 [PubMed: 12437938]

Brown, TA., DiNardo, PA., Barlow, DH. Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV). Albany, NY: Graywind; 1994.

Carter MM, Marin NW, Murrell KL. The efficacy of habituation in decreasing subjective distress among high anxiety-sensitive college students. Journal of Anxiety Disorders. 1999; 13:575–589. DOI: 10.1016/S0887-6185(99)00024-9 [PubMed: 10688525]

Comer JS, Blanco C, Hasin DS, Liu S, Grant BF, Turner J, Olfson M. Health-related quality of life across the anxiety disorders: Results from the National Epidemiologic Survey on Alcohol and Related Disorders (NESARC). Journal of Clinical Psychiatry. 2010; 72:43–50. DOI: 10.4088/JCP.09m05094blu [PubMed: 20816036]

Comer JS, Kendall PC. High-end specificity of the Children's Depression Inventory in a sample of anxiety-disordered youth. Depression and Anxiety. 2005; 22:11–19. [PubMed: 15965988]

Craske, MG., Barlow, DH. Panic disorder and agoraphobia. In: Barlow, DH., editor. Clinical handbook of psychological disorders: A step-by-step treatment manual. 4. New York, NY: Guilford Press; 2008.

Dahl RE. The regulation of sleep and arousal: Development and psychopathology. Developmental Psychopathology. 1996; 8:3–27. DOI: 10.1017/S0954579400006945

Fallone G, Owens J, Deane J. Sleepiness in children and adolescents: Clinical implications. Sleep Medicine Review. 2002; 6:287–306. DOI: 10.1053/smrv.2001.0192

Finch AJ, Saylor CF, Edwards GL. Children's Depression Inventory: Sex and grade norms for normal children. Journal of Consulting and Clinical Psychology. 1985; 53:424–425. [PubMed: 4008727]

Finch AJ, Saylor CF, Edwards GL, McIntosh JA. Children's Depression Inventory: Reliability over repeated administrations. Journal of Consulting and Clinical Psychology. 1987; 16:339–341.

Fredriksen K, Rhodes J, Reddy R, Way N. Sleepless in Chicago: Tracking the effects of adolescent sleep loss during the middle school years. Child Development. 2004; 75:84–95. DOI: 10.1111/j.1467-8624.2004.00655.x [PubMed: 15015676]

Ginsburg GS, Kendall PC, Sakolsky D, Compton SN, Piacentini J, Albano A, March J. Remission after acute treatment in children and adolescents with anxiety disorders: Findings from the CAMS. Journal of Consulting and Clinical Psychology. 2011; 79(6):806–813. DOI: 10.1037/a0025933 [PubMed: 22122292]

Gregory AM, Eley TC. Sleep problems, anxiety, and cognitive style in school-aged children. Infant and Child Development. 2005; 14:435–444. DOI: 10.1002/icd.409

Gregory AM, Eley TC, O'Connor TG, Plomin R. Etiologies of associations between childhood sleep and behavioral problems in a large twin sample. Journal of the American Academy of Child and Adolescent Psychiatry. 2004; 43:744–751. DOI: 10.1097/01.chi/0000122798.47863.a5 [PubMed: 15167091]

Gregory AM, O'Connor TG. Sleep problems in childhood: A longitudinal study of developmental change and association with behavioral problems. Journal of the American Academy of Child and Adolescent Psychiatry. 2002; 41:964–971. DOI: 10.1097/00004583-200208000-00015 [PubMed: 12162632]

Gurley D, Cohen P, Pine DS, Brook J. Discriminating anxiety and depression in youth: A role for diagnostic criteria. Journal of Affective Disorders. 1996; 39:191–200. DOI: 10.1016/0165-0327(96)00020-1 [PubMed: 8856423]

Hart CN, Palermo TM, Rosen CL. Health-related quality of life among children presenting to a pediatric sleep disorders clinic. Behavioral Sleep Medicine. 2005; 3:4–17. DOI: 10.1207/s15402010bsm0301_3 [PubMed: 15639754]

Hecker JE, Fink CM, Vogeltanz ND, Thorpe GL, Sigmon ST. Cognitive restructuring and interoceptive exposure in the treatment of panic disorder: A crossover study. Behavioural and Cognitive Psychotherapy. 1998; 26:115–131.

Kazdin AE. Children's depression scale: Validation with child psychiatric inpatients. Journal of Child Psychology and Psychiatry. 1987; 28:29–41. [PubMed: 3558537]

Kendall PC, Hudson JL, Gosch E, Flannery-Schroeder E, Suveg C. Cognitive-behavioral therapy for anxiety disordered youth: A randomized clinical trial evaluating child and family modalities. Journal of Consulting and Clinical Psychology. 2008; 76(2):282–297. DOI: 10.1037/0022-006X.76.2.282 [PubMed: 18377124]

Kovacs, M. The Children's Depression Inventory Manual. North Tonawanda, NY: Multihealth Systems; 1992.

Langley AK, Bergman R, McCracken J, Piacentini JC. Impairment in childhood anxiety disorders: Preliminary examination of the Child Anxiety Impact Scale-Parent Version. Journal Of Child And Adolescent Psychopharmacology. 2004; 14:105–114. DOI: 10.1089/104454604773840544 [PubMed: 15142397]

Lewinsohn PM, Rhode P, Seeley JR. The clinical consequences of comorbidity. Journal of the American Academy of Child and Adolescent Psychiatry. 1995; 34:510–520. DOI: 10.1037/0021-843X.102.4.517 [PubMed: 7751265]

March JS, Parker JDA, Sullivan K, Stallings P. The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. Journal of American Academy of Child and Adolescent Psychiatry. 1997; 36:554–565. http://dx.doi.org/10.1097/00004583-199704000-00019.

Merikangas KR, He JP, Burstein M, Swendson J, Avenevoli S, Case B, Olfson M. Service utilization for lifetime mental disorders in U.S. adolescents: Results of the National Comorbidity Survey-Adolescent Supplement (NCS-A). Journal of the American Academy of Child and Adolescent Psychiatry. 2011; 50:32–45. DOI: 10.1016/j.jaac.2010.10.006 [PubMed: 21156268]

Merikangas KR, He JP, Burstein M, Swanson SA, Avenevoli S, Cui L, Benjet C, Georgiades K, Swendsen J. Lifetime prevalence of mental disorders in U.S. Adolescents: Results from the National Comorbidity Survey Replication-Adolescent Supplement (NCS-A). Journal of the American Academy of Child and Adolescent Psychiatry. 2010; 49:980–989. DOI: 10.1016/j.jaac.2010.05.017 [PubMed: 20855043]

Mindell JA. Empirically supported treatments in pediatric psychology: Bedtime refusal and night wakings in children. Journal of Pediatric Psychology. 1999; 24:465–481. DOI: 10.1093/jpepsy/24.6.465 [PubMed: 10608096]

Morin CM, Rodrigue S, Ivers H. Role of stress, arousal, and coping skills in primary insomnia. Psychosomatic Medicine. 2003; 65:259–267. DOI: 10.1097/01.PSY.0000030391.09558.A3 [PubMed: 12651993]

Nelson WM, Politano PM. Children's Depression Inventory: Stability over repeated administrations in psychiatric inpatient children. Journal of Clinical Child Psychology. 1990; 19:254–256.

Ollendick TH, Yule W. Depression in British and American children and its relation to anxiety and fear. Journal of Consulting and Clinical Psychology. 1990; 58:126–129. [PubMed: 2319046]

Owens J, Spirito A, McGuinn M. Children's sleep habits questionnaire (CSHQ):Psychometric properties of a survey instrument for school-aged children. Sleep. 2000; 23:1043–1051. [PubMed: 11145319]

Peterson RA, Reiss RL. The Anxiety Sensitivity Index: Construct validity and factor analytic structure. Journal of Anxiety Disorders. 1987; 1:265–277. DOI: 10.1016/0887-6185(87)90002-8

Pincus DB, May J, Whitton SW, Mattis SG, Barlow DH. Cognitive-behavioral treatment of panic disorder in adolescence. Journal of Clinical Child and Adolescent Psychology. 2010; 39(5):638–649. [PubMed: 20706917]

Reiss S, Peterson RA, Gursky DM, McNally RJ. Anxiety sensitivity, anxiety frequency and the predictions of fearfulness. Behaviour Research and Therapy. 1986; 24:1–8. DOI: 10.1016/0005-7967(86)90143-9 [PubMed: 3947307]

Reiss S. Expectancy model of fear, anxiety, and panic. Clinical Psychology Review. 1991; 11:141–153. DOI: 10.1016/0272-7358(91)90092-9

Reiss, S., McNally, RJ. Expectancy model of fear. In: Reiss, S., Bootzin, RR., editors. Theoretical issues in behavior therapy. San Diego: Academic Press; 1985. p. 107-121.

Reiss S, Peterson RA, Gursky DM, McNally RJ. Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. Behavior Research and Therapy. 1986; 24:1–8. DOI: 10.1016/0005-7967(86)90143-9

Silverman, WK. Anxiety Disorders Interview Schedule, Child and Parent Versions. San Antonio, Texas: The Psychological Corp./Graywind Publications, Incorporated; 1991.

Silverman WK, Fleisig W, Rabian B, Peterson RA. Child Anxiety Sensitivity Index. Journal of Clinical Child Psychology. 1991; 20:162–168. DOI: 10.1207/s15374424jccp2002_7

Silverman WK, Ollendick TH. Evidence-based assessment of anxiety and its disorders in children and adolescents. Journal of Clinical Child and Adolescent Psychology. 2005; 34(3):380–411. DOI: 10.1207/s15374424jccp3403_2 [PubMed: 16026211]

Silverman WK, Pina AA, Viswesvaran C. Evidence-based psychosocial treatments for phobic and anxiety disorders in children and adolescents. Journal of Clinical Child and Adolescent Psychology. 2008; 37(1):105–130. DOI: 10.1080/15374410701817907 [PubMed: 18444055]

Silverman WK, Saavedra LM, Pina AA. Test-retest reliability of anxiety symptoms and diagnoses with the Anxiety Disorders Interview Schedule for DSM-IV: Child and parent versions. Journal of the American Academy of Child and Adolescent Psychiatry. 2001; 40:937–944. DOI: 10.1097/00004583-200108000-00016 [PubMed: 11501694]

Silverman, WK., Weems, CF. Anxiety sensitivity in children. In: Taylor, S., editor. Anxiety sensitivity: Theory, research, and the treatment of the fear of anxiety. Mahwah, NJ: Lawrence Erlbaum; 1998. p. 239-268.

Smucker MR, Craighead WE, Craighead LW, Green BJ. Normative reliability data for the Children's Depression Inventory. Journal of Abnormal Child Psychology. 1986; 14:25–39. [PubMed: 3950219]

SPSS 15.0 Command Syntax Reference. Chicago, Illinois: SPSS Inc; 2006.

Stepanski EJ, Rybarczk B. Emerging research on the treatment and etiology of secondary or comorbid insomnia. Sleep Medicine Reviews. 2005; 10:7–18. DOI: 10.1016/j.smrv.2005.08.002 [PubMed: 16376125]

Storch EA, Murphy TK, Lack CW, Geffken GR, Jacob ML, Goodman W. Sleep-related problems in pediatric obsessive-compulsive disorder. Journal of Anxiety Disorders. 2008; 22:877–885. DOI: 10.1016/j.janxdis.2007.09.003 [PubMed: 17951025]

Tang NK, Harvey AG. Effects of cognitive arousal and physiological arousal on sleep perception. Sleep. 2004; 27:69–78. [PubMed: 14998240]

Verduin TL, Kendall PC. Differential occurrence of comorbidity within childhood anxiety disorders. Journal of Clinical Child and Adolescent Psychology. 2003; 32:290–295. [PubMed: 12679288]

Vincent N, Walker J. Anxiety sensitivity: Predictor of sleep-related impairment and medication use in chronic insomnia. Depression and Anxiety. 2001; 14:238–243. DOI: 10.1002/da.1073 [PubMed: 11754132]

Walkup JT, Albano A, Piacentini J, Birmaher B, Compton SN, Sherrill JT, Kendall PC. Cognitive behavioral therapy, sertraline, or a combination in childhood anxiety. New England Journal of Medicine. 2008; 359(26):2753–2766. DOI: 10.1056/NEJMoa0804633 [PubMed: 18974308]

Walsh TM, Stewart SH, McLaughlin E, Comeau N. Gender differences in Childhood Anxiety Sensitivity Index (CASI) dimensions. Anxiety Disorders. 2004; 18:695–706. DOI: 10.1016/S0887-6185(03)00043-4

Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. Child Development. 1998; 69:875–887. DOI: 10.2307/1132351 [PubMed: 9768476]

Wood JJ, Piacentini JC, Bergman L, McCracken J, Barrios V. Concurrent validity of the anxiety disorders section of the anxiety disorders interview schedule for DSM-IV: Child and parent versions. Journal of Clinical Child and Adolescent Psychology. 2002; 31:335–342. DOI: 10.1207/153744202760082595 [PubMed: 12149971]

Highlights

- Roughly three-quarters of anxious youth in the present sample showed sleep-related problems.
- Younger anxious children (6–11 years) showed more nighttime wakings and sleep anxiety than older anxious youth (12–17 years), whereas older anxious youth experienced greater daytime sleepiness than younger anxious children.
- Heightened anxiety sensitivity predicts prolonged sleep onset latency among anxious youth, even after accounting for severity of anxiety, depression, and age.
- Further research is needed to identify factors beyond anxiety sensitivity that may underlie other sleep-related problems found in anxious youth.

Table 1

Means, standard deviations, and zero-order correlations for the Children's Sleep Habits Questionnaire subscales in a sample of anxious youth (N=101)

Variable	*M*	SD	1	2	3	4	5	6	7	8
1. Sleep Duration (Minutes)	558.07	65.28	-							
2. Total Sleep Disturbance	47.87	8.34	−.22*	-						
3. Bedtime Resistance	8.46	2.82	−.04	.67**	-					
4. Sleep Onset Delay	1.70	0.82	−.13	.49**	.43**	-				
5. Sleep Anxiety	6.12	2.07	−.05	.65**	.78**	.32**	-			
6. Night Wakings	4.20	1.49	−.02	.52**	.45**	.16	.55**	-		
7. Parasomnias	8.60	1.86	−.17	.48**	.07	−.08	.23*	.25*	-	
8. Sleep Disordered Breathing	3.40	0.96	−.09	.29**	−.03	−.24*	.08	.17	.46**	-
9. Daytime Sleepiness	13.72	3.87	−.17	.67**	.13	.28**	.07	.05	.21*	.12

* $p < .05$.

** $p < .01$.

Table 2

Means and standard deviations for the Children's Habits Sleep Questionnaire subscales in a sample of anxious sample (N=101)

	Total Sample		Anxiety Sensitivity				Age group			
			High		Low		6–11 years		12–17 years	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD
Bedtime Resistance	8.46	2.82	9.11	3.14	7.95	2.53	8.88	3.17	7.66	1.80
Sleep Onset Delay	1.70	0.82	2.06	0.80	1.37	0.68	1.74	0.82	1.64	0.83
Sleep Anxiety	6.12	2.07	6.83	2.33	6.05	2.04	6.55	2.20	5.31	1.51
Night Wakings	4.20	1.49	4.83	1.92	3.74	1.24	4.48	1.62	3.61	1.03
Parasomnias	8.60	1.86	7.94	1.16	8.84	2.32	8.69	1.76	8.44	2.05
Sleep Disordered Breathing	3.40	0.96	3.17	0.38	3.32	1.00	3.43	1.03	3.33	0.83
Daytime Sleepiness	13.72	3.87	12.89	4.01	14.42	3.06	12.77	3.71	15.51	3.57

Note: Patients in the High anxiety sensitivity group scored ≥ 1 standard deviation above the mean on the Children's Anxiety Sensitivity Index, and patients in the Low anxiety sensitivity group scored ≤ 1 standard deviation below the mean.

Table 3

Details of the Hierarchical Linear Regression Model Evaluating the Adjusted Contribution of Anxiety Sensitivity in Predicting Total Sleep Disturbance (N=101)

	B	*SE B*	B
Step 1[1]			
Age	0.02	0.33	0.01
Step 2[1]			
Age	0.02	0.33	0.01
CASI total score	0.03	0.12	0.04

Note. Sleep disturbance measured by the CSHQ total score.

R^2 = .025 for Step 1 (p = *ns*), ΔR^2 = .001 for Step 2 (p = *ns*).

[1]Step also controls for child anxiety severity and depression (see methods)

Table 4

Details of the Hierarchical Linear Regression Model Evaluating the Adjusted Contribution of Anxiety Sensitivity in Predicting Sleep Onset Latency (N=101)

	B	*SE B*	B
Step 1[1]			
Age	0.03	0.03	0.11
Step 2[1]			
Age	0.04	0.03	0.12
CASI total score	0.03	0.01	0.28**

Note. Sleep onset latency measured by the CSHQ sleep onset subscale.

R^2 = .045 for Step 1(p = *ns*), ΔR^2 = .064 for Step 2 (p = .017).

** p = .01

[1] Step also controls for child anxiety severity and depression (see methods)