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Sleep-Related Problems and the Effects of Anxiety Treatment in Children and Adolescents

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Abstract

Objective—This study examined (a) demographic and clinical characteristics associated with sleep-related problems (SRPs) among youth with anxiety disorders, and (b) the impact of anxiety treatment: cognitive-behavioral therapy (CBT; *Coping Cat*), medication (sertraline), their combination, and pill placebo on SRPs.

Method—Youth (N = 488, ages 7-17, 50% female, 79% White) with a principal diagnosis of generalized anxiety disorder, separation anxiety disorder, or social phobia participated. SRPs were reported by parents and youth.

Results—Findings differed by informant and by type of SRP, with evidence that SRPs are associated with age, anxiety severity, externalizing problems, functional impairment, and family burden at pretreatment. Anxiety treatment reduced SRPs; effect sizes were small to medium. Reductions in parent-reported separation-related sleep difficulties were significantly greater in active treatment than in the placebo condition, with the greatest reductions reported by parents of youth whose active treatment was multimodal or included sertraline. Youth whose anxiety treatment involved CBT reported significantly greater decreases in dysregulated sleep (e.g., sleeplessness).

Conclusions—Both CBT for anxiety and sertraline appear to be somewhat effective in reducing SRPs, and multimodal treatment may be preferable depending on the symptom presentation. To inform practice, future research should examine a broad range of SRPs, incorporate objective measures of sleep, and evaluate the impact of behavioral strategies that directly target SRPs in youth with anxiety disorders.

Keywords

sleep problems; anxiety; treatment

Recurrent sleep disruption in youth has physical health (Leproult, & Van Cauter, 2010) and mental healthlks (e.g., executive functions, academic performance, emotion regulation) consequences (Beebe et al., 2004; Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010; Fallone,

Owens, & Deane, 2002; Gregory, & O'Connor, 2002; Mindell et al., 2011). Childhood sleep-related problems (SRPs) previously documented include nightmares, difficulty falling or staying asleep, early waking, parasomnias, refusal to sleep alone, and bedtime resistance (Alfano, Ginsburg, & Kingery, 2007; Fallone et al., 2002; Gregory, Rijsdijk, Dahl, McGuffin, & Eley, 2006). Incidence of parent-reported SRPs among youth range from 10-75% (depending on assessment method), with difficulties persisting for several years (Gregory et al., 2006; Mindell et al., 2011; Morrison, McGee, & Stanton, 1992; Paavonen, Solantaus, Almqvist, & Aronen, 2003; Zuckerman, Stevenson, & Bailey, 1987). SRPs in childhood can persist into adolescence (Gregory & O'Connor, 2002) and adulthood (Gregory et al., 2005; Gregory, Van der Ende, Willis, & Verhulst, 2008), and may be a risk factor for subsequent emotion dysregulation (Chorney, Detweiler, Morris, & Kuhn, 2008).

SRPs have been linked to numerous mental health problems, including anxiety, depression, and attention difficulties (Chorney et al., 2008; Ivanenko, Crabtree, Obrien, & Gozal, 2006) as well as social problems (e.g., not getting along with peers; Paavonen et al., 2003). The prevalence of SRPs in clinically anxious youth ranges from 42% to 92% (Hansen, Skirbekk, Oerbeck, Richter, & Kristensen, 2011; Kendall & Pimentel, 2003; Masi et al., 2004; Pina, Silverman, Fuentes, Kurtines, & Weems, 2003; Storch, Murphy et al., 2008), with some data indicating that 55% of anxious youth exhibit multiple SRPs (Alfano et al., 2007; Alfano, Pina, Zerr, & Villalta, 2010). Among school-aged community children, SRPs are associated with trait anxiety (Mindell & Barrett, 2002) and anxiety sensitivity (Gregory, Eley, & Moffitt, 2005). Although most studies have relied on subjective reports, objective measures (i.e., polysomnography) have also shown the link between sleep disturbance and anxiety (e.g., Forbes et al., 2008).

SRPs can precede anxiety, although the relationship is likely bidirectional (Chorney et al., 2008; Gregory, & O'Connor, 2002; Gregory et al., 2005, 2006; Leahy & Gradisar, 2012; Ong, Wickramaratne, Tang, & Weissman, 2006). SRPs may reflect other sleep-interfering anxiety symptoms (e.g., compulsions, worrying; Piacentini, Bergman, Keller, & McCracken, 2003; Storch et al., 2008) and are part of diagnostic criteria (e.g., for generalized anxiety disorder, GAD; separation anxiety disorder, SAD; APA, 2013). At the same time, sleep disruption results in decreased emotion regulation (e.g., Sagaspe et al., 2006) and increased pain sensitivity (Roehrs, Hyde, Blaisdell, Greenwald, & Roth, 2006). Thus, sleep disruption may exacerbate emotional, behavioral, attentional, and somatic symptoms, further interfering with sleep quality (Alfano & Gamble, 2009). Given that sleep behaviors in young children reflect early attempts to self-regulate (Alfano & Gamble, 2009), persistent sleep disruption may represent a prodromal form of emotion dysregulation, sharing neurological and hormonal circuitry (Leahy & Gradisar, 2012).

The number and severity of SRPs differs across developmental levels (Alfano & Gamble, 2009; Gregory, & O'Connor, 2002; Storch et al., 2008). Independent of anxiety, SRPs are most common in early childhood (Alfano et al., 2010). While the number of SRPs decreases from early childhood to preadolescence, the association between SRPs and anxiety becomes stronger throughout childhood (Gregory, & O'Connor, 2002). Thus, it may be the persistence of sleep difficulties, rather than their mere presence, that increases risk for anxiety disorders. In a non-clinical sample, anxiety severity was positively associated with SRPs for all age

groups, although SRPs were more strongly associated with particular aspects of anxiety (cognitive errors) among adolescents than among children (Alfano, Zakem, Costa, Taylor, & Weems, 2009). Furthermore, adolescents have displayed significant changes in sleep patterns at puberty, including delay of sleep initiation and daytime drowsiness (e.g., Crowley, Acebo, & Carskadon, 2007). Changes in sleep during adolescence may be due to external influences (e.g., social events) as well as pubertal changes in neurological processes (Hagenauer, Perryman, Lee, & Carskadon, 2009). Thus, the relationship between SRPs and anxiety disorders may change as a function of development.

SRPs among anxious youth may vary by gender, with females reporting greater numbers of SRPs (e.g., Storch et al., 2008). Specifically, nightmares, bedtime resistance, sleep anxiety, overtiredness, and excessive sleep have been found more common among females than males (Alfano et al., 2007; Alfano et al., 2010; Storch et al., 2008).

SRPs have been linked to externalizing problems (Angold, Costello, & Erkanli, 1999). Less self-reported sleep has been associated with self-reported attention problems and aggressive behavior (Gregory et al., 2008). Although research on the relationship between SRPs and oppositional defiant disorder (ODD) has yielded mixed results (e.g., Hvolby, Jørgensen, & Bilenberg, 2009; Mayes et al., 2009), approximately 25-50% of youth with ADHD have reported sleep-related difficulties (Owens, 2005) that may exacerbate attention difficulties (Alfano & Gamble, 2009). Frequent SRPs experienced by youth with ADHD include bedtime resistance, difficulty waking, and frequent waking (Cortese, Faraone, Konofal, & Lecendreux, 2009). The comorbid presentation of anxiety and ADHD has been shown to compound SRPs (Hansen et al., 2011; Mayes et al., 2009; Mick, Biederman, Jetton, & Faraone, 2000).

Given that prior research has supported the efficacy of CBT and selective serotonin reuptake inhibitors for treating anxiety disorders (e.g., Kendall et al., 2008; Research Units on Pediatric Psychopharmacology Anxiety Study Group, 2001), reductions in SRPs following these treatments might be expected. However, few studies have examined treatment-related change in SRPs among anxious youth. Storch et al. (2008) found a significant reduction in the number of SRPs exhibited by youth with obsessive-compulsive disorder (OCD) after completing CBT, but it was unclear if this reflected decreased distress or decreased family accommodation (e.g., parents not allowing a child to sleep in their bed). In another study, anxious youth exhibited significantly greater reductions in clinician- and parent-reported SRPs following a course of fluvoxamine (compared to placebo; Alfano et al., 2007). The relative effects of CBT and pharmacotherapy on SRPs among anxious youth have not yet been studied.

The current study examined the relationship of SRPs to demographic (gender, age) and clinical characteristics (anxiety severity, functional impairment, externalizing problems, family burden, pubertal status) among anxiety-disordered youth. The impact of CBT, medication, and their combination on SRPs was also examined. We hypothesized that SRPs would differ as a function of pubertal status and would be positively associated with anxiety severity and comorbid externalizing problems. We also hypothesized that SRPs would be significantly associated with functional impairment and family burden, controlling for

anxiety severity. We expected that active treatments (sertraline, CBT, and their combination) would result in significantly greater reductions in SRPs than pill placebo, and that treatment responders would show significantly greater reductions in SRPs than non-responders.

Method

Participants

Data from the Child/Adolescent Anxiety Multimodal Study (CAMS; Walkup et al., 2008) were analyzed. Participants were 488 youth (50% male) with a principal diagnosis of SAD, GAD, or social phobia (SoP) based on DSM-IV criteria (APA, 1994). They ranged in age from 7 to 17 years (M=10.72, SD=2.80). Youth were randomly assigned to: medication (sertraline, n = 133), CBT (*Coping Cat*; n = 139), their combination (n = 140), and pill placebo (n = 76). The sample was predominantly of non-Hispanic ethnicity (88%). The majority of the sample was White (79%, n = 385), followed by African American (9%, n = 44), Asian (3%, n = 12), American Indian (1%, n = 6), Native Hawaiian/Other Pacific Islander (<1%, n = 2), and other (8%, n = 39). Outside of anxiety, the most common comorbidities were ADHD (10%, n = 49), ODD (9%, n = 46), and OCD (9%, n = 42). Additional sample characteristics have been reported (Kendall et al., 2010). The attrition rate was low (Walkup et al., 2008).

Measures

Anxiety Disorders Interview Schedule-Child/Parent Versions (ADIS-IV-C/P; Silverman & Albano, 1996). The ADIS-IV-C/P is a clinician-administered, semi-structured interview that assesses anxiety disorders and associated psychopathology in youth. The ADIS-IV-C/P has excellent psychometric properties (Silverman, Saavedra, & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). Based on a review of 10% of videotaped assessments, interrater reliability for diagnostic status (intraclass correlation coefficients) ranged from .82 to .88.

Clinical Global Impressions-Improvement (CGI-I; Guy, 1976). The CGI-I provides a global rating of improvement in clinical presentation, ranging from 1 (*very much improved*) to 7 (*very much worse*). A CGI-I score of 1 (*very much improved*) or 2 (*much improved*) was used to designate treatment response.

Pediatric Anxiety Rating Scale (PARS; Research Units on Pediatric Psychopharmacology Anxiety Study Group, 2002). The PARS is a clinician-rated measure of anxiety severity in youth. The PARS is administered to the child and parent(s) together, and consists of a symptom checklist and seven global items. Global items are rated on a 6-point scale based on the number and frequency of symptoms, severity of distress, and interference with functioning. In CAMS, six of the seven global items were summed; the item assessing the number of symptoms present (per checklist) was not included in the total score due to concerns about item overlap. Reliability and validity of the PARS is acceptable (Research Units on Pediatric Psychopharmacology Anxiety Study Group, 2002). Inter-rater reliability in CAMS was excellent (>.97).

Child Anxiety Impact Scale-Parent Version (CAIS-P; Langley, Bergman, McCracken, & Piacentini, 2004; Langely et al., 2014). The CAIS-P is a 27-item, parent-report measure of anxiety-related interference in social activities, school, and home/family functioning. For this study, two items pertaining to sleep were not scored due to overlap with items on the sleep measure. The CAIS-P has good internal consistency and validity (Langely, 2004; Langely et al., ahead of print). Cronbach's alpha was .88 at pre- and .92 at post-treatment.

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). The CBCL is a 118-item parent-report measure of child psychopathology over the past six months. The psychometric properties of the CBCL have been demonstrated across a variety of populations (Achenbach & Rescorla, 2001). The current study used the CBCL Externalizing Problems score, which had a Cronbach's alpha of .96 at pre- and .99 at post-treatment.

Burden Assessment Scale (BAS; **Reinhard, Gubman, Horwitz, & Minsky, 1994**). The 21-item BAS measures caregiver burden associated with having a child with a mental health disorder. Parents indicated the degree to which the child's anxiety disrupts family life (5-point scale). Cronbach's alpha for the current sample was .91 at pre- and .93 at post-treatment.

Pubertal Development Scale (**Petersen, Crockett, Richards, & Boxer, 1988)**. The PDS is a 5-item youth self-report measure of physical changes associated with puberty. With the exception of menarche, which is reported by females as present/absent, items are rated on a 1 (*not yet started*) to 4 (*seems complete*) scale and averaged. In the current sample, Cronbach's alpha was .87 for girls and .85 for boys.

Sleep composite measure. To assess SRPs, exploratory factor analyses (EFA) with maximum likelihood estimation were conducted using sleep items from parent- and child-report measures administered at pretreatment. Parent-rated sleep items (11 total) consisted of 6 items from the CBCL, 4 items from the Screen for Child Anxiety and Related Emotional Disorders (SCARED; Birmaher, 1997; Birmaher, Khetarpal, Brent, & Cully, 1997; Birmaher et al., 1999), and 1 item from the Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997). Child-rated sleep items (9 total) consisted of 4 items from the Physical Symptoms Checklist (PSC; Emslie et al., 2006), 4 items from the SCARED, and 1 item from the MASC. All items were rescaled using the least common multiple of the number of response options across measures. Based on the results of a parallel analysis of eigenvalues (Hayton, Allen, & Scarpello, 2004; Zwick & Velicer, 1986), three factors were extracted from parent-rated sleep items and two factors were extracted from child-rated sleep items. Varimax rotation was used to evaluate the solution. One factor from the parent-rated measure was not considered empirically-defined because it had fewer than three “marker” items (Brown, 2006); thus, a two-factor solution was evaluated. Items that loaded above |.40| on one factor and below |.30| on the other were retained. Based on low factor loadings, items pertaining to nightmares with specific content (i.e., something bad happening to the child or to his/her parents) were dropped from both the parent- and child-report scales. Two additional items were dropped from the parent-report: sleeping more than most kids and talking/walking during sleep. The resulting parent- and child-report SRP measures each consisted of a Dysregulated Sleep factor (3 parent-rated

items, Cronbach's alpha = .63; 4 child-rated items, Cronbach's alpha = .71) and a factor reflecting Separation-Related Sleep Problems (3 parent-rated items, Cronbach's alpha = .75; 3 child-rated items, Cronbach's alpha = .69). These scales cover the SRPs most commonly endorsed in prior research sampling clinic-referred youth with the same principal diagnoses (Alfano et al., 2007). Tables 1 and 2 present EFA results.

Procedures

Procedures were approved by relevant IRBs. Measures were administered at pre- and post-treatment by independent evaluators masked to treatment condition who were trained to a pre-specified reliability and monitored for drift. Randomly-selected, videotaped therapy sessions were reviewed for treatment fidelity and had excellent correspondence with the protocol. The CAMS design, rationale for treatments, and quality assurance procedures have been discussed by Compton et al. (2010).

Cognitive-behavioral therapy (CBT). CBT participants received 14, 60-minute sessions over 12 weeks. Treatment (*Coping Cat*; Kendall & Hedtke, 2006) was adapted to the youth's age (Kendall, Choudhury, Hudson, & Webb, 2002). *Coping Cat* trains skills for managing anxiety (e.g., cognitive restructuring; problem solving) and provides exposure to anxiety-provoking situations. Youth were assigned between-session treatment-related homework.

Pharmacotherapy. Pharmacotherapy consisted of eight, 30- to 60-minute sessions (weeks 1-4, 6, 8, 12) that involved discussing anxiety symptoms, overall functioning, treatment response, and adverse events in the context of supportive care. Providers checked-in with participants by phone during weeks without in-person sessions. Sertraline was administered on a fixed-flexible schedule beginning with 25 mg per day and adjusting up to 200 mg per day by week 8.

Combination therapy. Combination therapy consisted of all components of the CBT and the pharmacotherapy conditions. Sessions occurred on the same day whenever possible. Dose increases were determined with input from the CBT therapist.

Data Analytic Plan

Analyses used the intent-to-treat sample with multiple imputation for handling missing data (<10%) at posttreatment.[1] ANOVA examined pretreatment SRPs by condition. *T*-tests and correlations evaluated relationships between SRPs and demographics, pubertal development, anxiety severity, functional impairment, externalizing problems, and family burden. Multiple regressions examined pretreatment SRPs, functional impairment and family burden, controlling for anxiety severity. Mixed-model ANOVA examined treatment-related changes in SRPs by type of treatment (e.g., active versus placebo). ANOVA examined treatment responders' and non-responders' SRPs, controlling for pretreatment SRPs. An alpha level of .01 was used.

[1]Results are reported for the pooled dataset whenever possible; for analyses in which multiple imputation procedures did not yield pooled estimates, results for non-imputed data are reported.

Results

Preliminary Analyses

Pretreatment SRPs did not differ by condition. The correlation between parent and child report of sleep problems related to Separation was .63 ($p < .01$) at each time point. The correlation between parent and child report of Dysregulated Sleep was .28 ($p < .01$) at each time point. Within informant, inter-factor correlations at pre- and post-treatment ranged from .17 to .28 (all p-values < .01). Means and standard deviations are reported in Table 3.

Demographics

Parent- and child-reported SRPs were not significantly related to gender. Child age in months was significantly and negatively associated with sleep problems related to Separation, as rated by parents ($r = -.45$, $p < .001$) and children ($r = -.33$, $p < .001$). Age was significantly and positively associated with Dysregulated Sleep by child report only ($r = .14$, $p < .01$).

Clinical Characteristics

Pubertal development was significantly and negatively associated with sleep problems related to Separation, as reported by parents ($r = -.41$, $p < .001$) and children ($r = -.27$, $p < .001$); however, these associations were not significant when controlling for age. Pubertal development was not related to parent- or child-rated Dysregulated Sleep.

Clinician-rated anxiety severity was significantly and positively associated with SRPs, as reported by parents (Separation: $r = .20$, $p < .001$; Dysregulated Sleep: $r = .14$, $p < .01$) and children (Separation: $r = .17$, $p < .001$; Dysregulated Sleep: $r = .24$, $p < .001$). Parent-reported externalizing problems were significantly associated with parent-rated SRPs (Separation: $r = .15$, $p = .001$; Dysregulated Sleep: $r = .29$, $p < .001$) but not with child-rated SRPs.

Parent-reported functional impairment was significantly and positively associated with parent-rated SRPs (Separation: $r = .16$, $p < .001$; Dysregulated Sleep: $r = .18$, $p < .01$) and child-rated Dysregulated Sleep ($r = .27$, $p < .001$), but not with child-rated sleep problems related to Separation. Controlling for age and anxiety severity, parent- and child-rated Dysregulated Sleep each significantly predicted functional impairment (parent: $\beta = .13$, $t = 3.29$, $p = .001$; child: $\beta = .13$, $t = 3.00$, $p < .01$), as did parent-rated sleep problems related to Separation ($\beta = .17$, $t = 3.73$, $p < .001$). Child-rated sleep problems related to Separation did not significantly predict functional impairment.

Family burden was positively and significantly associated with parent-rated SRPs (Separation: $r = .22$, $p < .001$; Dysregulated Sleep: $r = .21$, $p < .001$) and child-rated sleep problems related to Separation ($r = .17$, $p < .001$), but not with child-rated Dysregulated Sleep. Controlling for anxiety severity, parent-rated SRPs significantly predicted family burden (Separation: $\beta = .17$, $t = 3.78$, $p < .001$; Dysregulated Sleep: $\beta = .17$, $t = 3.84$, $p < .001$). Child-rated sleep problems related to Separation also significantly predicted family

burden when controlling for anxiety severity (β =.13, $t = 2.83$, $p < .01$). Controlling for age and anxiety severity, child-rated Dysregulated Sleep was not related to family burden.

Treatment-Related Change in SRPs

A 2 (treatment type: active vs. non-active) × 2 (time) mixed-model ANOVA examined treatment effects on SRPs. There were significant main effects of time for sleep problems related to Separation (parent- report: $F = 131.32$, $p < .001$, $\eta^2 = .23$; child-report: $F = 41.89$, $p < .001$, $\eta^2 = .09$) as well as Dysregulated Sleep (parent-report: $F = 47.53$, $p < .001$, $\eta^2 = .11$; child-report: $F = 67.30$, $p < .001$, $\eta^2 = .14$). Compared to placebo, active treatment (sertraline, CBT, combination) resulted in significantly greater reductions in sleep problems related to Separation, as reported by parents ($F = 6.52$, $p = .01$, $\eta^2 = .01$) but not by children. There were no significant treatment type X time interactions for parent- or child-rated Dysregulated Sleep.

For participants in active treatment only, a 2 × 2 mixed-model ANOVA examined the impact of combined treatment versus sertraline alone or CBT alone on SRPs. Multimodal treatment was associated with significantly greater reductions in sleep problems related to Separation, as rated by parents ($F = 9.69$, $p < .01$, $\eta^2 = .01$) and children ($F = 10.78$, $p = .001$, $\eta^2 = .02$). There were no significant treatment type X time interactions for parent- or child-rated Dysregulated Sleep.

A 2 (presence/absence of CBT) × 2 (time) mixed-model ANOVA examined the impact of CBT on SRPs. There were significant main effects of time for sleep problems related to Separation (parent-report: $F = 323.17$, $p < .001$, $\eta^2 = .43$; child-report: $F = 93.77$, $p < .001$, $\eta^2 = .18$) and Dysregulated Sleep (parent-report: $F = 99.70$, $p < .001$, $\eta^2 = .21$; child-report: $F = 148.47$, $p < .001$, $\eta^2 = .26$). There were no significant treatment type X time interactions for sleep problems related to Separation. Relative to conditions that did not include CBT (sertraline, placebo), the CBT conditions (CBT, combination) were associated with significantly greater reductions in Dysregulated sleep by child report ($F = 8.60$, $p < .01$, $\eta^2 = .02$) but not by parent report.

A 2 (presence/absence of sertraline) × 2 (time) mixed-model ANOVA examined the impact of sertraline on SRPs. There were significant main effects of time for all SRPs (parent-rated Separation: $F = 337.37$, $p < .001$, $\eta^2 = .44$; child-rated Separation: $F = 100.86$, $p < .001$, $\eta^2 = .19$; parent-rated Dysregulated Sleep: $F = 105.06$, $p < .001$, $\eta^2 = .22$; child-rated Dysregulated Sleep: $F = 167.95$, $p < .001$, $\eta^2 = .29$). Conditions that included sertraline (sertraline; combination) were associated with significantly greater reductions in parent-rated sleep problems related to Separation ($F = 11.81$, $p = .001$, $\eta^2 = .02$) than conditions that did not include sertraline (CBT, placebo). There were no significant treatment type X time interactions for child-rated sleep problems related to Separation, or for parent- or child-rated Dysregulated Sleep.

Relationship to Change in Anxiety

A series of ANCOVA examined differences between treatment responders and non-responders in posttreatment SRPs, controlling for pretreatment SRPs and age. Treatment responders had significantly lower posttreatment scores on the Separation scale, as rated by

parents (F = 103.15, p < .001, η^2 = .07) and children (F = 36.24, p < .001, η^2 = .04). Treatment responders also had significantly lower posttreatment scores on Dysregulated Sleep scale, as rated by parents (F = 13.05, p < .001, η^2 = .02) and children (F = 18.02, p < .001, η^2 = .03).

Discussion

The present findings highlight the separate role of (a) dysregulated sleep and (b) sleep difficulties related to separating from caregivers. These SRPs were differentially associated with age, child functional impairment, and family burden. Additionally, the findings suggest that treating anxiety (CBT and sertraline) has some beneficial effects on SRPs; effect sizes were small to medium and differed somewhat by treatment type and informant.

Unlike prior research that examined the number of SRPs reported by parents or children (Alfano et al., 2010; Gregory, & O'Connor, 2002; Storch et al., 2008), this study examined the severity of parent- and child-rated SRPs. There were no gender differences in SRPs. Age was negatively associated with separation-related sleep problems, as rated by parents and youth, and positively associated with youth-rated dysregulated sleep. In line with prior research, youth with higher anxiety severity displayed more severe SRPs (across informants), and parent-rated SRPs were positively associated with comorbid externalizing problems, functional impairment, and family burden (Ivanenko, 2006; Alfano et al., 2009). Youth-rated sleep problems related to separation were associated with family burden only, whereas youth-rated dysregulated sleep was associated with functional impairment only.

Both separation-related sleep difficulties and dysregulated sleep improved over time, and reductions in separation-related sleep difficulties reported by parents were greater for those in active treatment than in the placebo condition, with the greatest reductions exhibited by youth whose anxiety treatment was multimodal/sertraline. Dysregulated sleep improved over time in all treatment conditions (including placebo), with significantly greater reductions reported by youth whose anxiety treatment included CBT. Across informants, treatment responders exhibited greater reductions in both types of SRPs than did non-responders.

Previous longitudinal research indicated that the total number of SRPs decreases with age while the association between SRPs and anxiety stabilizes with age (Gregory, & O'Connor, 2002). The current results suggest that this pattern is driven by reductions in separation-related sleep difficulties as children age. Beyond sleep disturbance, separation anxiety symptoms are more prevalent among younger children than adolescents (Allen, Lavallee, Herren, Ruhe, & Schneider, 2010). Perhaps as youth enter puberty, families are more reluctant to share a bed and parents are less likely to accommodate anxiety symptoms, allowing youth to tolerate separation-related distress. Consistent with pubertal changes in sleep, older youth reported greater sleep dysregulation; however, parent-rated dysregulated sleep was not related to age (Crowley et al., 2007). It may be that younger children are more likely to seek comfort from their parents when experiencing dysregulated sleep, and that youth become less likely to share such difficulties with their parents as they age. Findings highlight the need for multi-informant assessment of SRPs in future research.

Surprisingly, youth reports of dysregulated sleep difficulties, but not separation-related sleep difficulties, were associated with greater functional impairment. Perhaps families grow accustomed to altered sleeping arrangements such that the separation difficulties no longer interfere with the child's functioning. However, both parent- and youth-rated sleep difficulties related to separation were positively associated with family burden. Youth with higher sleep anxiety and emotional problems have exhibited higher rates of co-sleeping compared to healthy peers (Allen et al., 2010). Perhaps it is parental accommodation that burdens the family but leads to little interference elsewhere. Youth–reported dysregulated sleep was not associated with family burden, which may again reflect discrepancies in parent and youth reports of dysregulated sleep. It's possible that when youth experience difficulty falling and staying asleep but do not share their concerns or seek help from parents, family members remain unaware of these difficulties and do not perceive any associated burden.

Given that SRPs are linked to poor physical health (Leproult & Van Cauter, 2010) and decreased emotion regulation (Sagaspe et al., 2006), and predict difficulties with anxiety and depression in adulthood (Gregory et al., 2005), it is encouraging that both separation-related sleep difficulties and dysregulated sleep among youth with anxiety can be improved by anxiety treatment: the findings indicate that CBT and sertraline are each associated with some improvements in SRPs. Because CBT can involve decreasing family accommodation and practicing sleeping apart from a caregiver, it is surprising that sertraline was associated with a greater reduction in parent-rated sleep concerns related to separation. However, CBT in CAMS did not directly address parent-child interactions at bedtime; SRPs may be further reduced when they are a focus of CBT. Given that multimodal treatment was superior to monotherapy and that both forms of monotherapy reduced separation-related sleep concerns, it may be that sertraline and CBT had an additive effect.

All treatment conditions were associated with decreases in dysregulated sleep, though active anxiety treatment involving CBT was superior to treatment without CBT. This may reflect CBT-related decreases in worry, which can contribute to difficulties falling and staying asleep. Alternatively, the difference in effect between CBT and sertraline may be due to adverse effects of sertraline on sleep (Rynn, Siqueland, & Rickels, 2001; Rynn et al., 2015). The possibility that medication improves some SRPs (e.g., related to separation concerns) but interferes with other aspects of sleep (e.g., architecture; Zhang et al., 2013) underscores the need for studies designed to evaluate a broad range of sleep outcomes. Overall, the current findings suggest that both CBT and sertraline are somewhat effective in reducing SRPs, and that multimodal treatment may be preferable for addressing separation-related sleep concerns, but additional research is required to make specific practice recommendations.

Limitations merit comment. First, assessments relied on retrospective self- and parent-report, and did not address the extent to which SRPs were persistent and distinct from normal sleep disruptions in youth. Future research should incorporate objective measures of sleep (e.g., polysomnography; actigraphy) and sleep logs that assess disturbances in real time with less influence from recall bias (Forbes et al., 2008). Second, the measure of SRPs was developed for this study using items from non-sleep measures administered to the same sample used to test hypotheses; thus, some SRPs (e.g., sleepwalking) were not represented

and there was potential for capitalization on chance characteristics of the data. Also, because approximately half of the SRP items were embedded in anxiety measures, reductions in SRPs may partly reflect a halo effect related to improvement in anxiety symptoms. Third, family accommodation of youth SRPs was not assessed. Given the relationship of SRPs to family burden and the lack of impairment associated with youth-rated separation concerns, accommodations may have been in place to help youth sleep. Family accommodation of youth anxiety symptoms is common (Benito et al., 2015; Lebowitz et al., 2013), yet little is known about how it relates to SRPs and how it may be impacted by CBT and sertraline. Finally, data were collected from a well-characterized, treatment-seeking sample of anxious youth that was predominantly non-Hispanic White; results may not generalize to other groups. Future studies should examine the mechanism by which successful anxiety treatment impacts SRPs (e.g., reducing anxious cognitions, emotion dysregulation, or family accommodation) using diverse samples, and may benefit from distinguishing biological and behavioral components (e.g., sleep hygiene). Additionally, the impact of sleep-focused behavioral interventions for youth with anxiety disorders should be investigated.

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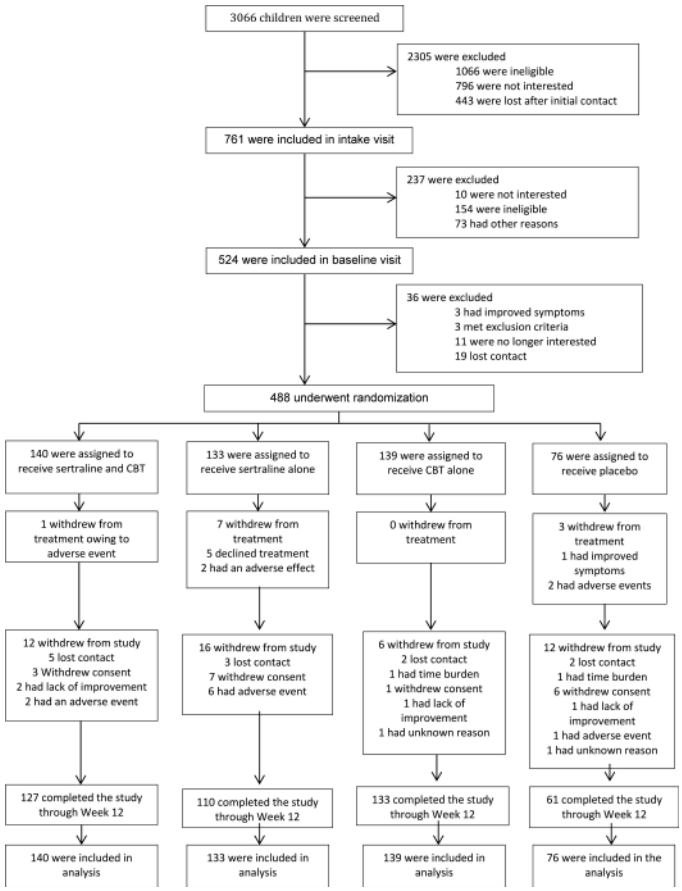

Figure 1.
CONSORT Flow diagram reproduced from the Child/Adolescent Anxiety Multimodal Study (Walkup et al., 2008).

Table 1

Factor loadings for parent-rated sleep items (N = 488).

	Separation	Dysregulated Sleep
Sleeps less than most kids	.116	.510
Sleeps next to someone from family	.710	.151
Worry about sleeping alone	.977	.213
Scared if sleeps away from home	.438	.081
Trouble sleeping	.045	.882
Nightmares	.218	.435

Table 2

Factor loadings for child-rated sleep items (N = 488).

	Separation	Dysregulated Sleep
Sleeplessness	.120	.719
Sleeps next to someone from family	.623	.065
Worry about sleeping alone	.922	.159
Scared if sleeps away from home	.426	.111
Trouble sleeping	.173	.784
Feeling drowsy or too sleepy	.031	.459
Nightmares or very strange dreams	.126	.460

Table 3

Means and Standard Deviations for Sleep-Related Problems

Sleep-Related Problems	Sertraline (*n*=133)		CBT (*n*=139)		Combination (*n*=140)		Placebo (*n*=76)		Total Sample (*N*=488)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Parent-rated Separation	8.21 (6.34)	3.85 (5.12)	7.50 (6.06)	3.63 (4.80)	8.19 (6.38)	2.57 (3.37)	8.67 (6.00)	5.64 (5.93)	8.08 (6.21)	3.70 (4.83)
Child-rated Separation	4.71 (5.45)	2.69 (4.47)	4.14 (4.84)	2.32 (4.06)	5.45 (5.34)	2.28 (3.53)	5.33 (5.50)	3.65 (4.90)	4.85 (5.27)	2.62 (4.18)
Parent-rated Dysregulated Sleep	4.56 (4.80)	2.31 (3.54)	4.68 (5.03)	2.19 (3.04)	5.89 (5.09)	2.50 (3.49)	4.83 (5.01)	2.64 (3.84)	5.02 (5.00)	2.38 (3.42)
Child-rated Dysregulated Sleep	4.89 (5.13)	2.43 (3.73)	5.89 (5.71)	1.65 (2.68)	6.10 (6.00)	2.26 (3.69)	5.22 (5.60)	2.89 (5.04)	5.57 (5.64)	2.23 (3.68)

Note. Means were calculated using imputed data. Standard deviations for the non-imputed dataset are reported, as multiple imputation procedures do not yield pooled standard deviation estimates. All pre-post differences were significant at $p < .01$. CBT = cognitive-behavioral therapy.