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Sleep-Related Problems in Pediatric Obsessive-Compulsive Disorder and Intensive Exposure Therapy

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Limited research has examined sleep-related problems (SRPs) among children and adolescents with obsessive-compulsive disorder (OCD). The present study addresses this gap by investigating preliminary associations between SRPs, demographic factors (gender and age), family variables (family accommodation and parental stress), and clinical factors (medication status, internalizing and externalizing symptoms, OCD severity, OCD-related impairment), and treatment outcomes in a sample of 103 youth (aged 7 to 17 years; 53% female) with a primary diagnosis of OCD. Clinician, parent, and child measures were used to assess demographic, family, and clinical predictors. SRPs were assessed using an 8-item measure comprising items of the Child Behaviour Checklist, Child Depression Inventory, and Multidimensional Anxiety Scale for Children as used in previous studies. Results showed that SRPs were highly prevalent among this sample and that more SRPs were associated with younger age, internalizing problems, and functional impairment. However, SRPs were not an independent predictor of OCD severity, impairment, or treatment response. Preliminary findings suggest that SRPs among youth with OCD may be more strongly associated with broader internalizing symptoms than with OCD itself. Future longitudinal research is warranted to further explore the complexity of SRPs when co-occurring with pediatric OCD.

Keywords: obsessive-compulsive disorder (OCD); sleep-related problems (SRPs); cognitive behavioral therapy (CBT); exposure and response prevention (ERP); children and adolescents

OBSESSIVE-COMPULSIVE DISORDER (OCD) is a neuropsychiatric disorder that affects people of all ages and has an impact on various aspects of everyday functioning (Piacentini, Peris, Bergman, Chang, & Jaffer, 2007). In childhood, OCD is particularly burdensome for sufferers and families because the disorder is often complicated by the presence of one or more other psychiatric disorders, such as depression, anxiety disorders, and attention-deficit/hyperactivity disorder (ADHD) (Geller, 2006). In addition to comorbid psychiatric disorders, recent research suggests that sleep-related problems (SRPs), such as nightmares, difficulty falling asleep, sleeping more/less than others, being overtired, and refusal to sleep alone (Alfano, Ginsburg, &

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Kingery, 2007), may also occur in pediatric OCD and, moreover, may be associated with greater dysfunction, impairment, and an attenuated response to cognitive behavioral therapy (CBT) (for a review, see Reynolds, Gradisar, & Alfano, 2015).

Sleep is an essential psychobiological process that is involved in the maintenance of physical and mental health (Meltzer & Mindell, 2008). Sleep neural pathways are closely connected and partially overlap with regulatory affect and cognition pathways and other key brain functions also associated with psychiatric disorders (Baglioni et al., 2016). In childhood and adolescence, up to 40% of youth are affected by SRPs, which commonly remit with age and without specific interventions (Alfano & Gamble, 2009). For some youth, however, these difficulties persist into adulthood, and are associated with profound negative psychosocial consequences. Among youth of the general population, evidence shows that persistent SRPs are associated with increased anxiety, impaired psychological, interpersonal, and academic functioning, heightened family dysfunction and conflict (Mindell, Meltzer, Carskadon, & Chervin, 2009). Furthermore, persistent SRPs in childhood may forecast depression and anxiety in adolescence (Gregory & O'Connor, 2002) and development of an anxiety disorder in adulthood (Gregory et al., 2005).

More recently, sleep disturbances have been suggested as transdiagnostic risk mechanism for mental health disorders (Baglioni et al., 2016). Findings for transdiagnostic disruptions of sleep continuity across psychiatric disorders suggest that sleep disturbances affect the neurobiological balance between arousal and de-arousal systems in the brain (Baglioni et al., 2016). As such, sleep disturbances are associated with altered neural function (Ma, Dinges, Basner, & Rao, 2015), impaired cognitive processes (Drummond, Paulus, & Tapert, 2006), behavioral response inhibition, dysregulated mood and emotional functioning (Mauss, Troy, & LeBourgeois, 2013); and predicts greater depression, anxiety and externalizing in children and adolescents over time (Kelly & El-Sheikh, 2014). In turn, reduced mood and emotional well-being are associated with sleep disturbances, and impaired mental and physical performance (Peterman, Carper, & Kendall, 2015); and better psychological adjustment is predictive of positive sleep changes (Kelly & El-Sheikh, 2014). Thus, contemporary explanations of sleep disturbances and co-occurrence with psychiatric disorders highlight dimensional models of bi-directional influence (Baglioni et al., 2016; Kelly & El-Sheikh, 2014). The presence of co-occurring SRPs may therefore have particularly pronounced effects on youth with OCD, given that functioning and psychosocial adjustment are already impaired (Clementi, Alfano, Holly, & Pina, 2016).

While sleep disturbances are not considered part of the OCD diagnostic criteria as with other disorders, increasing numbers of empirical studies identify SRPs within youth with OCD. Although relatively few studies have objectively measured sleep in those with OCD, extant research indicates that individuals with OCD exhibit multiple disturbances in sleep compared to healthy controls, including decreased total sleep time, increased wake after sleep onset, and decreased sleep efficiency (Alfano & Kim, 2012). In both children and adults, decreased sleep has been associated with greater OCD severity (Storch et al., 2008). Alfano and Kim (2012) suggest that insufficient sleep has a profound effect on executive functions of the prefrontal cortex, including behavioral and emotional inhibition. Objective findings indicate significantly disrupted sleep patterns in children with OCD and an association with more severe compulsions (Alfano & Kim, 2012; Rapoport et al., 1981). Thus, obsessions and compulsions may become more difficult to inhibit when sleep is inadequate (Alfano & Kim, 2012). Conversely, obsessions may also interfere with healthy sleep via dysfunction in neurocognitive executive functioning processes (in particular, inhibition), as a result of overload on these processes due to the persistence of obsessions (Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005). However, findings regarding the nature of the relationship between SRPs and pediatric OCD have been largely inconsistent. Some research with adult OCD populations report normal sleep patterns and describe sleep disturbances as a function of depression rather than OCD (Bobdey, Fineberg, Gale, Patel, & Davies, 2002; Robinson, Walsleben, Pollack, & Lerner, 1998), whereas other studies have found disturbed sleep patterns among adults with OCD and suggest their independence of depression (Kluge, Schussler, Dresler, Yassouridis, & Steiger, 2007; Voderholzer et al., 2007). Conclusions that can be drawn from many of these studies are limited, as they include adults with OCD with high rates of comorbid depression and the impact of psychotropic medication on sleep is poorly understood (Reynolds et al., 2015).

As adults with OCD are more likely to suffer from comorbid depressive disorders compared to youth (Farrell, Barrett, & Piacentini, 2006), examining SRPs in youth may further our understanding of the relationship between sleep disturbances and OCD. Storch and colleagues (2008) cross-

sectionally investigated the frequency of SRPs in a pediatric OCD sample (n = 66) and found that 92% of youth experienced one SRP, and 27% experienced five or more SRPs. The most common SRPs were trouble sleeping and being overtired during the day; and SRPs were more frequently experienced by females relative to males, and children (aged 8 to 11 years) relative to adolescents (aged 12 to 17 years). Further, youth with SRPs were more likely to experience greater OCD symptom severity, increased anxiety, higher rates of internalizing and externalizing problems. However, no significant associations between SRPs and depression or OCD-related functional impairment were found (Storch et al., 2008). A pilot study by Alfano and Kim (2012) used wrist actigraphs to measure sleep with a small sample of non-medicated, non-depressed children with OCD (n = 6) and a matched, healthy control group. Results indicated that the OCD group experienced significantly less sleep time, more waking after sleep onset, and longer duration of pre-sleep arousal (Alfano & Kim, 2012). These findings suggest that the fragmented sleep patterns in youth with OCD are independent of the presence of depressive symptoms, and instead, associated with greater arousal before sleep (e.g., due to obsessions and bed-time rituals) (Alfano & Kim, 2012). Bed-time rituals involving parents or siblings are frequently observed and found to be associated with high levels of family accommodation and familial distress (Alfano & Kim, 2012), which may further affect energy and motivation to engage in therapy tasks.

Similarly, Ivarsson and Larsson (2009) found higher rates of SRPs in youth (aged 7 to 17 years) with OCD (n = 185) relative to youth with non-OCD psychiatric disorders (n = 177) and healthy controls (n = 317). Additionally, it was found that comorbid internalizing and externalizing problems were stronger predictors of SRPs than OCD (Ivarsson & Larsson, 2009). More recently, Ivarsson and Skarphedinsson (2015) examined the relationship between SRPs and CBT outcomes in a large community sample of youths with OCD. Similar to previous studies, 68% of the sample experienced at least one SRP. Moreover, the sample of youth with OCD experienced elevated symptoms of sleep deprivation and nightmares before treatment (Ivarsson & Skarphedinsson, 2015). Following a course of CBT for OCD, most SRPs decreased; however, the presence of baseline SRPs was predictive of poorer immediate response of OCD symptoms to CBT.

The current literature highlights that SRPs are highly prevalent in youth with OCD, and that the bi-directional relationship between SRPs and OCD may exacerbate OCD symptom severity and functional impairment, which may in turn also interfere with CBT effectiveness. Nevertheless, research examining the relationship between SRPs in youth with OCD is currently limited; and previous studies have not controlled for other sleep-relevant factors associated with OCD, such as internalizing and externalizing problems or age. Further, previous studies have not examined the degree to which SRPs are associated with CBT response at longer-term follow-up. Given that almost 50% of youth with OCD remain symptomatic following treatment (Öst et al., 2016), determining whether SRPs are associated with attenuated treatment response may inform treatment refinement for pediatric OCD. The aim of the present preliminary study was as follows: (a) to explore associations between SRPs and OCD severity, age, gender, externalizing and internalizing symptoms, and comorbidity; (b) to examine the associations between SRPs and OCD-related functional impairment, family accommodation (FA), parental distress, comorbid disorders, and current use of medication; and (c) to examine whether SRPs predict poorer response to intensive CBT at posttreatment and at 3-month follow-up. It was hypothesized that (a) SRPs would be high among youth with OCD and more frequently endorsed by females, younger versus older children, and those with higher comorbidity; (b) SRPs would be associated with baseline anxiety and depressive symptoms, internalizing and externalizing problems, OCD severity and impairment, FA and parental distress; (c) SRPs would uniquely predict increased baseline OCD severity and functional impairment, after controlling for age, FA, comorbid internalizing and externalizing symptoms; and (d) SRPs would predict poorer treatment response at posttreatment and at 3-month follow-up, after controlling for baseline OCD severity, age, FA, comorbid internalizing and externalizing symptoms.

Method

PARTICIPANTS

Participants comprised 103 children (37%) and adolescents (63%) aged 7 to 17 years (M_{age} = 12.18 years; SD = 2.76) with a primary diagnosis of OCD, who participated in intensive CBT-ERP at a university specialist clinic. Participants were 55 females, with a mean age of 12 years (SD = 2.77), and 48 males with a mean age of 12.4 years (SD =2.75). Recruitment occurred through community advertisements and self-referral into the program. Youth were included in the study if they were 6 to 17 years of age, had a principal diagnosis of OCD, were willing to cease concurrent psychotherapy for duration of the trial, and, if on medication, were required to be on a stable dose for 12 weeks prior. Exclusion criteria

included presence of psychosis, active suicidal ideation, and significant learning difficulties.

The sample was in the moderate range of OCD severity, with a mean severity score on the Children's Yale-Brown Obsessive Compulsive Scale (CYBOCS; Scahill et al., 1997) of 26.91 (*SD* = 4.44). Forty-nine percent of participants were currently receiving psychotropic medication. The sample had a high level of comorbidity, with 90% having a secondary psychiatric diagnosis, and 59% having a tertiary diagnosis. On average, the mean number of comorbid diagnoses was 1.95 (*SD* = 1.32). Table 1 shows a breakdown of demographic and clinical characteristics of the sample. Due to the ongoing nature of the research, 88.3% (*N* = 86) of participants' had completed posttreatment data, and 79.6% (*N* = 77) had completed follow-up data.

MEASURES

Diagnostic Interview

The Anxiety Disorders Interview Schedule Parent Version (ADIS-IV-P; Silverman & Albano, 1996) is a semistructured, clinical interview used for diagnosis of anxiety disorders, and comorbid mood and externalizing disorders. The ADIS-IV-P was administered to parents via telephone interview. The ADIS-IV-P has good inter-rater and retest reliability (Silverman, Saavedra, & Pina, 2001), and good sensitivity to treatment effects in pediatric OCD (Farrell, Waters, Milliner, & Ollendick, 2012; Farrell, Waters, & Zimmer-Gembeck, 2012). A clinician severity rating (CSR; ranging from 1 to 8) was assigned by the interviewer to each diagnosis. Diagnoses and CSR ratings were reviewed in group supervision meetings, during which the group determined the final CSR for each diagnosis. Inter-rater reliability was conducted across 20% of videotaped diagnostic interviews by an independent rater, with results indicating excellent reliability (primary diagnosis = 1.0; secondary diagnosis = 0.84; tertiary diagnosis = 0.83).

Table 1
Demographic and Clinical Characteristics of the Entire Sample (N = 103)

Characteristics	*n*	%
Age		
Children (7 – 11)	38	36.9
Adolescents (12 – 17)	65	63.1
Gender		
Female	55	53.4
Male	48	46.6
Current Medication	50	48.5
SSRI	37	35.9
Other	24	23.3
ADIS-IV-P Diagnosis		
OCD	103	100
SAD	8	7.8
Social Phobia	34	33
Specific Phobia	47	45.6
Panic Disorder	2	1.9
Agoraphobia	1	1
GAD	56	54.4
PTSD	2	1.9
Dysthymic Disorder	4	3.9
MDD	6	5.8
ADHD/ADD	17	16.5
ODD	12	11.7
ASD	15	14.6
Tics	10	9.7

Note. GAD = generalised anxiety disorder, SAD = social anxiety disorder, MDD = major depressive disorder, ADHD = attention deficit / hyperactivity disorder, ODD = oppositional defiant disorder, PDD = pervasive developmental disorder, ASD = Autism Spectrum Disorder.

OCD Severity

The CYBOCS (Scahill et al., 1997) is a semistructured clinical interview that measures obsessions, compulsions, and symptom severity over the past week, with higher scores indicating greater symptom severity. The CYBOCS has excellent reliability (α = .87–.90), 6-week stability, treatment sensitivity, inter-rater agreement, and construct validity (Scahill et al., 1997; Storch et al., 2004).

Functional Impairment

The Child Obsessive-Compulsive Impact Scale Parent Versions (COIS-P; Piacentini et al., 2003) is a parent-report measure, consisting of 52 specific items assessing youth's impairment in the domains of school, social, and home/family functioning caused by OCD over the previous month, and 4 additional items assessing global ratings of domain-specific dysfunction. The COIS-P has good construct validity, convergent validity between total scores of COIS-P and CYBOCS (*r* = 0.46), and internal consistency for the subscales (range *r* = .78–.85; Piacentini et al., 2003). In the current study, Cronbach's α for the subscales ranged between .89 and .92.

Family Accommodation

The Family Accommodation Scale 13 (FAS; Calvocoressi et al., 1995) is a 13-item clinician-rated measure assessing the extent to which family members have accommodated the young person's OCD during the previous month and experienced distress in doing so. The FAS has sound psychometric properties, with good internal consistency (α = .76–.80; Calvocoressi et al., 1995), inter-rater reliability (Calvocoressi et al., 1999), and convergent and divergent validity (Flessner et al., 2011). Cronbach's α was .90 in the current study.

Parental Distress

The Depression Anxiety and Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure used to assess the severity and frequency of depression, anxiety, and stress symptoms in adults. Psychometric analyses support good reliability, construct and convergent validity (Lovibond & Lovibond, 1995; Sinclair et al., 2012). In the current study, Cronbach's α for the subscales ranged between .70 and .86.

Internalizing and Externalizing Problems

The Child Behaviour Checklist for Ages 6–18 (CBCL; Achenbach & Rescorla, 2001) is a 113-item parent report measure used to assess a vast range of internalizing and externalizing symptoms in children, with higher scores indicating greater symptom severity. The internalizing and externalizing subscales were used, and six sleep-related items (*"Has nightmares," "Is overtired without good reason," "Sleeps less than most kids," "Sleeps more than most kids during day and/or night," "Talks or walks in sleep," "Has trouble sleeping"*) were drawn from the CBCL for the sleep composite measure. Research studies have demonstrated good psychometric properties (Aschenbrand, Angelosante, & Kendall, 2005; Heubeck, 2000) and extensive normative data are available (Achenbach & Rescorla, 2001). For the current study, Cronbach's α for the internalizing and externalizing subscales were .87 and .88, respectively, in the current study.

Pediatric Anxiety

The Multidimensional Anxiety Scale for Children (MASC; March, 1997) is a 39-item, self-report measure of youth anxiety symptoms. The MASC assesses frequency of anxiety symptoms, including physical symptoms, harm avoidance, social anxiety, and separation/panic. The MASC includes one sleep-related item (*"I sleep next to someone from my family"*), which was used for the sleep composite measure. The MASC was not used for other statistical analyses in order to avoid overlap with CBCL internalizing problems. The MASC has excellent internal reliability, adequate test-retest stability, and excellent convergent and construct validity (March, 1997; March, Parker, Sullivan, Stallings, & Conners, 1997). Cronbach's α was .93 in the current study.

Pediatric Depression

The Child Depression Inventory (CDI; Kovacs, 1992) is a self-report measure assessing depression symptoms in youth. The measure consists of 27 items, with higher scores indicating greater depression symptom severity. The CDI includes one sleep-related item (*"I have trouble sleeping"*), which was used for the sleep composite measure. The CDI was not used for other statistical analyses in order to avoid overlap with CBCL internalizing problems. The CDI is widely used and demonstrates good test-retest reliability, internal consistency, and construct validity (Kovacs, 1992; Timbremont, Braet, & Dreessen, 2004). Cronbach's α was .89 in the current study.

Sleep-Related Problems

Following Storch et al.'s (2008) method, an 8-item sleep composite measure was formed based on SRPs items from the CBCL (6 items), CDI (1 item), and MASC (1 item). Positive endorsement of SRPs (i.e., ratings of 1, 2, or 3 on the MASC, and ratings of 1 or 2 on the CDI or CBCL) were recoded as "1," and ratings of "0" remained the same. A total score was created by summing the items, and a higher score indicated the presence of more SRPs (ranging from 0 to 8). Prior research has provided construct validity for this SRPs composite measure (Storch et al., 2008). Consistent with Storch and colleagues (2008), Cronbach's α was .63 in the current study. As the SRPs composite measure consists of parent- and child-report items, a separate SRPs composite measure using the 6 parent-reported CBCL items only was also formed to examine study hypotheses in relation to both measures.

PROCEDURE

Following referral into the trial, a telephone screen assessing inclusion/exclusion criteria was conducted to ascertain youth suitability for participation. If deemed suitable, a telephone diagnostic interview (ADIS-IV-P) was conducted with a parent, followed by the parent and child CYBOCS interview at the clinic. Diagnostic interviews were conducted by blind independent raters. Interviewers were trained to use the interview schedules through observation of expert clinicians, extensive skills training, and supervision by the principal investigator. To ensure reliable ratings, diagnostic outcomes and CYBOCS interview scores were presented by interviewers in weekly team consensus meetings. Parents completed an online battery of questionnaires including the DASS-21, FAS, COIS-P, and CBCL. Adolescents completed the MASC and CDI online at home, whereas children completed the questionnaires online during treatment sessions. Where required due to young age or other developmental challenges, the questionnaires were administered via a research assistant reading out or clarifying questions to the participant.

Following assessment, youth received an intensive CBT-ERP with prolonged sessions of exposure-based

CBT, as based on March and Mulle's (1998) original CBT protocol for paediatric OCD. Treatment comprised three intensive ERP sessions of 3 hours duration, which were held over consecutive weeks, with either one booster session 1 month later, or a series of weekly Skype calls (30 minutes) to provide maintenance support. Data from children, parents, and clinicians were collected at baseline, 1 week after the booster session (i.e., posttreatment), and at 3-month follow-up. All participants received this CBT treatment as part of their enrolment in one of two separate, consecutive randomized controlled trials (one pilot, the second a larger efficacy RCT: treatment outcomes from larger trials in preparation; Farrell et al., 2016).

OVERVIEW OF DATA ANALYSES

Prevalence of SRPs was analyzed using the SRPs composite measure and following Storch et al.'s (2008) method. In order to examine distinct developmental age groups, a categorical variable for age was created, resulting in a children (7–11 years) and adolescents (12–17 years) group. Given the evidence that the majority of both boys and girls in Australia show physical signs of puberty by the age of 12 years of age (Edwards, 2014), adolescents were defined as age 12 and above. These age groups are commonly used within the pediatric OCD literature (e.g., Farrell et al., 2012; Storch et al., 2008). A categorical variable for comorbidity was calculated using the median split procedure, whereby two groups were formed (low comorbidity = 0–1 comorbid disorders, and high = 2–5 comorbid diagnoses). The variables age (young = 0, and older age = 1), gender (male = 0, female = 1), and comorbid groups (low = 0, and high comorbidity = 1) were dummy coded. Further, dummy coded variables for current use of SSRI medication (no current use of SSRI = 0, current use of SSRI = 1) and current use of other medication (no current use of other medication = 0, current use of other medication = 1) were created to control for medication effects. Additionally, variables were created for youth with OCD *and* a comorbid anxiety disorder (OCD + ANX = 1) and youth with OCD *without* a comorbid anxiety disorder (OCD-ANX = 0); for youth with OCD *and* a mood disorder (OCD + MOOD = 1) and youth with OCD *without* a mood disorder (OCD-MOOD = 0); and for youth with OCD *and* an "other" comorbid disorder (i.e., AHDH, etc.; OCD + OTHER = 1) and youth with OCD *without* an "other" comorbid disorder (OCD-OTHER = 0). Independent-groups *t*-tests were conducted to examine whether there were mean differences in SRPs based on age, gender, current medication, low or high comorbidity and comorbidity groups. Additionally, χ^2-contingency table analyses were conducted using these category variables to investigate mean differences of individual SRPs.

Pearson correlation coefficients were used to examine associations between baseline SRPs, and other clinical variables. In order to control for inflated correlations, internalizing problems, anxiety and depression scores (as measured by CBCL, MASC, and CDI, respectively) were calculated without the relevant sleep-item. In order to investigate whether SRPs would make a unique independent contribution to the explanation of OCD severity, functional impairment, and treatment response, separate hierarchical regression analyses were conducted. In all models, OCD-related predictors were entered at step one, and SRPs at step two.

Analyses were conducted with both measures of SRP—that is, parent-rated items (6 items), as well as combined parent and child-rated items (8 items, consistent with Storch et al., 2008). Both measures yielded almost identical outcomes across all analyses. As a common critique of reporting outcomes in research studies is inconsistency in terms of how factors are measured, only the results of the analyses using the SRPs composite measure following Storch and colleagues (2008) method are reported.

While overall treatment efficacy was not being examined in the current study, preliminary analyses examined differences in treatment effects across the two trials that participants were drawn from (treatment trial: pilot, larger RCT) or variations of the intensive CBT within each trial (CBT condition: d-cyloserine augmentation or pill placebo). For the current sample, there were no overall Time × Trial effects on CYBOCS outcomes indicating similar treatment efficacy across trials of the intensive CBT treatment. Further, there were no Time × Condition effects for this sample; therefore, treatment trial and condition were not entered as covariates into the regression models examining predictors of CBT response.

Results

DATA SCREENING

Upon initial inspection of the data, seven participants were identified with more than 30% of missing data on individual items and were excluded for all subsequent analyses. Little's MCAR tests (Little, 1988) were calculated for individual self-report scales. Results revealed that all data were missing completely at random, as indicated by nonsignificant Little's MCAR tests (all *ps* > .10). Overall, less than 5% of COIS-P, MASC, and CBCL data were missing at the item level, thus the expectation-maximization technique was used to replace items with a mean item response based on

Table 2
Percentage of Sleep-Related Problems by Gender, Age, and Medication ($N = 96$)

SRP Item	SRPs	Gender		Age		SSRI		Other Medication	
	Total ($N = 96$) %	Male ($n = 43$) %	Female ($n = 53$) %	Children ($n = 37$) %	Adolescents ($n = 59$) %	Yes ($n = 37$) %	No ($n = 59$) %	Yes ($n = 24$) %	No ($n = 72$) %
1. Has Nightmares [w]	33	33	34	41	29	27	36	5	44
2. Is Overtired [w]	38	37	38	35	39	41	34	24	34
3. Sleeps less [w]	32	28	36	24	37	27	36	11	39
4. Sleeps more [w]	14	12	15	11	15	16	12	10	14
5. Sleep Talks or walks [w]	20	16	23	30	14	14	25	8	22
6. Has trouble sleeping [w]	40	35	43	32	44	42	41	22	49
7. I have trouble sleeping [a]	46	40	51	54	41	35	60	27	58
8. I sleep next to someone [a]	43	37	47	59	32	32	54	22	53
Mean	2.63	2.33	2.87	2.86	2.47	2.33	2.70	2.13	2.67
SD	*1.92*	*1.70*	*2.06*	*2.18*	*1.74*	*1.69*	*2.00*	*1.89*	*1.90*

Note. [w] = Parent reported; [a] = Child reported

the individuals' pattern of response (Enders, 2001).

PREVALENCE OF SRPS

Table 2 presents the frequency and means of SRP items for the sample by age, gender, and current medication status; Table 3 presents the frequency and means of SRP items by low or high comorbidity and comorbidity groups. The majority of the sample experienced SRPs, with 84.4% of participants reporting at least one SRP, 65.6% reporting two SPRs, and 50% reporting three or more SRPs. Overall, the mean number of SRPs was 2.63 (SD = 1.92, median = 2, ranging from 0 – 7 SRPs), and the most commonly reported SRPs were having trouble sleeping (46%), sleeping next to someone (43%), and being overtired (38%). Approximately one third of the sample experienced nightmares (33%) and were sleeping less than other kids (32%); whereas sleep walking/talking (20%) and sleeping more than other kids (13%) were reported less frequently.

The mean difference of SRPs between younger and older aged children was statistically significant, $t(1, 94) = 5.90$, $p = .017$, with children reporting more SRPs than adolescents. In terms of individual SRPs items, sleeping next to someone from their family was significantly more common in children than in adolescents, $\chi^2(96) = 6.90$, $p = .009$; and although marginally nonsignificant, sleep talking/walking was also more common in children $\chi^2(96) = 3.75$, $p = .053$. The mean number of SRPs, and type of SRPs, between males and females was nonsignificant ($p = .091$). No statistically significant differences were found in terms of mean number of SRPs, and type of SRPs, between youth currently using SSRI medication ($p = .217$) and youth not currently on SSRI medication; as well as between youth taking other medication ($p = .643$).

Table 3
Percentage of Sleep-Related Problems by Comorbidity Groups ($N = 96$)

SRP Item	Comorbid Disorders		Anxiety Disorders		Mood Disorders		Other Disorders	
	Low ($n = 40$) %	High ($n = 56$) %	Yes ($n = 79$) %	No ($n = 17$) %	Yes ($n = 12$) %	No ($n = 84$) %	Yes ($n = 33$) %	No ($n = 63$) %
1. Has Nightmares [w]	25	39	35	29	33	35	27	38
2. Is Overtired [w]	30	43	41	24	42	37	27	48
3. Sleeps less [w]	28	36	34	29	42	32	27	36
4. Sleeps more [w]	10	16	11	24	8	14	15	13
5. Sleep Talks or walks [w]	25	16	22	18	8	23	18	22
6. Has trouble sleeping [w]	38	41	43	41	42	43	42	43
7. I have trouble sleeping [a]	48	45	48	59	50	50	36	57
8. I sleep next to someone [a]	53	36	43	59	42	46	15	62
Mean	2.50	2.71	2.75	2.04	2.67	2.58	2.22	2.76
SD	*1.75*	*2.03*	*1.87*	*1.87*	*1.97*	*1.88*	*1.58*	*2.00*

Note. [w] = Parent reported; [a] = Child reported

The mean number of SRPs, and type of SRPs, between low and high comorbidity groups was also nonsignificant (p = .416). Likewise, no statistically significant differences in the mean number of SRPs between youth with OCD *and* a comorbid anxiety disorder and youth with OCD *without* a comorbid anxiety disorder (p = .786), between youth with OCD *and* a mood disorder and youth with OCD *without* a mood disorder (p = .803), and between youth with OCD *and* an "other" comorbid disorder and youth with OCD *without* an "other" comorbid disorder (p = .096) were found. In terms of individual sleep items, however, youth with OCD *and* a comorbid anxiety disorder reported feeling overtired more frequently than youth with OCD *without* a comorbid anxiety disorder, $\chi^2(96) = 4.60$, p = .032.

RELATIONSHIP BETWEEN SRPS AND OCD-RELATED FACTORS

Pearson's bivariate correlations were used to examine the associations between baseline SRPs with OCD-related factors. Table 4 presents descriptive statistics and correlations between SRPs and factors of interest in the current study. Consistent with hypotheses, a significant weak positive correlation was found between SRPs and functional impairment, and a significant strong positive correlation was found between SRPs and internalizing scores. Contrary with hypotheses, however, no significant relationships were found between SRPs and OCD severity, externalizing problems, FA, or parental distress (all $ps > .05$).

SRPS AS PREDICTORS OF OCD SEVERITY AND FUNCTIONING

Separate hierarchical linear regression models were used to examine SRPs as a predictor of baseline OCD severity as measured by baseline CYBOCS and OCD-related functional impairment as measured by COIS-P, as presented in Table 5. At baseline, the regression model examining OCD severity at step one accounted for 34.2% (adj. R^2 = 31.3%) of the variance in CYBOCS symptom severity, $F(4, 91) = 11.832$, $p < .001$. Baseline FA and age were significant unique correlates of baseline OCD severity, with FA independently accounting for 17.6% and age accounting for 9.6% of unique variance. At step two of the analysis, the addition of SRPs was not found to make a unique contribution to the prediction of OCD severity. FA and age remained significant unique predictors, accounting for 17.5% and 9% of unique variance, respectively. FA was found to be the strongest predictor of baseline OCD symptom severity. Contrary to expectations, SRPs were not found to predict baseline OCD severity.

As evident from Table 5, the regression model examining baseline functional impairment accounted for 39.7% (adj. R^2 = 37.1%) of the variance in COIS-P functional impairment at step one, $F(4, 91) = 15.00$, $p < .001$. In ascending order, age, internalizing problems, and FA were significant unique predictors of OCD-related functional impairment, with higher levels corresponding to increased impairment. FA independently accounted for 15% of the unique variance in functional impairment, while internalizing problems accounted for 10.6%, and age accounted for 3.7%. At step two, the addition of SRPs was not found to make a unique contribution to the variance in functional impairment. Age, internalizing problems, and FA remained significant unique correlates, accounting for 4%, 8.1%, and 15.1% of unique variance, respectively. Similar to OCD symptom severity, FA was found to be the strongest predictor of functional impairment, followed by internalizing problems. Contrary to expectations, SRPs were not found to predict baseline OCD-related functional impairment.

SRPS AS PREDICTORS OF CBT RESPONSE

Response rates are presented based on internationally recognized criteria for determining treatment response and remission. Treatment responders were defined by at least 25% reduction in CYBOCS score, and treatment remitters are defined by at least a 50% CYBOCS reduction combined with a final CYBOCS score of less than 14 (Storch et al., 2010). Based on these criteria, 74% of participants were considered responders and 32% as in remission at posttreatment. Furthermore, at 3 months follow-up, 61% were classified as treatment responders and 49% were classified as in

Table 4
Pearson Correlations and Descriptives of SRPs and OCD-Related Factors (N = 96)

	SRPs	Mean	*SD*
SRPs	-	2.63	*1.92*
Baseline OCD Severity	.05	27.05	*4.38*
Post-treatment OCD Severity	.14	14.29	*6.29*
Follow-up OCD Severity	-.03	11.95	*8.51*
Functional Impairment	.27**	42.85	*27.19*
Internalizing	.53***	15.18	*8.37*
Externalizing	.13	9.47	*7.64*
FA	.19	26.72	*16.37*
Parental Distress	.18	9.68	*7.38*

Note. SRPs = Sleep Related Problems. FA = Family Accommodation. *SD* = Standard Deviation.
** $p < .01$. *** $p < .001$.

Table 5
Hierarchical Regression Examining Predictors of OCD Severity and Predictors of Functional Impairment ($N = 96$)

Analysis	Step	Variable	B	SE(B)	β	sr
Severity	Step 1, $R^2 = .342$, $F(4, 91) = 11.832$, $p < .001$					
		Externalizing	.026	.054	.045	.041
		Internalizing	.011	.052	.021	.018
		FA	.124	.025	.464***	.419
		Age	.494	.136	.311***	.310
	Step 2, $R^2\Delta = .001$, $F_{chg}(1, 90) = .116$, $p = .734$					
		Externalizing	.024	.055	.042	.037
		Internalizing	.022	.061	.042	.031
		FA	.124	.025	.464***	.418
		Age	.486	.138	.306**	.300
		SRPs	-.080	.236	-.035	-.029
	Final $R^2 = .343$, $F(5, 90) = 9.397$, $p < .001$.					
Impairment	Step 1, $R^2 = .397$, $F(4, 91) = 15.00$, $p < .001$					
		Externalizing	-.081	.322	-.023	-.021
		Internalizing	1.061	.309	.326**	.279
		FA	.644	.150	.387***	.350
		Age	1.880	.805	.191*	.190
	Step 2, $R^2\Delta = .003$, $F_{chg}(1, 90) = .485$, $p = .488$					
		Externalizing	-.054	.326	-.015	-.014
		Internalizing	.927	.364	.285*	.208
		FA	.646	.150	.389***	.351
		Age	1.980	.821	.201*	.197
		SRPs	.974	1.398	.069	.057
	Final $R^2 = .401$, $F(5, 90) = 12.029$, $p < .001$.					

Note. FA = Family Accommodation. SRPs = Sleep Related Problems. sr = Semi-partial Correlation.
* $p < .05$, ** $p < .01$, *** $p < .001$.

remission. In order to examine whether the presence of baseline SRPs predict attenuated CBT treatment response at posttreatment, and at 3-month follow-up, two hierarchical regression analyses were conducted with posttreatment and 3-month CYBOCS scores as the DVs. In both models, step one included baseline OCD severity as a covariate and OCD-related predictors, while step two included SRPs (see Table 6).

At posttreatment, step one of the regression model accounted for 27.3% (adj. $R^2 = 22.8\%$) of the variance in treatment response, $F(5, 80) = 6.013$, $p < .001$. Only baseline symptom severity was found to independently and significantly account for 5.11% of the variance in treatment response. At step two, the addition of SRPs was not found to make a unique contribution to treatment response, and baseline OCD severity was no longer uniquely significant ($p = .051$). Nevertheless, baseline OCD severity was only marginally non-significant and remained the strongest predictor of CBT response at posttreatment.

At 3 months follow-up, the regression model accounted for a marginally non-significant 14.1% (adj. $R^2 = 8.1\%$) of the variance in treatment response, $F(5, 71) = 2.334$, $p = .051$. Similar to treatment response at posttreatment, none of the predictors were found to uniquely account for unique variance in treatment response at 3-month follow-up, with only baseline OCD severity approaching significance ($p = .055$). At step two, SRPs were not found to make a unique contribution to the explanation of variance in treatment response. Moreover, none of the predictors in the final model made significant unique contributions, and the overall regression model no longer accounted for significant variance in CBT treatment response.

Discussion

This preliminary study investigated SRPs in pediatric OCD. It was found that SRPs were highly prevalent, with 84% of youth with OCD experiencing at least one SRP, and 66% experiencing two or more SRPs. The most common SRPs reported by the current sample of young people were having trouble sleeping, sleeping next to someone, and being overtired, which is consistent with past research among OCD (Storch et al., 2008) and anxious youth (Alfano et al., 2007). Further, these results suggest that SRPs in youth may be similar to patterns of sleep disturbance found in adults with OCD (Kluge et al., 2007). Although this study found no effect of gender, medication use, rates

Table 6
Hierarchical Regression Examining Predictors of OCD Symptom Severity at Posttreatment and 3 Months Follow-up ($N = 86$)

Analysis	Step	Variable	B	SE(B)	β	sr
Post-treatment	Step 1, $R^2 = .273$, $F(5, 80) = 6.013$, $p < .001$					
		Baseline CYBOCS	.345	.173	.226*	.190
		Externalizing	.154	.094	.176	.156
		Internalizing	.105	.084	.134	.119
		FA	.076	.045	.197	.163
		Age	-.027	.231	-.012	-.011
	Step 2, $R^2\Delta < .001$, $F_{chg}(1, 79) < .001$, $p = .991$					
		Baseline CYBOCS	.345	.174	.226	.190
		Externalizing	.154	.095	.176	.155
		Internalizing	.106	.099	.135	.102
		FA	.076	.045	.198	.163
		Age	-.027	.234	-.012	-.011
		SRPs	-.004	.380	-.001	-.001
	Final $R^2 = .273$, $F(6, 79) = 4.948$, $p < .001$.					
Follow-up	Step 1, $R^2 = .141$, $F(5, 71) = 2.334$, $p = .051$					
		Baseline CYBOCS	.226	.262	.114	.095
		Externalizing	.147	.152	.120	.106
		Internalizing	-.051	.128	-.049	-.044
		FA	.128	.068	.251	.206
		Age	.217	.356	.071	.067
	Step 2, $R^2\Delta = .007$, $F_{chg}(1, 70) = .600$, $p = .441$					
		Baseline CYBOCS	.205	.264	.104	.086
		Externalizing	.129	.154	.106	.092
		Internalizing	.016	.154	.015	.011
		FA	.135	.069	.263	.215
		Age	.201	.357	.066	.062
		SRPs	-.484	.625	-.107	-.085
	Final $R^2 = .148$, $F(6, 70) = 2.034$, $p = .072$.					

Note. FA = Family Accommodation. SRPs = Sleep Related Problems. sr = Semi-partial Correlation.
* $p < .05$, ** $p < .01$, *** $p < .001$.

of comorbidity, or type of comorbid disorder on SRPs, children reported significantly more SRPs than adolescents and were more likely to report sleeping next to someone from their family. Given that younger children are more likely to seek out their parents to cope with nighttime fears compared to their adolescent counterparts (who may seek out electronic devices, as opposed to parental comfort, for example), this finding reflects normal developmental changes in sleep-related behaviors (Meltzer & Mindell, 2008). Moreover, youth with OCD *and* a comorbid anxiety disorder, compared to youth with OCD *without* a comorbid anxiety disorder, were more likely to report feeling overtired. Previous findings suggest that anxious youth experience more SRPs and increased pre-sleep arousal due to thoughts and worries (Alfano et al., 2010), which may impact sleep initiation, quality of sleep, and, thus, tiredness the following day.

As noted above, it was found that more baseline SRPs were associated with greater OCD-related functional impairment and internalizing problems. These findings are consistent with prior literature demonstrating the co-occurrence of SRPs with anxiety and mood disorders in pediatric community samples (Gregory & O'Connor, 2002), and clinical populations (Caporino et al., 2015). However, no significant associations were found between SRPs and OCD symptom severity, externalizing problems, FA or parental distress. These findings may be partially due to the low prevalence of externalizing disorders relative to internalizing disorders. Furthermore, SRPs were not found to be significant predictors of baseline OCD severity and functional impairment. Although inconsistent with existing pediatric OCD studies, it should be noted that the current study controlled for the effect of age, internalizing and externalizing problems, as well as FA, while prior studies did not. Unsurprisingly, FA was found as the strongest predictor of both OCD severity and OCD-related impairment, followed by internalizing problems. Given the strong association found between SRPs and internalizing problems in prior literature (e.g., Ivarsson & Larsson, 2009), it would seem that SRPs

may be more strongly associated with comorbid internalizing conditions rather than OCD.

Finally, baseline SRPs was not an independent predictor of treatment response at posttreatment 3-month follow-up. It was somewhat surprising that none of the other OCD-related factors emerged as significant independent predictors of poorer treatment outcomes, as numerous empirical studies describe these factors as significant predictors of treatment outcomes in youth with OCD (for a review, see Öst et al., 2016). However, the CBT-ERP treatment used in the current study was more intensive than the CBT-ERP used in previous trials. In line with prior research, the current study found a positive effect of intensive CBT-ERP on OCD and a trend towards ongoing improvement in the months following CBT; with 76% of youth classified as treatment responders and 32% remitters at posttreatment, and 49% responders and 63% remitters at 3 months follow-up. These findings suggest that intensive CBT-ERP may be more robust to baseline predictors of response relative to weekly CBT (Rudy et al., 2014); however, future randomized controlled trials are needed to examine this empirical question.

STRENGTHS

The current study examined SRPs in a relatively large, clinical sample of youth with OCD with a wide age range, which allowed for comparison of age in relation to SRPs. Stringent inclusion and exclusion criteria were used to ensure a clearly defined sample of youth, with multimethod assessments, along with independent raters to ensure reliable diagnoses. Moreover, this study examined the impact of SRPs on longer-term CBT response, which has not been previously examined. Finally, the study used a predictive model controlling for other OCD-related factors to assess the relationship between SRPs and OCD severity, functional impairment, and treatment response to provide a more precise estimation of the specificity of these associations.

LIMITATIONS AND DIRECTION FOR FUTURE RESEARCH

Thus, the true extent of SRPs in youth with OCD may be greater and more debilitating than estimated in the present study. Second, a proportion of participants were on stable doses of one or more psychotropic medications. This study examined some simple comparisons of SRPs between participants currently on SSRI medication. Although no differences were found, the impact of medication (particularly where multiple medications are used) on sleep is largely poorly understood (Reynolds et al., 2015). Hence, it cannot be ruled out that medication may have affected participants' sleep. Lastly, it should be noted that the impact of sleep disturbances on CBT may be different for weekly versus the intensive CBT-ERP treatment used in this study. Adequate sleep is not only important for participants' motivation to engage in the exposure tasks, but has also been shown to be implicated in ERP outcomes via processes of memory consolidation following ERP, which occur during sleep (Peterman et al., 2016). Thus, further larger scale research studies using longitudinal designs and multimethods are necessary in order to better understand the complex role of medications and comorbid internalizing problems in the occurrence of SRPs in youth with OCD, as well as the effect of SRPs on treatment outcomes across various modalities of exposure-based CBT.

CLINICAL IMPLICATIONS

Given the high prevalence of SRPs in both youth and adults with OCD, clinicians are advised to explore the extent of sleep disturbances in clients with OCD. Where SRPs are present, addressing these through additional psychoeducation about the effect of sleep on general functioning (Mindell et al., 2009), and monitoring of any changes throughout the course of treatment would be recommended (Peterman et al., 2016). Finally, given the likely relationship between SRPs and internalizing problems in youth with OCD, identifying youth with more severe comorbid internalizing symptoms during intake interviews is essential; and modifying CBT sessions to address internalizing problems, SRPs, and OCD concurrently may increase the likelihood of better long-term outcomes. This tailoring of current CBT treatments may be more holistic in combating pediatric OCD and may lead to better long-term outcomes for children and adolescents (Lavell, Farrell, Waters, & Cadman, 2016).

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

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