Published in final edited form as:

J Clin Child Adolesc Psychol. 2019 ; 48(3): 529–538. doi:10.1080/15374416.2018.1540009.

Symptom Dimension Response in Children and Adolescents with Obsessive-Compulsive Disorder

Joseph F. McGuire, Ph.D.^{1,2}, Patricia Z. Tan, Ph.D.², John Piacentini, Ph.D.²

¹Division of Child and Adolescent Psychiatry, Johns Hopkins University School of Medicine, Baltimore, Maryland. ²Semel Institute for Neuroscience and Human Behavior, Department of Psychiatry, University of California, Los Angeles

Abstract

Objective: Examine the nature of obsessive-compulsive disorder (OCD) symptoms nominated for treatment and investigate improvement in OCD symptom dimensions.

Method: Youth with OCD ($N = 71$) participated in a clinical trial that compared exposure-based cognitive behavior therapy (CBT) to psychoeducation plus relaxation training (PRT). Participants completed a baseline assessment to characterize OCD severity. Next, parents and youth collaboratively developed an OCD symptom treatment hierarchy. Afterward, these symptoms were independently re-assessed at each session by youth and parents. After 12 sessions, a post-treatment assessment was completed by independent evaluators.

Results: A greater incidence of baseline aggressive/checking symptoms predicted a positive CBT treatment response. For parent ratings of youth distress, CBT outperformed PRT across symptom dimensions, but hoarding symptoms exhibited a slower rate of improvement relative to other dimensions across treatments. For youth distress ratings, CBT outperformed PRT across most symptom dimensions. While symmetry/ordering symptoms exhibited a slower rate of improvement relative to other dimensions across treatments, post-hoc tests found no difference in the average distress rating for symmetry/ordering symptoms between treatment groups. Finally, across symptom dimensions, parents reported a linear reduction in youth distress whereas youth experienced a non-linear reduction in distress that diminished over treatment.

Conclusion: Exposure-based CBT is beneficial for OCD symptoms, and remains the principle treatment for pediatric OCD. However, as symmetry/ordering symptoms exhibited improvement from CBT and PRT, there is some shared treatment mechanisms that improves these symptoms. Finally, as youth perceive diminishing distress reduction over time, clinicians are encouraged to employ appropriate reinforcement strategies in treatment.

Keywords

obsessive-compulsive disorder; cognitive behavior therapy; exposure therapy

Corresponding Author: Joseph F. McGuire, Ph.D., Department of Psychiatry and Behavioral Sciences, Johns Hopkins University, Baltimore, Maryland. 1800 Orleans St, Baltimore, MD 21287. jfmcguire@jhmi.edu.

Disclosures

The authors report no conflicts of interest

Exposure-based cognitive behavior therapy (CBT) and serotonin reuptake inhibitors (SRIs) have strong empirical support for the treatment of pediatric obsessive-compulsive disorder (OCD) (McGuire et al., 2015a). Experts recommend CBT as the first-line treatment for youth with moderate OCD symptoms, and in combination with SRI medications for youth with severe OCD symptoms (Bloch & Storch, 2015). Thus, in almost every case of pediatric OCD, youth are recommended CBT. However, not all youth respond to CBT and many treatment responders remain symptomatic even after a standard course of treatment (McGuire et al., 2015a; POTS, 2004). Given the heterogeneity among OCD symptoms, a greater understanding of how OCD symptoms or symptom groups (referred to as symptom dimensions) influence patients' response to CBT is imperative. For instance, a child with primarily contamination/cleaning symptoms may exhibit a robust response to CBT and achieve diagnostic remission, whereas another child with primarily hoarding symptoms could exhibit limited benefit.

There may be several reasons why OCD symptom dimensions exhibit differential improvement to CBT. First, there may be brain-based differences associated with OCD symptom dimensions. Research suggests that youth with OCD who have symmetry/ordering symptoms or hoarding symptoms exhibit worse neurocognitive functioning (McGuire et al. 2014). Additionally, OCD symptom dimensions have been linked to differential neural correlates in youth (i.e., contamination/cleaning, symmetry/ordering; Gilbert et al. 2009). Thus, different OCD symptoms may reflect impairments in distinct neural circuits that are more (or less) susceptible to improvement via exposures. Second, CBT for pediatric OCD is based on extinction learning principles. Although extinction learning deficits have been identified in youth with OCD (Geller et al., 2017; McGuire et al., 2016) and may account for many OCD symptoms, extinction learning may not explain the etiology of all OCD symptoms (i.e., hoarding symptoms; Rozenman et al., 2017). Moreover, some OCD symptoms such as symmetry/ordering have been associated with both cognitive and somatic/autonomic fear responses (Rozenman et al., 2017). Thus, it may take a longer to adequately form inhibitory associations for symmetry/ordering and hoarding symptoms relative to other OCD symptoms, and/or CBT may have limited effects for non-fear symptoms. Finally, in vivo exposures may be more challenging to complete within a clinician's office for some OCD symptoms. For example, a youth may practice discarding small objects to address hoarding symptoms in the therapist's office, but the bulk of these exposures would require completion at home. Hoarding symptoms and/or other OCD symptoms for which in office exposures are challenging to complete, may necessitate a longer duration of treatment to effectively generalize to other settings (i.e., home or school).

Presently, only one study has examined the relationship between OCD symptom dimensions and treatment outcomes in pediatric OCD (Storch et al., 2008). Storch and colleagues (2008) investigated whether the presence of OCD symptom dimensions at baseline was associated with treatment response and/or reductions in OCD severity in 92 youth with OCD who received CBT. When applying a linear regression model consisting of five OCD symptom dimensions, these authors identified that more aggressive/checking symptoms at baseline predicted a greater pre-to-post change on the CGI-Severity scale ($p < .05$), with a trend that the presence of *any* aggressive/checking symptom at baseline was associated with a positive

treatment response on the CGI-Improvement ($p=.06$). However, there was no relationship between any symptom dimension and improvement in OCD severity on the clinician-rated Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Scahill et al., 1997). Finally, logistic regressions found no relationship between the number of symptoms within any dimension and treatment response on the CGI-Improvement.

Although important, certain methodological limitations complicate interpretation of the Storch et al. findings. First, only baseline OCD symptoms were modeled as treatment predictors, and the improvement of symptom dimensions over the course of CBT was not monitored. Second, OCD symptoms were assessed by an independent evaluator who was not involved in treatment, making it impossible to determine whether the identified symptoms were targeted in CBT. Third, the study used a model consisting of five OCD symptom dimensions, rather than a four symptom dimension model that has been shown to provide greater consistency across youth and adults (Stewart et al., 2008). Finally, prior reports excluded miscellaneous OCD symptoms, which are often targeted in CBT (e.g., need to tell, ask, or confess; seeking reassurance; "just-right" symptoms). Thus, it remains unclear whether: (1) specific OCD symptom dimensions targeted in CBT exhibit a differential response, and/or (2) miscellaneous OCD symptoms responded to CBT.

Investigating the responsiveness of OCD symptoms to CBT *across the course of treatment* is important. First, this knowledge can aid therapists in selecting specific symptoms to target first in CBT. As youth and parents see the benefits from *early* successes, therapeutic rapport can be strengthened to promote treatment engagement. Second, identifying OCD symptoms that respond better (or worse) to CBT can inform treatment planning by helping therapists and families appropriately manage treatment expectations and adapt treatment plans accordingly (e.g., longer treatment duration for less responsive OCD symptoms). Finally, identifying less responsive OCD symptoms may clarify why some youth do not adequately respond to CBT. This critical topic has received minimal attention in pediatric OCD. Thus, a better understanding of the responsiveness of specific OCD symptom dimensions over the course of CBT could refine evidence-based treatment approaches and optimize CBT outcomes for previously unresponsive and/or refractory youth.

This report therefore examined the treatment response of OCD symptom dimensions in youth with OCD who participated in a randomized controlled trial (RCT) that compared CBT to an active treatment consisting of psychoeducation plus relaxation training (PRT) (Piacentini et al., 2011). Aside from providing stronger control over multiple treatment-related confounds, this active treatment comparison is important because relaxation training is often preferred to exposure therapy for treating OCD by community clinicians (Reid et al., 2017). The primary report found that CBT produced greater improvement compared to PRT using independent evaluator ratings on the CY-BOCS (Piacentini et al. 2011). However, as OCD symptoms may be identified on the CY-BOCS symptom checklist and not targeted in CBT, participants' treatment hierarchies were used for the current examination. These symptoms were nominated for treatment due to patient distress and re-assessed at the start of each therapy session in a systematic manner.

First, we aimed to replicate and extend findings from Storch et al. (2008) using the four factor OCD symptom dimension model and an additional miscellaneous OCD symptom dimension. We examined whether these five symptom dimensions were associated with treatment response and/or reductions in OCD severity. We hypothesized that more baseline aggressive/checking symptoms would be associated with a positive treatment response. Second, to address the specificity of findings to the target treatment, we investigated the improvement of OCD symptom dimensions over the course of both CBT and PRT. We hypothesized that fear-based OCD symptom dimensions (i.e., contamination/cleaning, aggressive/checking) would respond more positively to CBT in comparison to OCD symptoms not directly related to fear (i.e., hoarding).

Methods

Participants

Seventy-one youth (45 [63%] female) participated in a RCT that compared CBT to PRT (Piacentini et al., 2011). Youth were 12 years of age on average ($M=12.20$, $SD=2.50$, range: 8–17 years) and predominantly Caucasian (77.5%). Few were taking psychotropic medications ($n=6$, 8.5%). Co-occurring psychiatric conditions included: anxiety disorders ($n=33$, 46.5%), attention deficit hyperactivity disorder ($n=9$, 13.9%), tic disorders ($n=8$, 11.3%), oppositional defiant disorder ($n=3$, 4.2%), and mood disorders ($n=3$, 4.2%). Treatment groups did not differ on demographic or clinical characteristics at baseline (see Piacentini et al. 2011 for further details).

Measures

Anxiety Disorders Interview Schedule: Child and Parent Versions (ADIS-C/P) (Silverman & Albano, 1996).—The ADIS-C/P is a semi-structured psychiatric interview administered separately to parents and youth, which determined eligibility and psychiatric diagnoses. The ADIS has good validity (Wood, Piacentini, Bergman, McCracken, & Barrios, 2002).

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS)(Scahill et al., 1997).—The CY-BOCS is a clinician-administered scale that serves as the gold-standard measure of OCD severity. It was administered to parents and youth together at the baseline assessment to determine the presence and severity of OCD symptoms. The CY-BOCS total score has good reliability, validity, and treatment sensitivity (Scahill et al., 1997; Storch, Lewin, De Nadai, & Murphy, 2010).

OCD Symptom Hierarchy.—At Session 2, youth, parents, and therapists collaboratively developed an OCD symptom hierarchy of the most bothersome OCD symptoms to target in treatment. Therapists reviewed the baseline CY-BOCS symptom checklist with youth and parents, and used these symptoms to systematically generate a list of up to 25 OCD symptoms. This allowed for treatment to focus only on bothersome OCD symptoms and not address symptoms that youth and parents did not consider distressing. Parents and youth rated the perceived distress of each nominated OCD symptom on a 10-point subjective unit of distress (SUDS) Likert-style scale. While consensus was present for initial distress ratings

at Session 2, hierarchy symptoms were re-assessed weekly at the start of each therapy session and rated independently by parents and youth (Sessions 3–12).

Clinical Global Impression of Improvement (CGI-Improvement)(Guy, 1976).—

The CGI-Improvement is a clinician rating of improvement relative to baseline on a 7-point scale that ranges from “*very much improved*” (1) to “*very much worse*” (7). Ratings of “*much improved*” and “*very much improved*” correspond with a positive treatment response. The CGI-Improvement is well-validated in treatment studies of pediatric OCD (Storch et al., 2010).

Treatment

Cognitive Behavior Therapy (CBT)(Piacentini, Langley, & Roblek, 2007).—The manualized CBT protocol consisted of 12 90-minute sessions delivered over 14 weeks. The protocol included multiple therapeutic components such as: psychoeducation about OCD; treatment rationale; OCD symptom hierarchy development; implementation of a behavioral reward system; and exposure with response prevention (ERP). While the first two sessions focused on psychoeducation and treatment rationale (Session 1), and hierarchy development (Session 2), the remaining ten sessions included at least 60 minutes of individual child ERP and 30 minutes of parent-focused intervention. All therapy sessions were videotaped, with good adherence and treatment quality found across sampled sessions (Piacentini et al., 2011).

Psychoeducation and Relaxation Training (PRT) (Cautela & Groden, 1978; Piacentini et al., 2011).—The manualized PRT protocol also consisted of 12 sessions delivered over 14 weeks that included: psychoeducation about OCD; treatment rationale; OCD symptom hierarchy development; implementation of a behavioral reward system; and relaxation exercises learned and practiced in session. While the first two sessions focused on psychoeducation, treatment rationale, and hierarchy development, similar to the CBT protocol; the remaining ten sessions emphasized both muscular and verbally-cued relaxation techniques which the child was instructed to practice twice-daily at home.

Procedures

Study procedures were approved by the local institutional review board. Consent and assent were obtained from parents and youth, respectively. Youth and parents completed a baseline assessment that included the ADIS-C/P, demographic questionnaires, and a CY-BOCS to measure OCD severity. Thereafter, youth were randomly assigned to receive CBT or PRT using an unbalanced randomization scheme (70:30). Forty-nine youth were randomly assigned to CBT and 22 to PRT. Thirteen participants withdrew prior to completing treatment (8 CBT, 5 PRT). The OCD symptoms nominated on the treatment hierarchy at Session 2 were re-evaluated by youth and parents separately at each subsequent therapy visit. After completing treatment, trained independent evaluators masked to treatment condition conducted a post-treatment assessment that included the CY-BOCS and CGI-Improvement.

Analytic Plan

Although 71 youth were randomized to treatment, one CBT participant was missing hierarchy ratings at all visits and excluded from analyses. Treatment hierarchies ($n=70$) were classified into categories by two authors using the CY-BOCS symptom checklist to guide classification. This process yielded 92% agreement between raters; disagreement was resolved through discussion and consensus. Thereafter, symptom categories were collapsed into symptom dimensions according to Stewart et al. (2008): (1) hoarding, (2) contamination/cleaning, (3) aggressive/sexual/religious/somatic/checking symptoms (referred to as aggressive/checking), and (4) symmetry/ordering/counting/repeating (referred to as symmetry/ordering). A fifth miscellaneous symptom dimension was created to include OCD symptoms nominated for treatment, but not included in the other four dimensions. Binary logistic regressions examined whether the number of endorsed OCD symptoms on a dimension was associated with treatment response on the CGI-Improvement. Linear regressions examined whether the number of endorsed OCD symptoms on a dimension was associated with OCD severity reductions on the CY-BOCS total score. Two multilevel linear mixed (MLM) models examined the change in parent-reported and youth-reported subjective distress for OCD symptom dimensions between CBT and PRT over the course of treatment. The MLM models were used to account for intra-individual dependency due to repeated measures across time. Models examined the five OCD symptom dimensions as predictors of change in subjective distress ratings. Both models included an autoregressive error structure, a random intercept allowing for individual variation in initial distress rating, as well as a random slope allowing for individual variation in distress change rates. Final models were conducted using REML estimation and included time (repeated factor), treatment condition, symptom dimension and their interactions.

Results

Baseline Symptom Dimensions and Therapeutic Improvement.

The logistic regression model examining the relationship between baseline OCD symptom dimensions and CBT treatment response was significant (see Table 1), and indicated that a greater number of baseline aggressive/checking symptoms was predictive of a positive treatment response to CBT. However, no predictive relationship was found between baseline OCD symptom dimensions and treatment response to PRT on the CGI-Improvement (Table 1). Linear regression models found no significant relationship between the number of endorsed baseline OCD symptoms on a dimension and reductions in OCD severity on the CY-BOCS total score for youth receiving either CBT or PRT (see Table 1).

Improvement in OCD Symptom Dimensions Using Parent-and Youth-Report.

We examined treatment, symptom dimension, and their interaction as predictors of level and rate of change in parents' subjective distress ratings (see Table 2 for summary of fixed effect estimates).¹ Main effects for symptom dimension, $F(4,5131.56)=13.62$, $p<.001$, and time

¹A model with three additional fixed effects, quadratic time, time $\times$ symptom dimension interaction, and time $\times$ treatment condition $\times$ symptom dimension, indicated no significant 3-way interaction effect and did not improve model fit. Thus, 3-way interactions were excluded from the final reported model.

(centered at baseline; $F(1,60.90)=39.76, p<.001$), suggest that parents' distress ratings exhibited a linear reduction across treatment and that parents' mean distress rating (averaged across weeks) differed by symptom dimension. There were also two significant 2-way interaction effects with time, a treatment condition $\times$ time effect, $F(1, 51.66)=6.66, p=.013$, suggesting that rate of decline in parents' distress ratings differed by treatment, as well as a symptom dimension $\times$ time effect, suggesting this rate of decline also differed by symptom dimension, $F(4, 6891.60)=3.38, p=.009$. Parents reported a faster linear decline in youth's distress levels when youth were assigned to the CBT condition as compared to PRT (see Figure 1). Furthermore, regardless of treatment, parents reported that hoarding symptoms showed a slower rate of distress reduction in comparison to the other symptoms.

For youth distress ratings, MLM results show significant main fixed effects of linear, $F(1, 69.73)=69.21, p<.001$, and quadratic time, $F(1, 65.10)=12.83, p=.001$ (centered at baseline), as well as symptom dimension, $F(4,5143.69)=11.69, p<.001$. These main effects were qualified by the following significant 2-way interactions: linear time $\times$ treatment condition, $F(1,55.72)=6.87, p=.011$; linear time $\times$ symptom dimension, $F(4,8158.31)=2.85, p=.022$; and treatment condition $\times$ symptom dimension $F(4,3231.32)=4.22, p=.002$ (see Table 3 for summary of fixed effect estimates).² In contrast to parents, youths' distress ratings show a *non-linear* decrease, such that the rate of change decreased over time. Additionally, the decline in youth-reported distress varied as a function of both symptom dimension and treatment. First, as seen in Figure 2, youth reported a slower rate of distress reduction for symmetry/ordering symptoms compared to other symptom dimensions. Second, youth's level of distress differed by treatment and symptom dimension (see significant Treatment Condition $\times$ Symptom Dimension fixed effect, Table 3). As shown in Figure 3, relative to youth receiving PRT, youth receiving CBT reported lower distress ratings across all symptom dimensions--with the noted exception of symmetry/ordering and miscellaneous symptom dimensions (Figure 3). Post-hoc ANOVAs indicated that at the mid-point of treatment (Session 6), youth in CBT and PRT reported similar levels of average distress for symmetry/ordering symptoms, $F(1,46)=.01, p=.95$, and miscellaneous symptoms, $F(1,46)=2.05, p=.16$. However, at the end of treatment, youth receiving CBT reported significantly lower levels of distress for miscellaneous symptoms, $F(1,46)=6.03, p<.05$, with similar levels of distress still observed between treatment groups for symmetry/ordering symptoms, $F(1,46)=1.39, p=.24$ (see Figure 3).

Discussion

This report examined the responsiveness of symptom dimensions among youth with OCD participating in a RCT examining the efficacy of CBT compared to PRT. At baseline, a greater incidence of baseline aggressive/checking symptoms was associated with a greater likelihood of a positive treatment response to CBT but not PRT. Despite measurement differences between our report and those of Storch et al. (2008), these findings are largely consistent with one another. Given that baseline aggressive/checking symptoms were associated with significant distress, the successful treatment of these symptoms with CBT

²A model including a 3-way time $\times$ treatment condition $\times$ symptom dimension interaction indicated no significant 3-way interaction effect and did not improve model fit. Thus, 3-way interactions were excluded from the final reported model.

may lead to substantially reduced distress in daily functioning. This reduction in day-to-day distress might contribute to improvements in general functioning that are not fully captured by targeted OCD severity ratings. Indeed, this may explain why this finding was only present for the global CGI-Improvement scale, but not the more targeted CY-BOCS total score.

When examining the trajectory of OCD symptom dimensions using parent-and youth-report over the course of treatment, two interesting patterns emerged. First, specific OCD symptom dimensions exhibited a differential rate of improvement based on respondent. For parent ratings of youth distress, CBT produced a faster improvement compared to PRT across symptom dimensions. However, hoarding symptoms exhibited a slower improvement relative to other OCD symptoms from parents' perspective, regardless of treatment condition. Youth presenting with hoarding symptoms may likely require a longer treatment course to achieve desired therapeutic gains. Thus, clinicians should set appropriate expectations for parents and youth at the outset of treatment when hoarding symptoms are present. Although hoarding behaviors have been associated with worse CBT outcomes in adults with OCD (Abramowitz, Franklin, Schwartz, & Furr, 2003), it is important to note that hoarding symptoms still improved and were not associated with non-responsive outcomes. Therefore, clinicians and parents should not be disheartened if youth exhibiting hoarding symptoms appear to show little improvement in the beginning stages of treatment and should target them in CBT nonetheless.

When examining youth distress ratings, CBT produced a faster improvement compared to PRT across most symptom dimensions. However, no significant difference was found between treatments for the average distress rating among symmetry/ordering symptoms at post-treatment. As these symptoms are associated with somatic/autonomic arousal (Rozenman et al., 2017), the muscular and verbally-cued relaxation techniques provided in PRT likely helped youth minimize arousal and distress associated with these symptoms. Indeed, these relaxation strategies have been incorporated into evidence-based treatments for tics that are often accompanied by similar somatic/autonomic sensations (McGuire et al., 2015b). While symmetry/ordering symptoms may serve as initial treatment targets due to lower distress, clinicians employing PRT (instead of CBT) may perceive this treatment approach as initially helping youth overcome OCD-related distress. However, when progressing to other OCD symptoms (e.g., contamination/cleaning symptoms, aggressive/checking symptoms), limited and slower improvement would be observed. As such, while PRT may be helpful for some OCD symptoms based on youth-report, findings suggest that CBT remains the principle treatment for pediatric OCD.

The second interesting finding pertains to the pattern of distress reduction between parents and youth. While parents' ratings of youth distress decreased in a linear fashion, youths' self-reported distress ratings exhibited a *non-linear* pattern of change. Specifically, youth reported that the rate of distress reduction decreased over time. As youth experience diminishing rates of distress reduction later in treatment, they may feel less intrinsic motivation to participate in therapeutic activities because of a perception that they are already "better". Alternatively, youth may experience some OCD symptoms as causing only a low level of distress and little functional impairment. While factors like insight and family

accommodation may influence youth's perception of distress and impairment, youth may perceive targeting these low distress symptoms as "more effort" than the symptoms require and ultimately continue to rely on compulsive behaviors and/or avoidance. In either case, these findings highlight the importance of incorporating behavioral reinforcement strategies (i.e., rewards) for treatment participation in a developmentally appropriate manner.

Despite the methodological rigors associated with a RCT, certain limitations exist. First, some symptoms identified on treatment hierarchies could have been placed in more than one category. However, there was good agreement of symptom categorization (92%) and disagreement was resolved through consensus. Second, this report focused on symptom level factors and did not examine participant level factors. Although participant characteristics are important, this would not substantially impact the present analyses because most participants were represented in more than one symptom categories. Indeed, only 6% of participants had OCD symptoms that all fell within a single symptom dimension. Third, the relationship between aggressive/checking symptoms and CBT response may also suggest that those youth with greater OCD symptoms in general have more opportunity for potential improvement. Finally, while participants' symptom hierarchies consisted of the most bothersome OCD symptoms to target in treatment, it is unknown which specific symptoms were targeted in treatment at each session.

Conclusion

While CBT is efficacious for pediatric OCD, the presence of aggressive/checking symptoms at baseline was associated with a greater chance of CBT treatment response. Additionally, specific symptoms exhibited differing rates of improvement based on informant perspective. From parents' perspective, hoarding symptoms take longer to improve regardless of treatment condition. Meanwhile, based on youth-report, PRT offers some benefit for reducing distress associated with symmetry/ordering symptoms. Finally, parents perceive a linear reduction in distress during treatment, whereas youth experience diminishing distress reduction over time. Clinicians should take this information into consideration when developing treatment plans, selecting treatment targets for the patient, and planning for therapeutic care.

Although clinicians' concerns regarding exposures in pediatric OCD have been disproven (McGuire, Wu, Choy, & Piacentini, 2018), some clinicians continue to prefer PRT to CBT. Despite the limited empirical support for PRT, clinicians employing this therapeutic technique may indeed observe some benefit for symmetry/ordering—when relying on youth report. However, while PRT strategies reduce child-reported distress for some OCD symptoms, they do not yield comparable benefits relative to CBT. Thus, CBT remains the principle psychosocial treatment for pediatric OCD.

Acknowledgements:

acknowledge that support for this article comes in part from the National Institute of Mental Health (NIMH) under award T32MH073517 and R01MH58549 to Dr. Piacentini, and K01MH100261 to Dr. Tan. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIMH or NIH.

References

- Abramowitz JS, Franklin ME, Schwartz SA, & Furr JM (2003). Symptom presentation and outcome of cognitive-behavioral therapy for obsessive-compulsive disorder. *Journal of Consulting and Clinical Psychology*, 71, 1049–1057. [PubMed: 14622080]
- Bloch MH, & Storch EA (2015). Assessment and management of treatment-refractory obsessive-compulsive disorder in children. *Journal of the American Academy of Child & Adolescent Psychiatry*, 54, 251–262. [PubMed: 25791142]
- Cautela JR, & Groden J (1978). *Relaxation: A comprehensive manual for adults, children, and children with special needs*. Champaign, IL: Research Press.
- Geller DA, McGuire JF, Orr SP, Pine DS, Britton JC, Small BJ, ... Storch, E. A. (2017). Fear conditioning and extinction in pediatric obsessive-compulsive disorder. *Annals of Clinical Psychiatry*, 29, 17–26. [PubMed: 28207912]
- Gilbert AR, Akkal D, Almeida JR, Mataix-Cols D, Kalas C, Devlin B, ... & Phillips, M. L. (2009). Neural correlates of symptom dimensions in pediatric obsessive-compulsive disorder: a functional magnetic resonance imaging study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48(9), 936–944 [PubMed: 19625980]
- Guy W (1976). *Clinical global impression scale*. Rockville, MD: National Institute of Mental Health.
- McGuire JF, Crawford EA, Park JM, Storch EA, Murphy TK, Larson MJ, & Lewin AB (2014). Neuropsychological performance across symptom dimensions in pediatric obsessive compulsive disorder. *Depression and Anxiety*, 31, 988–996. [PubMed: 24523044]
- McGuire JF, Orr SP, Wu MS, Lewin AB, Small BJ, Phares V, ... Storch, E. A. (2016). Fear Conditioning and Extinction in Youth with Obsessive-Compulsive Disorder. *Depression and Anxiety*, 33, 229–237.
- McGuire JF, Piacentini J, Lewin AB, Brennan EA, Murphy TK, & Storch EA (2015a). A Meta-Analysis of Cognitive Behavior Therapy and Medication for Child Obsessive Compulsive Disorder: Moderators of Treatment Efficacy, Response, and Remission. *Depression and Anxiety*, 32, 580–593. [PubMed: 26130211]
- McGuire JF, Ricketts EJ, Piacentini J, Murphy TK, Storch EA, & Lewin AB (2015b). Behavior therapy for tic disorders: an evidenced-based review and new directions for treatment research. *Current developmental disorders reports*, 2, 309–317. [PubMed: 26543797]
- McGuire JF, Wu MS, Choy C, & Piacentini J (2018). Editorial Perspective: Exposures in cognitive behavior therapy for pediatric obsessive-compulsive disorder: addressing common clinician concerns. *Journal of Child Psychology and Psychiatry*, 59, 714–716. [PubMed: 29808492]
- Piacentini J, Bergman RL, Chang S, Langley A, Peris T, Wood JJ, & McCracken J (2011). Controlled comparison of family cognitive behavioral therapy and psychoeducation/relaxation training for child obsessive-compulsive disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 50, 1149–1161. [PubMed: 22024003]
- Piacentini J, Langley A, & Roblek T (2007). *Cognitive behavioral treatment of childhood OCD: It's only a false alarm therapist guide*: Oxford University Press.
- POTS. (2004). Cognitive-behavior therapy, sertraline, and their combination for children and adolescents with obsessive-compulsive disorder: the Pediatric OCD Treatment Study (POTS) randomized controlled trial. *Jama*, 292, 1969–1976. [PubMed: 15507582]
- Reid AM, Bolshakova MI, Guzik AG, Fernandez AG, Striley CW, Geffken GR, & McNamara JP (2017). Common Barriers to the Dissemination of Exposure Therapy for Youth with Anxiety Disorders. *Community Mental Health Journal*, 1–6.
- Rozenman M, Peris T, Bergman RL, Chang S, O'Neill J, McCracken JT, & Piacentini J (2017). Distinguishing fear versus distress symptomatology in pediatric OCD. *Child Psychiatry & Human Development*, 48, 63–72. [PubMed: 27225633]
- Scahill L, Riddle MA, McSwiggin-Hardin M, Ort SI, King RA, Goodman WK, ... Leckman JF (1997). Children's Yale-Brown obsessive compulsive scale: reliability and validity. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 844–852. [PubMed: 9183141]
- Silverman WK, & Albano AM (1996). *The Anxiety Disorders Interview Schedule for DSM-IV -child and parent versions*. San Antonio, TX: Graywind Publications.

- Stewart SE, Rosario MC, Baer L, Carter AS, Brown TA, Scharf JM, ... Katsoyich L (2008). Four-factor structure of obsessive-compulsive disorder symptoms in children, adolescents, and adults. *Journal of the American Academy of Child & Adolescent Psychiatry*, 47, 763–772. [PubMed: 18520961]
- Storch E, Merlo L, Larson M, Bloss C, Geffken G, Jacob M, ... Goodman W (2008). Symptom dimensions and cognitive-behavioural therapy outcome for pediatric obsessive-compulsive disorder. *Acta Psychiatrica Scandinavica*, 117, 67–75. [PubMed: 17986317]
- Storch EA, Lewin AB, De Nadai AS, & Murphy TK (2010). Defining treatment response and remission in obsessive-compulsive disorder: a signal detection analysis of the Children's Yale-Brown Obsessive Compulsive Scale. *Journal of the American Academy of Child & Adolescent Psychiatry*, 49, 708–717. [PubMed: 20610140]
- Wood JJ, Piacentini JC, Bergman RL, McCracken J, & Barrios V (2002). 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*, 31, 335–342. [PubMed: 12149971]

Figure 1.

Predicted parental distress ratings, as a function of time, treatment condition, symptom dimension, time*treatment condition, time*symptom dimension, and treatment condition*symptom condition fixed effects.

Figure 2.

Predicted youth distress ratings, as a function of time, treatment condition, symptom dimension, time*treatment condition, time*symptom dimension, and treatment condition*symptom condition fixed effects.

Figure 3. Comparisons of youth-reported average subjective units of distress (SUDS) at week 6 (mid-treatment) and week 12 (post-treatment) by symptom dimension

Table 1.

Baseline OCD Symptom Dimensions Predicting Treatment Response and Symptom Reduction In Participants Receiving CBT (N = 48) and PRT (N = 22)

	CBT					PRT				
OCD Symptom Dimensions Predicting Treatment Response on the CGI-Improvement ^{a,b}	B (SE)	OR	95% CI	P	B (SE)	OR	95% CI	P		
Number of Hoarding Symptoms	.01 (.050)	1.01	.38 – 2.69	.98	2.64 (1.67)	13.98	.53 – 368.85	.11		
Number of Contamination/Cleaning Symptoms	-.03 (1.00)	.97	.78 – 1.19	.76	.47 (.29)	1.61	.91 – 2.84	.10		
Number of Aggressive/Sexual/Religious/Somatic/Checking Symptoms	-.39 (0.14)	.68	.51 – .89	.006	-.36 (.26)	.70	.42 – 1.17	.17		
Number of Symmetry/Counting/Repeating/Ordering Symptoms	-.21 (0.19)	.81	.55 – 1.18	.27	-.47 (.39)	.63	.30 – 1.34	.23		
Number of Miscellaneous Symptoms	.10 (0.14)	1.11	.84 – 1.47	.47	.89 (.65)	2.42	.67 – 8.73	.18		
OCD Symptom Dimensions Predicting Reduction in Symptom Severity on the CY-BOCS ^{c,d}	B (SE)	β	t	P	B (SE)	β	t	P		
Number of Hoarding Symptoms	1.33 (1.91)	.11	.70	.49	-.81 (3.15)	-.07	-.26	.80		
Number of Contamination/Cleaning Symptoms	-.02 (.39)	-.01	-.05	.96	-.03 (.51)	-.01	-.05	.96		
Number of Aggressive/Sexual/Religious/Somatic/Checking Symptoms	.35 (.40)	.14	.86	.40	.87 (.60)	.35	1.45	.17		
Number of Symmetry/Counting/Repeating/Ordering Symptoms	.51 (.73)	.11	.70	.49	1.55 (.94)	.43	1.64	.12		
Number of Miscellaneous Symptoms	-.27 (.53)	-.10	-.52	.61	-.41 (.84)	-.13	-.49	.63		

Note: CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale, OR = Odds ratio

^aSummary of logistic regression model for CBT, $\chi^2(5)=13.81$, $p<.02$, Nagelkerke $R^2=.34$ ^bSummary of logistic regression model for PRT, $\chi^2(5)=7.07$, $p=.22$, Nagelkerke $R^2=.40$ ^cSummary of linear regression model for CBT, $F(5,42)=.53$, $p=.75$, $R^2=.06$ ^dSummary of linear regression model for PRT, $F(5,15)=.85$, $p=.54$, $R^2=.22$

Table 2.

Fixed effect estimates from multilevel models predicting change in parent-reported subjective units of distress (SUDS) ratings

Parent Distress Ratings	β	SE	<i>t</i>	<i>p</i>
Intercept	5.50	0.52	11.69	0.00
Time (linear)	-0.22	0.07	-3.64	0.00
Treatment Condition ^a				
Treatment = CBT	0.82	0.59	1.48	0.14
Treatment = PRT	0.00	--	--	--
Symptom Dimension ^b				
Hoarding	-1.62	0.41	-3.94	0.00
Contamination/Cleaning	-0.66	0.23	-2.92	0.00
Aggressive/Sexual/Religious/Somatic/Checking	-1.21	0.20	-5.98	0.00
Symmetry/Counting/Repeating/Ordering	-1.42	0.25	-5.76	0.00
Miscellaneous	0.00	0.00	--	--
Time*Treatment Condition				
Time*CBT	-0.18	0.08	-2.58	0.01
Time*PRT	0.00	--	--	--
Time*Symptom Dimension				
Time*Hoarding	0.18	0.06	2.80	0.01
Time*Contamination/Cleaning	0.10	0.03	2.86	0.00
Time*Aggressive/Sexual/Religious/Somatic/Checking	0.06	0.03	1.91	0.06
Time*Symmetry/Counting/Repeating/Ordering	0.09	0.04	2.28	0.02
Time*Miscellaneous	0.00	--	--	--

^aThe PRT (psychoeducation + relaxation therapy) treatment condition serves as the reference group; parameter is therefore set to 0

^bMiscellaneous symptom dimension serves as the reference group

^cThe PRT*Symptom Dimension interaction terms serves as the reference group

Table 3.

Fixed effect estimates from multilevel models predicting change in child-reported subjective units of distress (SUDS) ratings

Youth Distress Ratings	β	SE	<i>t</i>	<i>p</i>
Intercept	6.41	0.33	19.47	0.00
Time (linear)	-0.53	0.08	-6.67	0.00
QuadTime (quadratic)	0.02	0.01	3.58	0.00
Treatment Condition ^a				
Treatment = CBT	-0.42	0.38	-1.91	0.28
Treatment = PRT	0.00	--	--	--
Symptom Dimension ^b				
Hoarding	-0.36	0.45	-0.79	0.43
Contamination/Cleaning	0.19	0.26	0.73	0.47
Aggressive/Sexual/Religious/Somatic/Checking	0.00	0.23	-0.01	0.99
Symmetry/Counting/Repeating/Ordering	-1.66	0.30	-5.67	0.00
Miscellaneous	0.00	0.00	--	--
Time*Treatment Condition				
Time*CBT	-0.15	0.06	-2.63	0.01
Time*PRT	0.00	--	--	--
Time*Symptom Dimension				
Time*Hoarding	0.01	0.05	0.15	0.88
Time*Contamination/Cleaning	0.05	0.03	1.90	0.06
Time*Aggressive/Sexual/Religious/Somatic/Checking	0.01	0.02	0.44	0.66
Time*Symmetry/Counting/Repeating/Ordering	0.09	0.03	2.95	0.00
Time*Miscellaneous	0.00	--	--	--
Treatment Condition ^c *Symptom Dimension				
CBT*Hoarding	-0.30	0.48	-0.62	0.54
CBT*Contamination/Cleaning	-0.52	0.28	-1.89	0.06
CBT*Aggressive/Sexual/Religious/Somatic/Checking	-0.51	0.24	-2.11	0.04
CBT*Symmetry/Counting/Repeating/Ordering	0.67	0.31	2.19	0.03
CBT*Miscellaneous	0.00	--	--	--
PRT*Hoarding	0.00	--	--	--
PRT*Contamination/Cleaning	0.00	--	--	--
PRT*Aggressive/Sexual/Religious/Somatic/Checking	0.00	--	--	--
PRT*Symmetry/Counting/Repeating/Ordering	0.00	--	--	--
PRT*Miscellaneous	0.00	--	--	--

^aThe PRT (psychoeducation + relaxation therapy) treatment condition serves as the reference group; parameter is therefore set to 0

^bMiscellaneous symptom dimension serves as the reference group

^cThe PRT*Symptom Dimension interaction terms serves as the reference group