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Review article

Cognitive-behavioral therapy for pediatric obsessive-compulsive disorder: Empirical review and clinical recommendations

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ABSTRACT

The efficacy of cognitive-behavioral therapy (CBT) for pediatric obsessive-compulsive disorder (OCD) has been the subject of much study over the past fifteen years. Building on a foundation of case studies and open clinical trials, the literature now contains many methodologically sound studies that have compared full CBT protocols to waitlist controls, pill placebo, psychosocial comparison conditions, active medication, combined treatments, and brief CBT. This review is part of a series commissioned by The Canadian Institute for Obsessive Compulsive Disorders (CIOCD) in an effort to publish in one place what is known about the efficacy of treatments for OCD. A total of fourteen studies were identified; collectively their findings support the efficacy of CBT for youth with OCD. CBT protocols that emphasized either strictly behavioral or cognitive conceptualizations have each been found efficacious relative to waitlist controls. Efforts to enhance CBT's efficacy and reach have been undertaken. These trials provide guidance regarding next steps to be taken to maximize efficacy and treatment availability. Findings from studies in community clinics suggest that significant treatment benefits can be realized and are not reported only from within academic contexts. These findings bode well for broader dissemination efforts. Recommendations for future research directions are provided.

Contents

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1. Introduction

Epidemiological studies estimate that up to one in 100 children and adolescents suffers from clinically relevant obsessive-compulsive disorder (OCD; Flament et al., 1988). Left untreated, OCD often continues until adulthood and leads to many negative consequences (Rasmussen and Eisen, 1990; Piacentini et al., 2003; Micali et al., 2010). Therefore, effective treatment of pediatric OCD is crucial. Fortunately, significant advances have been made over the past two decades in developing and empirically evaluating treatments for OCD in children and adolescents. As with adult OCD and as has been chronicled in several comprehensive and recent pediatric OCD review papers and meta-analyses, cognitive-behavioral therapy (CBT), either alone or in combination with pharmacotherapy, has emerged as the initial treatment of choice for pediatric OCD (March et al., 1997; Abramowitz et al., 2006; O'Kearney et al., 2007; Rosa-Alcazar et al., 2008; Watson and Rees, 2008; Freeman et al., 2014; Sanchez-Meca et al., 2014).

As has been the case with other pediatric internalizing disorders, the building of the CBT outcome literature in pediatric OCD began with age-downward extension of protocols found efficacious with adults, then publication of single case studies, case series, and open clinical trials involving these protocols. Collectively the published uncontrolled evaluations (Franklin et al., 1998, 2001; March, 1998) yielded remarkably similar and encouraging findings across settings and cultures: at post-treatment, the majority to the vast majority of patients were responders, with clinically meaningful and statistically significant symptom reductions reported. This pilot work set the stage for randomized studies evaluating the efficacy of CBT.

The empirical evidence upon which these expert opinions are based has strengthened considerably in the last decade and has provided further support for experts' recommendation that families seek CBT for children and adolescents suffering from this often disabling condition. The current review is part of a series of papers commissioned by The Canadian Institute for Obsessive Compulsive Disorders (CIOCD), in an effort to publish in one place what is known about the efficacy of treatments for OCD across the developmental spectrum. Ready access in one centralized location, in our view, would promote use of this information by the scientific and clinical communities interested in the topic. By doing so, it is our expectation that consolidation of scientific review papers of a refined topic such as OCD treatment would help support efforts to make these treatments more available in Canada and beyond by making clearer the case that the field now has developed viable pharmacotherapy and psychotherapy options to address this condition in sufferers, and that the next critical step is to disseminate these empirically supported interventions so that more may avail themselves of them.

The challenge, of course, is that there remains a paucity of mental health treatment providers properly trained in the provision of CBT for pediatric OCD (Valderhaug et al., 2004; Lewin et al., 2005b; Goldfried et al., 2014). Thus, despite the collective urging of highly knowledgeable professionals and the availability of several empirically supported treatments, many families still cannot access the treatment modality that provides affected youth with the best chance of avoiding the deleterious effects of OCD. Addressing this gap in treatment availability is an overarching goal of the CIOCD. In this review paper, we aim to make the empirical case that, given the preponderance of the evidence supporting the efficacy of CBT for pediatric OCD, closing this chasm in pediatric OCD in particular is a matter of significant public health importance. To do this, we will review the evidence base for CBT for pediatric OCD specifically, and use that information to draw conclusions regarding what we already know and what we still need to know with respect to the efficacy of this form of treatment.

2. Method

We chose to concentrate our review efforts on the most methodologically rigorous studies conducted in the last fifteen years, which is when the first randomized trial examining CBT for pediatric OCD appeared in the literature (de Haan et al., 1998). In selecting clinical trials for consideration, we employed a system first presented in a review evaluating studies of CBT for OCD across the developmental spectrum that was published most recently in the third edition of Nathan and Gorman's seminal book "Treatments that Work" (Franklin and Foa, 2007). We have expanded upon that contribution here by including more recent papers; we also have focused our review here exclusively on studies that have employed pediatric samples.

In accordance with our approach in the Nathan and Gorman OCD review chapter, the following initial criteria were used to screen studies for inclusion in this review: (1) the sample comprised pediatric OCD patients (age < 18); (2) at least one comparison group; (3) at least 10 patients per experimental cell; (4) clearly defined inclusion/exclusion criteria; (5) reliable and valid diagnostic methods; (6) random assignment to treatment condition; (7) appropriate statistical analyses; and (8) inclusion of exposure plus response prevention that meets acceptable clinical practice standards as suggested by expert consensus (March et al., 1997). Numerous open trials of CBT for pediatric OCD have been conducted around the world over the past two decades (e.g., March et al., 1994), and they set the stage for the more methodologically rigorous studies that we discuss below. For the purpose of the current review, initial literature searches were conducted for individual clinical trials through PsychINFO and PubMed (keywords: obsessive, compulsive, obsessive-compulsive, OCD, cognitive behavior therapy, cognitive-behavioral therapy, cognitive behavioural therapy, youth, child, adolescent, or pediatric); the dates for the search were January 1, 1998 through December 31, 2013. Relevant publications were then vetted by the first and second authors. Upon completion of this process, fourteen studies were identified that met all inclusion criteria described above. Only English language publications were considered.

We included studies with and without no-treatment control conditions. For those without no-treatment conditions, this methodological omission leaves it impossible to disentangle non-specific effects (e.g., passage of time, repeated assessment, treatment expectancy) from the treatment signal. Accordingly, findings from studies comparing one psychotherapy to another without an adequate control group that can account for effects that could be attributed to the factors highlighted above should be interpreted with greater caution (for discussion see Klein, 1996). Nevertheless, their inclusion is warranted because such studies can be used to ask, and answer, questions about treatments other than efficacy. We did not include reviews of review papers, as this process would appear to be redundant.

3. Results

A total of 14 studies met all of the criteria for above and are discussed in detail below; their methodological and procedural details are also summarized in Table 1. All effect sizes are presented as Cohen's d (Cohen, 1988). Specifically, within-group effect sizes were calculated with the formula $d=(X_{post}-X_{pre})/s_{pooled}$ and between-group effect sizes with $d=(\bar{x}_t-\bar{x}_c)/\sqrt{(n_t-1)s_t^2+(n_c-1)s_c^2/n_t+n_c}$.

We review these studies by topic in order to provide the reader with a prevailing sense of which issues in pediatric OCD treatment outcome already have been examined; this also will allow for a more transparent consideration in the concluding sections of which areas are still in dire need of research.

3.1. CBT's comparative efficacy with active medication and psychotherapy

In the first of the randomized studies evaluating the efficacy of CBT in children, de Haan et al. (1998) randomly assigned 22 children ages 8–17 to 12 weeks of clomipramine (mean dose=2.5 mg/kg) or twice-weekly CBT involving exposure plus response prevention (ERP). Both treatments led to significant improvement; however, the mean level of symptom reduction as measured by the Children's Yale Brown Obsessive Compulsive Scale total score (Scahill et al., 1997) following CBT was significantly greater than what was found in the clomipramine group (60% versus 33% decrease). Response rates (defined as an improvement of more than 30% on the CY-BOCS) also were greater for the CBT group than the clomipramine group (73% for CBT versus 45% for clomipramine). Although encouraging and convergent with the CBT open trials in terms of percent reductions and response rates, no control condition was employed in this study, and thus the effects of passage of time, therapist contact, and repeated assessment on symptom reduction cannot be parsed out. Further, in the absence of a pill placebo control condition specifically, the effects of medication also cannot be isolated.

Psychotherapy studies also require adequate control groups, especially since the typically employed waitlist control conditions do not equate the groups on important confounding variables such as therapist contact time and treatment expectancy. In order to determine whether the specific techniques of CBT are responsible for the observed symptom reductions, it is preferable to use some sort of a psychosocial control condition that either equates or approximates contact time. Toward that end, Piacentini et al. (2011) directly compared individual CBT (ERP plus cognitive therapy) supplemented with a weekly manualized family intervention (family-focused-CBT) to a psychosocial comparison condition (relaxation training/psychoeducation) in 71 participants who ranged in age from 8–17 years. The family component of the intervention was designed to: (1) reduce level of conflict and feelings of anger, blame, and guilt; (2) facilitate disengagement from the child's OCD symptoms; (3) rebuild normal (OCD-free) family interaction patterns; and (4) foster an environment conducive to maintaining treatment gains. Importantly, both treatment conditions consisted of twelve manualized sessions delivered over 14 weeks. Findings in both ITT and completer analyses indicated that family-focused CBT was superior to the comparison condition in terms of clinician-rated response rate (clinical global improvement score of much or very much improved; 57% versus 27% in ITT analysis; 68% versus 35% in completer analysis) and remission rates (CY-BOCS score less than 11; 43% for family-focused CBT versus 18% for the comparison condition). Hierarchical linear modeling also indicated that family-focused CBT was associated with significantly greater change in OCD symptom severity and child-reported functional impairment. In addition, parents reported significantly less involvement in OCD symptoms at post-treatment, and changes in accommodation preceded child improvements, which shed light on a potential mechanism by which the treatment effects were realized. The trial's greatest contribution to the literature arises from its design: the use of an active comparison condition extended prior findings and increases confidence that the effects of CBT are above and beyond what could be expected from receiving face-valid advice, general encouragement, and anxiety management strategies from a supportive and knowledgeable mental health professional. Further, it is likely that the comparison condition in Piacentini et al. (2011) reflects what many families actually receive from community clinicians not trained in ERP or comfortable using it, and thus the superiority of ERP over this treatment highlights the importance of CBT dissemination efforts.

Building upon these initial findings from de Haan et al. (1998) and on a multi-site, randomized, placebo controlled trial establishing the efficacy of sertraline for pediatric OCD (March et al., 1998), the Pediatric OCD Treatment Study I (POTS I; Pediatric OCD Treatment Study Team, 2004) was the first multi-site, randomized, controlled trial to directly compare the efficacy of an established medication (sertraline), CBT, and their combination to a control condition, pill placebo (Franklin et al., 2003). A volunteer sample of 112 subjects between the ages of 7–17 inclusive with a primary DSM-IV diagnosis of OCD entered the study; the sample was evenly split between males and females, and approximately equal with respect to adolescents (ages 12–17) and younger children (ages 7–11). Consistent with an intention-to-treat (ITT) data analytic model, all patients, regardless of responder status, returned for all scheduled assessments, with the main dependent variables including the CY-BOCS assessed by an independent evaluator. Findings from the ITT analyses indicated a significant advantage for all three active treatments – combination, CBT, and sertraline – over pill placebo. With respect to comparisons of active treatments on CY-BOCS continuous outcomes, overall combined treatment was found superior to CBT and to sertraline, which did not differ from one another. When examining the data another way, however, a somewhat different picture emerged: approximately 54% of the patients who received combined treatment and 39% of those who received CBT alone met criteria for excellent clinical response (defined as a post-treatment CY-BOCS total score ≤ 10), in comparison to approximately 21% of those who received sertraline and 3% who received placebo. A significant site effect was also detected in POTS I, which indicated that CBT alone at Penn was clearly superior to CBT at Duke (the Brown site did not contribute enough subjects to the trial for its potential site effects to be examined), whereas the reverse was true for sertraline alone, although not as robustly so. Notably, no site by treatment effects were found for combined treatment or for placebo, suggesting that the effects of combined treatment are less vulnerable to site-specific influences.

One of the observations made by the POTS investigative team was that it was becoming more and more challenging by the late 1990s and early 2000s to find children and adolescents with OCD who had not been previously exposed to pharmacotherapy. Indeed, despite the growing evidence base for the efficacy of CBT both then and since, most pediatric OCD patients treated in the community receive monotherapy with an SRI as their first-line treatment. Unfortunately, even adequate trials of these medications leave the great majority of patients with clinically significant residual symptoms (March, 1999) and thus the chances for remission or excellent response are lower with medication alone – for example, POTS I indicated that the rate of excellent response (post-treatment CY-BOCS total ≤ 10) in children treated with sertraline only was just 21%. These observations led the POTS team to design a next phase research trial to address the issue of treatment augmentation (adding an additional treatment to a current treatment) as well as treatment transportability (developing a treatment in a research setting specifically for use in community clinical settings). In the POTS II study (Franklin et al., 2011), the relative efficacy of three conditions was examined: (1) medication management provided by a study psychiatrist (medication management only); (2) medication management plus OCD-specific CBT as delivered by a study psychologist (medication management plus CBT); and (3) medication management plus instructions in CBT delivered by the study psychiatrist assigned to provide medication management. The acute treatment phase

lasted for 12 weeks; notably, CBT in the medication management plus CBT condition followed the 14-session, hour-long session protocol used in POTS I, whereas instructions in CBT in the medication management plus instructions in CBT condition involved seven brief sessions and did not include in-session exposure. A total of 124 children and adolescents ages 7–17 were recruited at three sites (Penn, Duke, and Brown); inclusion criteria required that patients already were taking an adequate dose of a serotonergic medication (either an SSRI or clomipramine) for OCD and yet still were experiencing clinically significant OCD symptoms. Results indicated that medication management plus CBT was superior to medication management alone and to medication management plus instructions in CBT, which, contrary to study hypotheses, failed to separate statistically from one another (69% response for medication management plus CBT versus 34% for medication management plus instructions in CBT and 30% for medication management alone, where response was defined as a 30% reduction in baseline CY-BOCS score). POTS II thus provided further evidence for the efficacy of combined treatment, in this case administered sequentially rather than simultaneously, and also highlighted the potential need for using the "full dose" of CBT in order to achieve optimal outcomes. It also is notable that results on the continuous CY-BOCS outcomes for medication management plus CBT were somewhat attenuated relative to what was achieved with combined treatment in POTS I, which could reflect sampling difference, sequencing effects, or the possible influence of partial response to an initial treatment on subsequent outcomes. This observation is highly convergent with findings from an adult augmentation trial (Simpson et al., 2008) in which medication management plus CBT augmentation outcomes were less robust than what had been reported in the literature for CBT or combined treatment administered simultaneously.

3.2. Group CBT formats

In one of the key studies conducted in pediatric OCD, Barrett et al. (2004) compared individual cognitive-behavioral family-based therapy, group cognitive-behavioral family-based therapy, and a truncated waitlist control in 77 OCD youngsters aged 7–17 years. Both active treatments consisted of a 14-week manualized protocol that included both parent and sibling components; what differentiated the two active conditions was the use of an individual versus group format. Participants in the waitlist condition were assessed at baseline and 4–6 weeks later, which provides an estimate of what might be expected in terms of symptom reduction from the passage of a brief period of time as well as from repeated assessments. Both active treatments were associated with significant improvement as compared to the truncated waitlist group: at post-treatment, 88% of CBFT, 76% of GCBFT, and 0% of waitlist youngsters no longer met criteria for OCD according to parental report on structured interviews. Individual cognitive-behavioral family-based therapy was associated with a 65% reduction in OCD symptoms according to child-only reports as compared to 61% for group cognitive-behavioral family-based therapy and no change for wait-list. The two active treatments did not differ significantly from each other statistically, and examination of the percent symptom reduction and response rates for each would suggest that the observed differences were clinically negligible. Of particular interest, there were no treatment-related gains on any of the family measures despite the inclusion of family-specific elements to the protocol. The group findings from this trial were especially notable in that the effects were considerably larger than what had been observed previously in open trials of group-based interventions (e.g., Himle et al., 2003), and suggest more promise for this approach than might have been estimated from other efforts to measure its potential benefits. Barrett et al. (2005) reported follow-up data in a separate paper, which will be discussed below in the section on durability of CBT gains.

Asbahr et al. (2005) randomized 40 patients ages 9–17 inclusive to one of two active conditions: pharmacotherapy with sertraline or group-based CBT. Similar to de Haan et al. (1998), the study design could not support confident conclusions regarding medication effects per se because of the absence of a placebo control group. However, it did afford another opportunity to compare medication alone to a group format for CBT, a version of which had already been found efficacious for children and adolescents with OCD in Barrett et al.'s (2004) study. Moreover, because the study was conducted in Brazil, it also provided an opportunity to translate and back-translate manuals and measures that could prove helpful in dissemination efforts thereafter: Asbahr and colleagues based their group intervention on the CBT manual of March and Mulle (1998), which is the same protocol evaluated and ultimately validated in POTS I and POTS II. Findings indicated that both forms of treatments were associated with significant symptom reductions on OCD measures (including the CY-BOCS), but only SER was associated with a reduction in depressive symptoms as well. The investigators did not, however, identify a group by time interaction at post-treatment on OCD measures, and thus concluded that group CBT and SER were comparable in terms of their acute efficacy. The percent reductions reported on the CY-BOCS for the group protocol used in Asbahr et al. were less robust than reported by Barrett et al., indicating some variability in response that cannot be isolated easily because of differences in sampling procedures, manuals used, therapist background, training and supervision, and clinical setting. Findings from Asbahr et al.' study at follow-up will be discussed in the section below on durability of treatment gains.

3.3. CBT visit schedule

Most of the studies of CBT outcome in pediatric OCD have employed a weekly therapy regimen, which is a treatment visit schedule that is more readily implemented in clinical practice settings than would be the intensive forms of treatment commonly employed in many adult OCD RCTs. In an open, non-randomized pilot study, Franklin et al. (1998) found no differences between 14 weekly sessions of CBT over 12 weeks versus 18 sessions over four weeks. However, interpretation of this finding is hampered by the very small sample size ($N=14$) and, more importantly, the lack of random assignment. In order to examine the potential advantage of intensive versus less intensive CBT, Storch et al., 2007 compared 14 sessions of CBT delivered in a standard weekly protocol to 14 sessions of daily (or intensive) CBT in 40 7–17 year olds with OCD. Random assignment to condition was employed in this trial, although there was no control condition. Findings indicated that daily treatment was as effective as weekly treatment, with no group by time interaction evident on the continuous CY-BOCS measure. Some slight advantages were evident immediately post-treatment for the daily regimen on other measures (e.g., 90% of youth in the intensive group versus 65% in the weekly group were considered treatment responders in receiving a 1 or 2 on the Clinical Global Improvement scale). There were no significant differences in remission status, with 75% of the children in the intensive group and 50% in the weekly group meeting remission status criteria (no diagnosis on ADIS-P and CY-BOCS total score less than 11) at posttreatment. When global measures of functioning were considered, there appeared to be a slight advantage for daily treatment immediately post-treatment, but group differences were no longer evident at 3-month follow-up. These results suggested that the more easily transported weekly protocol is sufficient to treat OCD in patients with mild

to moderately severe OCD. It also suggests that intensive treatment can be effective for pediatric OCD when clinical and practical circumstances dictate its use, such as when patients must relocate temporarily to access expert care or when a faster rate of response is needed (e.g., treatment during summer vacation to reduce OCD-related dysfunction at school for the fall academic term).

3.4. Family-based treatment of early childhood OCD

Inclusion criteria for most of the studies of OCD reviewed here require that the child is at least seven years old in order to participate, yet epidemiological and clinical data indicate that there is a subset of youth with clinical OCD who are younger than this. Concerns about whether these very young children could be treated effectively with a protocol developed for and tested on older children necessitated treatment and measurement development work in an effort to see whether CBT could be efficacious when applied with these youngsters. Indeed, recent work supports the success of family-based CBT for young children (5–8) with OCD as compared to a family-based relaxation training (Freeman et al., 2008). Inclusion and exclusion criteria were identical to the POTS I and II trials described above except for the age range and, on a closely related note, that at least one parent was required to participate in every session. Both treatment protocols (CBT and relaxation training) consisted of 12 sessions delivered over the course of 14 weeks. This family-based CBT program was based on extant approaches for older children, but contained novel elements tailored to young children with OCD. These elements included: (1) attention to developmental stage and concomitant levels of cognitive and socio-emotional skills; (2) awareness of a child's involvement in and dependence on a family system; and (3) the incorporation of parent-training and behavior management techniques. Using the now standard ITT approach, 11 of 22 (50%) participants randomized to CBT were classified as achieving clinical remission (CY-BOCS total score less than 13 and a 1 or 2 on the CGI-I) after 12 weeks of treatment, as compared with 4 of 20 (20%) participants in the RT group; this difference in response rates was statistically and clinically significant. Using the completer sample, 11 of 16 (69%) participants randomized to CBT were classified as achieving clinical remission, compared with only 3 of 15 (20%) participants in the relaxation training group, which was again statistically and clinically significant. Although the sample size was small and thus exploration of moderators and predictors was necessarily restricted, findings were very encouraging and indicated that family-based CBT was associated with a moderate and clinically relevant treatment effect even when compared to a credible psychosocial control condition (ITT ES=0.53). Following on from this trial, the POTS Team just recently completed recruitment on a multi-site replication and extension of this study (POTS Jr.; for detailed descriptions of rationale and methods see Freeman et al., 2012) that will allow for examination of predictors and moderators of response with a larger sample ($N=127$).

3.5. Enhancing CBT's efficacy and reach

Collectively, the treatment outcome research in pediatric OCD has provided strong empirical support for CBT as the treatment of choice for pediatric OCD. That said, researchers have begun to build on this efficacy research in two key ways. First, based on the observation that there remain a number of children who do not respond to CBT or who respond but continue to have residual symptoms, researchers have worked to identify ways to further improve the efficacy of CBT. Second, in light of the recognition that CBT for pediatric OCD often does not reach or is not effectively implemented as designed in settings in which extensive training and expert supervision are not available, emerging research has focused on strategies for improving the reach of CBT.

To address the first goal, Merlo et al. (2010) examined the effectiveness of adding motivational interviewing (MI) as an adjunct to CBT. Sixteen youth with OCD (ages 6–17) all received intensive CBT following the protocol described by Lewin et al. (2005a), including up to 14 90-min sessions over three weeks. In addition, participants were randomized to receive either three MI sessions or three additional psychoeducational sessions as an adjunct to their CBT. Both the MI sessions and the control sessions took place immediately before Sessions 1, 4, and 8 and lasted 20 to 30 min. MI sessions focused on the patient's view of his or her OCD symptoms and treatment participation, with the goal of addressing ambivalence about OCD treatment and supporting self-efficacy. Both treatment groups were administered all measures immediately before and immediately after treatment, and the CY-BOCS also was administered at Sessions 5 and 9 to track progress during treatment. After four sessions, the mean CY-BOCS score for the CBT+MI group was significantly lower than for the CBT+psychoeducation group, and the degree of reduction in CY-BOCS scores was significantly greater for the CBT+MI group (16.8 vs. 8.1). This effect decreased over time, and scores at post-treatment were not significantly different (posttreatment CY-BOCS score of 9 for CBT+MI vs. 12 for CBT+psychoeducation). However, participants in the MI group completed treatment on average three sessions earlier than those in the PE group. Despite some limitations (small sample size of 16, no follow-up assessment), this suggests that targeting patients' motivation to engage in treatment via an adjunctive MI intervention may accelerate treatment progress and reduce the number of sessions needed, thereby minimizing burden for families and decreasing the likelihood of treatment attrition. These findings were inconsistent with those reported in a recent adult OCD study in which no enhancement effects for MI were found (Simpson et al., 2010), although those authors attributed the failure to find an augmentative effect in part to the fact that patients in the ERP alone group made substantial and clinically significant progress.

In a separate study, Storch et al. (2010) used a different approach for augmenting CBT by focusing on enhancing the impact of exposures through the use of d-cycloserine, a partial agonist at the NMDA receptor in the amygdala. This work initially was based on animal research showing that the N-methyl-D-aspartate (NMDA) receptor is critically involved in fear extinction, and that d-cycloserine enhances extinction of learned fear. Although preliminary results supported the use of d-cycloserine to augment exposure therapy in adult anxiety disorders, this was the first study to examine its role in augmenting treatment of pediatric anxiety. All 30 participants (youth ages 8–17 with principal diagnosis of OCD, recruited across two sites) received ten 60-min CBT sessions based on the POTS I and POTS II protocol. Using a double-blind design, participants also were randomized to either receive either D-cycloserine (25 or 50 mg., depending on participant's weight) or a placebo one hour before sessions 4–10, which all focused on exposure. These sessions were held a minimum of five days apart based on prior research that a d-cycloserine-free period between administrations maintains its positive effects on learning and fear extinction. Data initially were analyzed with separate site by time by condition analyses; however, since there were no interactions, remaining analyses focused on group by time analysis. Overall, both groups demonstrated clinical improvement across measures. Although no statistically significant differences were found, compared to the CBT+placebo group, youth in the CBT+d-cycloserine arm showed small-to-moderate treatment effects (72% vs. 58% symptom reduction on CY-BOCS; 57% vs. 41% on clinical severity ratings). Unlike studies of d-cycloserine in adult OCD, analyses of secondary outcomes

Table 1
Summary of studies reviewed.

Study	Sample Description	Comorbidity	Conditions(s)	CBT Type	Clinical Change	Effect Sizes (Cohen's *d*)	Follow-Up
Pediatric OCD Treatment Study I (POTS I; 2004)	• N=112 • Ages 7–17; 50% female; ethnicity not reported • Inclusion: OCD dx, CYBOCS > 15, NIMH > 7, IQ > 80 • Exclusion: MDD, bipolar, PDD, psychosis, primary TS, concurrent meds or therapy, 2 prior failed SRI or 1 failed CBT trials for OCD, previous remission via CBT/SRI	80% had at least 1 comorbid disorder: 63% had additional internalizing disorder; 27% had externalizing disorder; 16% had tic disorder. 10% taking a psychostimulant for ADHD	Four conditions: • Intensive CBT (ICBT):12 weeks (N=28) • Sertraline (SER): 12 weeks (N=28) • Combined tx (COM): 12 weeks (N=28) • Pill placebo (PBO): 12 weeks (N=28)	Intensive CBT; based on March and Mulle (1998)	ICBT: Pre-CYBOCS=26 Post-CYBOCS=14 % remission=39% SER: Pre-CYBOCS=22 Post-CYBOCS=17 % remission=21% COM: Pre-CYBOCS=24 Post-CYBOCS=11 % remission=54% PBO: Pre-CYBOCS=25 Post-CYBOCS=22 % remission=4% Remission=CYBOCS < 11	Within-group: ICBT (CYBOCS) =2.61 SER (CYBOCS) =1.49 COM (CYBOCS) =4.20 PBO (CYBOCS) =1.12 Between-group: ICBT v. PBO (CYBOCS)=0.99 SER v. PBO (CYBOCS)=0.68 COM v. PBO (CYBOCS)=1.46 COM v. CBT (CYBOCS)=0.31 COM v. SER (CYBOCS)=0.61 ICBT v. SER (CYBOCS)=0.27 Effect sizes presented in original paper as Hedges *g*; recalculated as *d* (above) by Barrett et al. (2008)	No follow-up data.
Barrett et al. (2004)	• N=77 • Ages 7-17; 51% female; ethnicity not reported • Inclusion: primary OCD • Exclusion: TS, autism, MR, psychosis, organicity • Stable meds OK	79% had comorbid diagnosis; 59% had more than one. 60% GAD, 35% specific phobia, 29% social phobia, 17% separation anxiety 5% dysthymic disorder, 3% MDD	Three conditions: • Individual family-based CBT (ICBFT): 14 weeks (N=24) • Group family-based CBT (GCBFT): 14 weeks (N=29) • Waitlist (WL): 4-6 weeks (N=24)	Individual family-based CBT vs. group family-based CBT; both based on March & Mulle (1998)	ICBFT: Pre-CYBOCS=24 Post-CYBOCS=8 % remission=88% GCBFT: Pre-CYBOCS=21 Post-CYBOCS=8 % remission=76% WL: Pre-CYBOCS=23 Post-CYBOCS=24 % remission=0% Remission=no OCD diagnosis on ADIS-P	Within-group: ICBFT (CYBOCS) =3.27 GCBFT (CYBOCS) =4.03 WL (CYBOCS) =-0.18 Between-group: ICBFT v. WL (CYBOCS)=2.84 GCBFT v. WL (CYBOCS)=2.63 GCBFT v. ICBFT (CYBOCS)=0.01 ICBFT v. WL (NIMH)=2.61 GCBFT v. WL (NIMH)=2.78 GCBFT v. ICBFT (NIMH)=0.09 ICBFT v. WL (MASC)=0.06 GCBFT v. WL (MASC)=0.60 GCBFT v. ICBFT (MASC)=0.66 ICBFT v. WL (CDI) =0.27 GCBFT v. WL (CDI)=0.82 GCBFT v. ICBFT (CDI)=0.52	Gains maintained over 6 months. All maintained post-tx gains at 18 months; 70% of ICBFT and 84% of GCBFT participants in remission.
Storch et al. (2007)	• N=40 • Ages 7–17; 55% female; 93% Caucasian • Inclusion: primary diagnosis of OCD, CYBOCS > 16 • Exclusion: psychosis, PDD, bipolar disorder, current suicidality • 60% on concurrent SRI	73% had comorbid diagnosis: 28% GAD; 13% tic disorder; 18% MDD; 30% ADHD; 18% ODD; 13% social phobia; 8% Asperger's; 5% panic disorder; 3% trichotillomania; 3% agoraphobia	Two conditions: • Weekly treatment: 14 sessions (N=20) • Intensive treatment: daily (N=20)	Weekly vs. intensive (daily) CBT	Weekly: Pre-CYBOCS=25 Post-CYBOCS=13 % responder=65% % remission=50% 3M-CYBOCS=10 Intensive: Pre-CYBOCS=26 Post-CYBOCS=10 % responder=90% % remission=75% 3M-CYBOCS=10 Responder=CGI-I of	Within-group, pre-/post-: Intensive (CYBOCS)=2.62 Weekly (CYBOCS) =1.73 Intensive (CGI-S) =3.29 Weekly (CGI-S) =1.68 Intensive (COIS-P)=1.30 Weekly (CDI)	No group differences at 3 months.

Table 1 (*continued*)

Study	Sample Description	Comorbidity	Conditions(s)	CBT Type	Clinical Change	Effect Sizes (Cohen's *d*)	Follow-Up
					1 or 2 Remission=no OCD diagnosis on ADIS-P and CYBOCS < 11	=0.74 Intensive (CDI) =0.40 Intensive (MASC) =0.86 Weekly (MASC) =0.37 Intensive (FAS) =1.41 Weekly (COIS-P) =0.45 Intensive (FAS) =1.41 Weekly (FAS) =0.52 Within-group, pre-/follow-up: Intensive (CYBOCS)=2.20 Weekly (CYBOCS) =2.33 Intensive (CGI-S) =3.11 Weekly (CGI-S) =2.44 Intensive (COIS-P)=1.89 Weekly (COIS-P) =0.57 Intensive (CDI) =0.60 Weekly (CDI) =0.75 Intensive (MASC) =1.00 Weekly (MASC) =0.45 Intensive (FAS) =1.24 Weekly (FAS) =0.32	
Asbahr et al. (2005)	• N=40 • Ages 9–17; 35% female; Latino • Inclusion: primary OCD, treatment-naïve, NIMH > 7 • Exclusion: primary MDD or ADHD, bipolar, PDD, PTSD, borderline PD, neurological disorder other than TS, autism, psychosis, organicity	70% had comorbid diagnosis; 25% had 2, 15% had 3+. 53% tic disorder, 30% another anxiety disorder, 23% ADHD, 15% ODD, 3% depression, 3% mania, 3% eating disorder	Two conditions: • Group CBT (GCBT): 12 weeks (N=20) • Sertraline (SER): 12 weeks (N=20)	Intensive; based on March and Mulle (1998)	GCBT: Pre-CYBOCS=26 Post-CYBOCS=NR % resp/rem=NR SER: Pre-CYBOCS=27 Post-CYBOCS=NR % resp/rem=NR	Insufficient data	9-month follow-up: 5% relapse in CBT vs. 53% in SER following treatment discontinuation.
de Haan et al. (1998)	• N=22 • Ages 8–18; 50% female; ethnicity not reported • Inclusion: primary OCD • Exclusion: TS, autism, MR, psychosis, • organicity, primary MDD; BT or SRI meds in past 6 mos	18% had comorbid disorder: 9% with separation anxiety disorder,5% eating disorder NOS, 5% tic disorder	Two conditions: • CBT: 12 sessions (N=12) • Clomipramine (CMI): 12 weeks (N=10)	CBT included EX/RP and cognitive elements; based on Emmelkamp (1982) and March et al. (1994)	CBT: Pre-CYBOCS =22 Post-CYBOCS =9 % response=67% % remission=NR CMI: Pre-CYBOCS=24 Post-CYBOCS=18 % response=42% % remission=NR Responder= > 30% CYBOCS reduction	Within-group: CBT (CYBOCS) =1.58 CMI (CYBOCS) =1.45 Between-group, CBT v. CMI: CYBOCS=0.86 LOI=0.51 CDS=0.32 CBCL=0.27	2 CBT nonresponders exhibited positive response following continued treatment.
Pediatric OCD Treat-ment	• N=124 • Ages 7-17; 53% female; 93% Caucasian	74% had comorbid disorders: 27% ADHD, 55% anxiety/mood, 19%	Three conditions: • Medication management only (MM): 7	CBT based on March and Mulle (1998).	MM: Pre-CYBOCS=26 Post-CYBOCS=21 % response=30%	Between-group, MM+CBT v. MM: Responder=0.39 CYBOCS=0.85	No follow-up data reported.

Table 1 (*continued*)

Study	Sample Description	Comorbidity	Conditions(s)	CBT Type	Clinical Change	Effect Sizes (Cohen's *d*)	Follow-Up
Study II (POTS II; 2011)	• Inclusion: CYBOCS > 15, experienced partial response to adequate SRI trial, had prior CBT trial (> 10 sessions) • Exclusion: other primary dx, PDD, taking more than 1 SRI concurrently	tic disorder, 2% externalizing	visits over 12 weeks (N=42) • Medication management and CBT (MM+CBT): 14 sessions over 12 weeks (N=40) • Med visits over 12 weeks, with instructions in CBT (MM+I-CBT): 7 visits (N=42)		% remission=NR MM+CBT: Pre-CYBOCS=25 Post-CYBOCS=14 % response=69% % remission=NR MM+I-CBT: Pre-CYBOCS=27 Post-CYBOCS=20 % response=34% % remission=NR Responder= > 30% CYBOCS reduction	NIMH=0.93 Between-group, MM+CBT v. MM-I-CBT: Responder=0.35 CYBOCS=0.70 NIMH=0.70 Between-group, MM+I-CBT v. MM: Responder=0.04 CYBOCS=0.16 NIMH=0.23	
Piacentini et al. (2011)	• N=71 • Ages 8-17; 63% female; Ethnicity: 78% Caucasian • Inclusion: CYBOCS > 15, IQ > 70, no concurrent meds • Exclusion: suicidality, psychosis, mania, PDD, substance dependence	66% met criteria for another DSM-IV diagnosis (tic disorders, anxiety disorders, ADHD, ODD, mood disorders, other)	Two conditions: • Family-focused CBT (FCBT): 12 sessions over 14 weeks (N=49) • Psychoed and relaxation training (PRT): 12 sessions over 14 weeks (N=22)	Child CBT Plus Family Intervention (FCBT) protocol; from Piacentini, Langley, & Roblek (2007)	FCBT: Pre-CYBOCS=25 Post-CYBOCS=13 % response=57% % remission=43% 1M-CYBOCS*=4 6M-CYBOCS*=3 PRT: Pre-CYBOCS=25 Post-CYBOCS=17 % response=23% % remission=18% 1M-CYBOCS*=4 6M-CYBOCS*=3 Responder=CGI-I of 1/2 Remission=CYBOCS < 11 *initial responders only	Within-group: FCBT (CYBOCS) =2.37 PRT (CYBOCS) =1.80 FCBT (COIS-C) =0.81 PRT (COIS-C) =0.05 FCBT (COIS-P) =1.01 PRT (COIS-P) =0.57 FCBT (FAS-P) =0.78 PRT (FAS-P)=0.27 Between-group, FCBT v. PRT: CYBOCS=0.40 COIS-C=0.48 FAS-P=0.42	Of 28 FCBT responders, 81% maintained gains at 1 month and 73% at 6 months. Of 6 PRT responders, 60% maintained gains at 1 month and 75% at 6 months.
Freeman et al. (2008)	• N=42 • Ages 5-8; 57% female; 80% Caucasian • Inclusion: OCD dx on KSADS, sx duration of 3 mos • Exclusion: other primary disorder, PDD, MR, psychosis, conduct disorder, suicidality, concurrent psychotherapy for OCD or behavioral parent training, treatment with psychiatric medication for OCD, depression or mood stabilization, PANDAS	55% comorbid internalizing diagnoses, 36% comorbid externalizing diagnoses, 10% tic disorder, 19% ADHD	Two conditions: • CBT: 12 sessions over 14 weeks (N=22) • Relaxation training (RT):12 sessions over 14 weeks (N=20)	Family-focused CBT adapted from March and Mulle (1998) for younger children	CBT, ITT analysis: Pre-CYBOCS=23 Post-CYBOCS=14 % rem-CY=50% % rem-CGI=50% RT, ITT analysis: Pre-CYBOCS=22 Post-CYBOCS=17 % rem-CY=20% % rem-CGI=40% CBT, completers only: Pre-CYBOCS=23 Post-CYBOCS=12 % rem-CY=69% % rem-CGI=69% RT, completers only: Pre-CYBOCS=22 Post-CYBOCS=17 % rem-CY=20% % rem-CGI=40% Rem-CY (remission on CYBOCS) =CYBOCS < 13 Rem-CGI (remission on CGI)=CGI-I of 1/2	Between-group, CBT v. RT: CYBOCS, ITT=0.53 CYBOCS, tx completers only=0.85	No follow-up data.
Bolton et al. (2011)	• N=96 • Ages 10-18; 59% female; ethnicity not reported • Inclusion: OCD dx on ADIS-C/P, stable meds for OCD, IQ > 70	2% tic disorder, 14% ODD, 8% ADHD, 9% MDD	Three conditions: • Full CBT (cognitive model): 12 sessions (N=36) • Brief CBT (cognitive	CBT based on cognitive model developed by Salkovskis (1999); modified for	Full: Pre-CYBOCS=22 Post-CYBOCS=10 % remission=61% 3M-CYBOCS=12 Brief: Pre-CYBOCS=22	Between-group: Full v. WL (CYBOCS)=2.2 Brief v. WL (CYBOCS)=1.6 No statistically significant difference in the	Full CBT group lost some gains (56% in remission) during 3 months, while brief CBT group continued to improve (50% in remission). No significant differences

Table 1 (*continued*)

Study	Sample Description	Comorbidity	Conditions(s)	CBT Type	Clinical Change	Effect Sizes (Cohen's *d*)	Follow-Up
	• Exclusion: current psychosis, marked PDD sx, sx warranting immediate tx (suicidality, depression)		model): 5 sessions (N=36) • Waitlist (WL): 12 weeks (N=24)	younger clients	Post-CYBOCS=13 % remission=49% 3M-CYBOCS=11 WL: Pre-CYBOCS=24 Post-CYBOCS=23 % remission=8% Remission=ADIS-C/P < 4	effect of full vs. brief CBT.	between groups at 3 months.
Storch et al. (2011)	• N=31 • Ages 7-16; 39% female; 74% Caucasian • Inclusion: CYBOCS > 15, no change in meds in past 8 wks, access to Internet-connected computer, receptive language > 80 • Exclusion: psychosis, bipolar, conduct, PDD, substance abuse, suicidality • 55% taking meds at stable dose while participating	97% had at least one comorbid diagnosis (including GAD, social phobia, MDD, ADHD, ODD, TS/tic disorder)	Two conditions: • Web-delivered CBT sessions over 12 weeks (W-CBT): 14 (N=16) • Waitlist (WL): 4 weeks (N=15)	Web-CBT; minor adaptations from POTS for use on web-cam	W-CBT: Pre-CYBOCS=25 Post-CYBOCS=11 % response=81% % remission=56% 3M-CYBOCS=11 WL: Pre-CYBOCS=21 Post-CYBOCS=19 % response=13% % remission=13% Response= > 30% CYBOCS reduction and CGI-I of 1/2 Remission=ADIS-P < 4 and CYBOCS < 11	Between-group, W-CBT v. WL: CYBOCS=1.36 CGI-S=1.48 COIS-P=0.99 COIS-C=0.46 FAS=0.37 MASC=0.46 CDI=0.43	Small but significant increase in CYBOCS for W-CBT at 3 months; remained lower than baseline. CGI-S stable. Slightly fewer responders (71%), remission rates maintained (57% at follow-up vs. 56% at posttreatment).
Merlo et al. (2010)	• N=16 • Ages 6-17; 38% female; 81% Caucasian • Inclusion: CYBOCS > 15, stable on meds for 8 weeks • Exclusion: psychosis, bipolar, PDD	Not reported	Two conditions. Both received up to 14 sessions of intensive CBT over 3 weeks: • CBT+MI: three motivational interviewing sessions (N=8) • CBT+PE: three additional psychoed sessions (N=8)	Intensive, family-based CBT (plus MI in experimental group)	CBT+MI: Pre-CYBOCS=31 S5-CYBOCS=14 S9-CYBOCS=9 Post-CYBOCS=9 % res/rem=NR CBT+PE: Pre-CYBOCS=27 S5-CYBOCS=23 S9-CYBOCS=18 Post-CYBOCS=12 % res/rem=NR	Between-group (CBT+MI v. CBT+PE): Session 5 (CYBOCS)=1.34 Session 9 (CYBOCS)=1.18 Post (CYBOCS): no significant difference (both groups demonstrating strong improvement)	No follow-up data.
Storch et al. (2010)	• N=30 • Ages 8-17; 37% female • Inclusion: CYBOCS > 15, stable on meds for 12 weeks, weight 25-90 kg. • Exclusion: presence of primary hoarding, epilepsy, renal insufficiency, generally poor physical health, pregnancy, psychosis, bipolar, autism, substance abuse/dependence	73% at least 1 comorbid diagnosis: 47% ADHD, 17% GAD, 13% ODD, 10% TS, 10% MDD, 6.6% social phobia, 7% enuresis, 3% specific phobia	Two conditions. All received 10 CBT sessions based on POTS: • CBT+DCS: D-cycloserine taken before sessions 4-10 (N=15) • CBT+PBO: placebo taken before sessions 4-10 (N=15)	CBT based on POTS	CBT+DCS: • Pre-CYBOCS=24 • Post-CYBOCS=7 • % res/rem=NR • CBT+PBO: • Pre-CYBOCS=26 • Post-CYBOCS=11 • % res/rem=NR	• Between-group (CBT+DCS v. CBT+PBO): • CGI-S=0.47 • CYBOCS=0.31 • ADIS=0.41	No follow-up data.
Bolton & Perrin (2008)	• N=20 • Ages 8-17; 30% female; 65% White British • Inclusion: primary OCD • Exclusion: current meds, autism, IQ < 70	50% had comorbid disorder(s). Most common comorbid disorder was another anxiety disorder. 5% tic disorder, 5% ODD, 5% ADHD, 10% MDD.	Two conditions: • Exposure and response prevention (E/RP): 10 sessions over 7 weeks (N=10) • Waitlist (WL; N=10)	E/RP focused on behavioral protocol; no psychoed or cognitive elements	E/RP, ITT analysis: Pre-CYBOCS=24 Post-CYBOCS=14 % response=60% % remission=40% 3M-CYBOCS=10 E/RP, completers only: Pre-CYBOCS=23 Post-CYBOCS=11 % response=75	Within-group (E/RP only reported): CYBOCS, ITT=2.11 CYBOCS, completer=2.71 CHOCI, ITT=3.4 CHOCI, completer=4.2 Between-group, E/RP v. WL:	8/10 patients in tx group completed 3-month follow-up. CYBOCS scores stable. 5/8 tx-completers below diagnostic threshold at follow-up.

Table 1 (*continued*)

Study	Sample Description	Comorbidity	Conditions(s)	CBT Type	Clinical Change	Effect Sizes (Cohen's *d*)	Follow-Up
					% remission=50% WL, ITT analysis: Pre-CYBOCS=22 Post-CYBOCS=21 % response=NR % remission=0% WL, completers only: Pre-CYBOCS=22 Post-CYBOCS=21 % response=NR % remission=0% Response= > 1 SD reduction on CYBOCS Remission=ADIS < 4	ITT (CYBOCS): =1.23 Completer (CYBOCS):=1.64	
Williams et al. (2010)	• N=21 • Ages 9-18; 38% female; • Inclusion: primary OCD present for at least 6 months • Exclusion: not English-speaking, psychosis, ASD • Concurrent meds OK; 33% taking medication throughout the trial	52% had no other clinical diagnoses, 19% GAD, 19% specific phobia, 19% separation anxiety, 10% ADHD, 10% social phobia, 5% dysthymia	2 conditions: • CBT: 10 sessions (N=11) • Waitlist (WL): 12 weeks; CBT optional after (N=10)	CBT based on Salkovskis (1998); focus on altering cognitive distortions in OCD	CBT: Pre-CYBOCS=23 Post-CYBOCS=12 % res/rem=NR 6M-CYBOCS=9 WL: Pre-CYBOCS=21 Post-CYBOCS=20 % res/rem=NR 6M-CYBOCS*=10 *At 6M, WL patients had received open trial CBT.	Within-group: CBT (CYBOCS) =2.62 WL (CYBOCS) =0.25 Between-group, CBT vs. WL: CYBOCS=1.07	Waitlist treated after 3 months; no significant differences between groups at 6-month follow-up (60% sx reduction from baseline to 6-month in CBT vs. 52% in waitlist + CBT).

Note: Effect size (Cohen's *d*)=(M_{post}–M_{pre})/s_{pooled}. 3M/6M=3-month/6-month follow-up; ADHD=Attention-Deficit/Hyperactivity Disorder; ADIS-C/P=Anxiety Disorders Interview Schedule for Children, Child (C) and Parent (P) Reports; ASD=Autism Spectrum Disorder; CBCL=Child Behavior Checklist; BT=behavior therapy; CBT=cognitive-behavioral therapy; CDI=Children's Depression Inventory; CDS=Children's Depression Scale; CGI-S=Clinical Global Impression Severity Scale; CHOCI=Children's Obsessional Compulsive Inventory; CMI=clomipramine; COIS-C/P=Child Obsessive-Compulsive Impact Scale, Child (C) and Parent (P) Reports; COM=combined treatment; CYBOCS=Children's Yale Brown Obsessive-Compulsive Scale; DCS=D-cycloserine; E/RP=exposure and response prevention; FAS-P=Family Accommodation Scale, Parent Report; FCBT=family-focused CBT; FCBFT=family-focused group CBT; GAD=Generalized Anxiety Disorder; GCBFT=group family-focused CBT; ICBT=intensive CBT; ICBFT=individual family-focused CBT; ITT=intent-to-treat analysis; KSADS=Schedule for Affective Disorders and Schizophrenia for School-Age Children; LOI=Leyton Obsessional Inventory; MASC=Multidimensional Anxiety Scale for Children; MDD=Major Depressive Disorder; MI=motivational interviewing; MM=medication management; MR=mental retardation; NIMH=National Institute of Mental Health – Global Obsessive Compulsive Scale; ODD=Oppositional Defiant Disorder; PBO=placebo group; PDD=pervasive developmental disorder; PE=psychoeducation; PRT=psychoeducation and relaxation training; NR=not reported; RT=relaxation training; SER=sertraline group; SRI=serotonin reuptake inhibitor; TS=Tourette Syndrome; W-CBT=web-delivered CBT; WL=waitlist.

(MASC and CDI scores) did not yield significant effects. Notably, no participant reported adverse effects related to d-cycloserine or placebo, and lab values did not change in d-cycloserine-treated youth. The authors suggest that that the mechanism of d-cycloserine may be specific to extinction learning, and thus may not differentially impact non-OCD anxiety or depressive symptoms. The authors conclude that, while this study was limited by a small sample size and no follow-up data, preliminary results complement findings in adult OCD and non-OCD anxiety disorders, suggesting that more extensive study of d-cycloserine augmentation of CBT among youth with OCD is warranted.

Rather than focusing on enhancing CBT's effects, Storch et al. (2011) conducted a trial designed to address the limited availability of CBT for youth by adapting an evidence-based treatment protocol for real-time delivery over web-video camera (webcam). The authors identify several potential advantages of this approach, including reducing the cost and burden of services; increasing the types of settings in which CBT can be delivered (e.g., home, community agencies, school); increasing privacy and relative anonymity, thereby possibly reducing individual barriers/stigma associated with treatment; and potentially improving treatment quality by conducting exposures in naturalistic settings. Thirty-one youth with OCD (ages 7–16) were randomly assigned to 14 sessions of web-CBT or a 4-week truncated waitlist control. web-CBT followed the protocol in POTS, in which participants received 14 60- to 90-min sessions of family-based CBT over 12 weeks, with adaptations made in order for sessions to be conducted over webcam (e.g., handouts e-mailed before sessions, completed homework assignments read aloud to therapist, parents instructed on coaching child through within-session exposures conducted out of therapist's view). When controlling for baseline group differences (higher severity in web-CBT group), web-CBT was superior to waitlist on all primary outcome measures with large effect sizes and pre-post change scores on the CY-BOCS of approximately 25 to 11 for web-CBT and 21 to 19 for waitlist. Thirteen of 16 youth (81%) in the web-CBT arm were treatment responders (defined as at least 30% reduction in CY-BOCS and a 1 or 2 on CGI-I), versus only two of 15 (13%) youth in the waitlist group. Similarly, 9 of 16 (56%) individuals in the web-CBT group met remission criteria (ADIS-P < 4 and CYBOCS < 11), versus 2 of 15 (13%) individuals in the waitlist group. Although therapists reported some difficulty adjusting to this treatment modality (e.g., building the therapeutic alliance, reading visual cues of anxiety), parents generally reported high satisfaction with the treatment approach. Despite its limitations (e.g., small sample size, brief waitlist control), this study suggests that web-based delivery is a

promising strategy for improving the reach of CBT into those communities for select patients in which access to in-person CBT is limited geographically or for other practical reasons (e.g., family scheduling difficulties).

3.6. Effects of behaviorally and cognitively oriented protocols

CBT protocols used in the pediatric OCD outcome studies conducted to date can for the most part be conceptualized as cognitive-behavioral in nature, meaning that they included both cognitive and behavioral techniques and explanations. This approach is convergent with the way that treatment is typically delivered for adult OCD (Franklin and Foa, 2011). Studies that have attempted to directly compare purely behavioral protocols to purely cognitive ones have for the most part found comparable outcomes (e.g., van Balkom et al., 1998), but also attenuated ones when compared to blended protocols. However, there are theoretical and practical reasons to examine this issue in children and adolescents, since the separate components of the CBT packages tested thus far have not been empirically validated as stand-alone treatments for OCD in youth. Bolton and Perrin (2008) were interested in examining the effects of a more behaviorally-oriented protocol that clearly emphasized a habituation model of change and specifically excluded formal discussions of feared consequences and other cognitive conceptualizations of OCD and its treatment. In this relatively small, randomized study, the investigators compared up to seven weeks of exposure plus response prevention treatment (mean 35.2 days, range 14–47 days) delivered once to three times per week to a waitlist control in 20 OCD children and adolescents ages 8–17. Using an intent-to-treat analytic approach, the authors reported statistically and clinically significant reduction in OCD symptoms for the exposure group at the end of treatment that were superior to those found in the WL control group (42% reduction in mean scores for exposure group versus no reduction for WL control), and concluded that ERP specifically is an effective treatment for pediatric OCD in and of itself. The potential advantages of ERP, as the authors state, are that it is relatively brief, easily manualized, and not overly complicated. Collectively these advantages could prove to be of particular relevance for youngsters, who for developmental reasons may not be especially adept yet at describing the content of their thoughts. The absence of a direct comparison to a blended protocol or a more cognitively oriented one leaves the relative efficacy question unanswered by this trial.

A different group of investigators interested in isolating the effects of cognitive as opposed to behavioral techniques and explanations examined the relative efficacy of a more cognitively-oriented protocol for pediatric OCD in an initial study. In particular, Williams et al. (2010) presented a cognitive rationale for treatment that emphasized the importance of cognitions related to exaggerated responsibility. Exposure exercises were included in the protocol, but their rationale involved attempting to find out what happens to OCD-related cognitions and emotions. Moreover, therapists did not emphasize the importance of habituation and did not wait for anxiety to dissipate even in the context of exposure exercises. This greater focus on identifying and changing misconceptions to carry out compulsions differentiated the rationale from the more behavioral explanations that involve resisting impulses to engage in rituals. Twenty-one youth with OCD (ages 9–18) were randomized to either 10 one-hour sessions of CBT or a 12-week waitlist and were evaluated by blind assessors at three and six months post-treatment. At post-treatment, the group who received CBT demonstrated significantly more improvement on the CY-BOCS than the waitlist group (48% vs. 7% reduction). The waitlist group then was treated using the same protocol and made similar gains, with no significant differences between the groups noted at six-month follow-up (60% symptom reduction from baseline to 6-month follow-up in CBT group versus 52% reduction in waitlist+CBT group). Despite differences on the primary measure, no significant differences were reported at post-treatment between the groups on secondary analyses that comprised self-report measures of OCD, anxiety, depression, and OCD-related cognitions. The authors offer several possible explanations: (1) changes in behavior, rather than changes in cognition, may be the most significant feature of treatment; (2) introduction of hope of treatment after the wait period may have altered cognitions for the control group without affecting assessor-rated severity; or (3) self-report measures may not be valid for this population. In addition, because the cognitive domain of responsibility assessed in this study is not predominant in several OCD subtypes (e.g., washers who report fear of getting sick or predominantly disgust; “not just right” obsessions), it is possible that other OCD-related cognitions changed but were not assessed. Another important aspect of the study involved its setting: patients were treated in an outpatient clinical setting as opposed to an academic context, which lends further credibility to the potential for dissemination of this protocol despite the more complex rationale for treatment as compared to the relatively straightforward theoretical model and rationale typically used for ERP.

Bolton et al. (2011) further examined the efficacy of a more cognitively-oriented treatment for OCD in a substantially larger study ($N=96$) of youth ages 10–18 inclusive in which they compared the full CBT protocol (12 sessions on average) to a brief CBT (5 sessions on average plus bibliotherapy augmentation) and a waitlist control condition. The study's design permitted both an extension of the Williams et al. (2010) study with respect to examining the efficacy of a cognitively-oriented protocol, but also addressed a question related to dissemination of treatment in that limited resources in many community clinical settings necessitate maximizing a given treatment's efficiency. At the end of the 12-week acute treatment phase, both of the active treatments were superior to waitlist, yet they were not significantly different from one another (e.g., 61% remission rate in full CBT, 49% remission in brief CBT, 8% remission in waitlist control; covariance adjusted mean differences between baseline and outcome CY-BOCS scores were 12.67 for full CBT compared with waitlist and 8.98 for brief CBT compared with waitlist). Findings provided further support for the efficacy of a cognitively-oriented program but also indicated that treatment could be delivered efficiently when augmented with bibliotherapy materials. The use of local community clinics as recruitment sites also suggested the generalizability of findings to settings more like those in which most OCD sufferers would be able to receive care, although the extensive training and expert supervision provided in the context of the trial leaves unanswered the potential utility of this approach when such elements are faded.

3.7. Durability of CBT effects

Epidemiological studies suggest that OCD is a chronic condition, and adult clinical trials attest to the durability of CBT outcomes even after treatment discontinuation (Franklin and Foa, 2011). Further, several of the open clinical trials conducted with youth that included follow-up (March et al., 1994; Wever, 1994; Franklin et al., 1998) attested to the durability of CBT's effects for up to nine months. Within the fourteen randomized trials reviewed above, nine trials reported outcomes for at least one follow-up assessment. However, the majority of these studies that included a waitlist or other comparison group then allow open treatment for those patients, which then obviates the follow-up comparison to active treatment in most cases. The exception is the Piacentini et al. (2011) trial, which reported 6-month follow-up

outcomes for both CBT and RT acute treatment responders, with each condition demonstrating good maintenance of response through that time point. The studies that did report follow-up of patients treated with CBT (de Haan et al., 1998; Barrett et al., 2004, 2005; Asbahr et al., 2005; Storch et al., 2007, 2011; Bolton and Perrin, 2008; Williams et al., 2010; Bolton et al., 2011; Piacentini et al., 2011) indicated that, for the most part, acute gains made in CBT were maintained through the follow-up period, which ranged from three to nine months across trials (see Table 1). Some evidence of relapse was seen at the 3-month follow-up reported in Bolton et al. (2011) for the full CBT protocol; interestingly, those assigned to the brief CBT + bibliotherapy condition appeared to make further gains during this same time period. Storch et al. reported a small but significant increase in CY-BOCS scores at 3-month follow-up for patients treated with web-based CBT; however, the mean CY-BOCS scores at that time point still remained significantly lower than at baseline. Relapse rates reported in medication trials in pediatric OCD after pharmacotherapy discontinuation generally have found less stability of treatment response than is seen in CBT trials (Abramowitz et al., 2006; Franklin and Foa, 2011), which is an important consideration when making clinical recommendations to families who have the possibility of accessing either CBT or pharmacotherapy. Due in part to relatively small sample sizes but also to the loss of randomization (thus permitting open treatment for other conditions that could confound follow-ups), studies conducted thus far that have included follow-up data have not shed enough light on predictors of maintenance of response versus relapse.

3.8. Predictors and moderators of CBT response

Although there are many viable candidates for prediction or moderation of CBT response, there is as yet an insufficient empirical foundation upon which to make confident and fully informed predictions about which patients will and which will not respond fully to this form of treatment. Ultimately it would be of great benefit to be able to use patient, therapist, intervention, and associated contextual factors to make such predictions, but here again the field is plagued by too few clinical outcome studies and by sample sizes that were recruited specifically to permit hypothesis testing for primary aims regarding treatment efficacy rather than prediction or moderation. Given the paucity of CBT providers available in most communities and the often lengthy waitlists that accrue in clinical practice as a result, it would be especially helpful to be able to predict response to CBT in light of the limitation of these resources. For example, it would be valuable to know specifically which patients would be likely to respond well to a course of CBT alone as opposed to which might benefit more from CBT after an adequate trial of an empirically supported pharmacotherapy. Building the evidence base upon which to make such recommendations is one of the most important goals facing our field in the next decade.

In the ideal world, questions about which child will respond to which treatment delivered under which circumstances would already be answered, but we are clearly not there yet in pediatric OCD. At the same time, some progress has been made at least in identifying factors that could inform clinical judgment regarding treatment selection. Ginsburg et al. (2008) reviewed the data on prediction or moderation of outcome in pediatric OCD and identified baseline OCD symptom severity and family psychopathology as predictors of poorer response to CBT. In the POTS I trial, the presence of comorbid tic symptoms served as a moderator of pharmacotherapy response, i.e., predicted poorer outcome to sertraline alone but not to the treatment conditions that included CBT (CBT alone or combined treatment; March et al., 2007). A more comprehensive examination of the POTS I dataset that was published after Garcia et al.'s (2010) systematic review identified several predictors of response to all treatments: lower OCD symptom severity, less OCD-related impairment, greater insight, fewer comorbid externalizing symptoms, and lower levels of family accommodation were associated with better outcomes. With respect to predicting response to specific treatments, only a family history of OCD emerged as a moderator: although family history did attenuate outcome somewhat across all treatment conditions, those with a family history had a six-fold decrease in effect size for CBT monotherapy compared to those without such a history. The mechanism by which this moderation occurred has yet to be elucidated, although examination of family variables in another RCT may prove helpful in thinking about how this effect may have been realized: Peris et al. (2012) examined data from Piacentini et al.'s (2011) RCT and found that families with lower levels of parental blame and family conflict as well as higher levels of family cohesion at baseline were more likely to have a child who responded to family-focused CBT. These observations led this investigative team to modify the family component of family-focused CBT; their initial findings for the modified protocol will be discussed below in future directions. What they tell us in general is that family environment and family history of OCD are important considerations to take into account clinically when treating OCD.

3.9. CBT's acceptability, tolerability, and availability

Experts have long recommended CBT as a first-line treatment for OCD in children and adolescents (March et al., 1997), and the empirical support for this recommendation has grown considerably over the last fifteen years. Nevertheless, several barriers continue to limit CBT's widespread use. First, few therapists have extensive experience with CBT for pediatric OCD; thus, CBT may continue to be accessible largely near major academic and medical centers associated with its development and empirical evaluation. Second, even when CBT is available, some patients and families reject the treatment as “too difficult;” therapists themselves may also be reluctant to use this seemingly counterintuitive method, especially with children they may view as especially vulnerable. Third, once involved in CBT, some patients find the initial distress when confronting feared thoughts and situations while simultaneously refraining from rituals so aversive they drop out of treatment – dropout rates from the clinical trials reviewed above have generally been in the 10–20% range, but the rates in clinical practice settings remains unknown and might be expected to be higher. The CBT protocols that have included formal ERP for pediatric OCD all generally involve hierarchy-driven ERP, actively involve the patient in choosing exposure exercises, and include some anxiety-management techniques for the few who may need them. The positive initial and long-term outcomes, coupled with what appears to be good patient retention rates across these trials, suggests that most children and adolescents can tolerate and will benefit from CBT when delivered in a clinically informed and developmentally sensitive fashion.

As has been lamented frequently both here and elsewhere, CBT for pediatric OCD is unfortunately often difficult to find outside of the academic and medical settings. This CBT dissemination gap is not specific to OCD and has been discussed cogently and in much greater detail elsewhere (Shafran et al., 2009). As a result of this difficulty, however it has come about, it is not actually feasible in many settings to begin treatment with CBT or with combined treatment (CBT plus a serotonin reuptake inhibitor) for pediatric OCD. Shafran et al. (2009) have strongly recommended that CBT research be extended into clinical settings to bring about a new era of effectiveness research in which adequately trained and supervised therapists can study its effects on “real” patients who are not excluded because of comorbidity or case complexity. A recently completed open trial in that vein examined the effectiveness of CBT in community clinics as delivered by masters'-level clinicians who were not OCD experts provides encouragement about the transportability of this treatment. Valderhaug et al. (2007) tested a

"supervision of supervisors" model in providing the psychologists who were supervising these clinicians in rural Norway with access to expert supervision. Findings indicated both statistically significant and clinically meaningful reductions in OCD and related symptoms at post-treatment (with mean CY-BOCS total score of 23 at baseline and 9 posttreatment) that were maintained at follow-up (mean CY-BOCS total score of 9 at 3 months and 7 at 6 months). Benchmarking these outcomes against findings from the studies discussed above demonstrates their comparability at both acute and follow-up assessment and indicates that CBT can be disseminated. Findings from another recent open trial demonstration study conducted in a community clinical setting with broad inclusion criteria selected to enhance external validity have converged with Valderhaug et al.'s results (Farrell et al., 2010) and lends further credence to the notion that CBT can be delivered effectively well beyond the academic context under expert clinical supervision. Larger, randomized studies with comparison conditions are now needed to extend these findings, which in turn will help build this important bridge to improved access to CBT for families in need.

4. Discussion

4.1. Summary and conclusions

CBT for pediatric OCD has blossomed in the last fifteen years into an empirically supported treatment for this oft disabling condition, with randomized studies from around the world attesting to its efficacy relative to various comparison conditions and to active medications. As is the case in treatment studies for adults suffering from OCD, the effects of CBT for children and adolescents appear to be both robust and durable, with the follow-up studies we have available indicating that the effects of treatment last for up to nine months after treatment has ended. Intensive treatment regimens are effective, although weekly treatment for approximately 12–14 weeks appears to be sufficient for most patients. With respect to making clinical judgments regarding whether a more intensive form of CBT is needed for a given patient, future studies now need to examine whether symptom severity, comorbidity, readiness for change, and case complexity (e.g., family problems) necessitate the more intensive approaches. The degree of family involvement and the degree to which this involvement needs to target specific family predictors of poorer response (e.g., accommodation) also remains an issue in need of more study. What is clear developmentally, however, is that the treatment of very young children requires a family-based approach, and the first RCT of this protocol provided encouraging news with respect to the efficacy of this approach.

Efforts made in recent years to enhance CBT's efficacy and reach have identified several promising avenues for each. Augmentation of CBT with motivational interviewing techniques appears to have potential benefit; what has yet to be addressed is whether MI augmentation would be of particular benefit for patients who are reporting more than the typical amount of reluctance to engage in CBT or are actively refusing to initiate this treatment. Augmentation of exposures using D-cycloserine to enhance extinction learning appears to be another promising avenue, one which could possibly result in more efficient treatment. The possible advantages of this approach are both to reduce patient costs and to reduce burden on the few experts who can provide CBT plus D-cycloserine augmentation in a safe and credible manner. Web-based CBT may be efficacious for select patients. The potential advantage of moving in that direction is to relieve some of the practical burdens that prevent some patients from accessing care, such as travel distance to expert clinics, the costs associated with child care for siblings when attending treatment sessions, disruption of work and home schedules, and patient reluctance to spare the time commuting to sessions. Another advantage of web-based treatment is that there are some exposures that are simply more difficult to conduct in an office setting (e.g., completing bed-time routines without engaging in compulsions) that would likely lend themselves especially well to this form of technology. Severely ill patients would more likely require in vivo therapist and family assisted ERP as appropriate in naturalistic environments.

Both alone and in combination with serotonin reuptake inhibitors, CBT provides a viable treatment alternative to SSRIs alone, although the paucity of therapists trained in its use makes it difficult in some regions to heed the expert consensus guidelines recommendations to begin treatment with CBT alone or combined with medication. Dissemination of CBT for pediatric OCD thus remains a pressing challenge to the field, although there are now encouraging data available suggesting that a "supervision of supervisors" model can yield impressive results that are comparable to what have been achieved in the academic medical settings that have developed the CBT protocol use with children and adolescents. The next step for the CIOCD is to attempt to bridge this gap and provide opportunities for therapists seeking to develop OCD expertise to do so. Increasing the number of CBT experts in Canada and beyond could then reduce waitlist times in the few centers that already have this expertise, and would thereby make it easier for families to find excellent clinical care, the quality of which is convergent with what the experts themselves would provide.

What should not be lost on anyone reviewing the literature critically is that CBT involving ERP is an efficacious yet imperfect treatment option, both alone and in combination with medication. More work needs to be done to isolate the key elements that underlie its success, since dissemination of these key elements will likely result in more patients being offered an effective treatment in clinical practice settings (Krebs and Heyman, 2010; Gillihan et al., 2012). Examination of moderators and mediators of response of course has its place as the field looks to further increase the response rate, but it is important not to lose sight of need to identify and then emphasize the core elements of treatment in our efforts to make the best possible treatment available beyond the academic medical context. At the same time, it is important to also recognize that partial response is evident in a substantial minority of cases, and there is a subset of patients who receive CBT who do not benefit much at all. More needs to be done to better connect CBT practice to theory as well, such as discerning whether habituation, either within- or between-sessions, is essential for good outcome, or is simply a measure of good outcome. If increased acceptance and tolerance of distress better accounts for treatment response, then that concept would need to be more strongly emphasized in CBT protocols as is now being done with adult OCD (e.g., Twohig et al., 2010).

Finally, it is important to note that over the last fifteen years of research we were only able to identify fourteen studies, which clearly indicates that there is much still to be accomplished even in areas that have been studied previously. Replication is the hallmark of good science, and it is noteworthy that there are only a handful of published trials in some key areas (e.g., CBT and SRI pharmacotherapy alone vs. combined treatment), which weakens claims that can be made about expected outcomes. What is remarkably consistent across all of the published studies, however, is the finding that CBT is efficacious and its effects appear to be durable, thus making it an excellent candidate for dissemination into the community settings so that families who have a child affected by OCD can access clinical care.

4.2. Directions for future research

Using the fourteen studies reviewed above as a stepping stone, research efforts in the field of pediatric OCD should now focus on

the following critical areas: (1) more controlled trials comparing medications, CBT, and combination treatment, delivered either simultaneously or sequentially, to determine whether medications and CBT are synergistic or additive in their effects on symptom reduction; (2) direct comparisons of individual- and family-based treatments to determine which is more effective for which children, and to examine whether family interventions that are more focused on identified predictors of CBT outcome (e.g., accommodation) yield more robust and durable treatment response; (3) theory-driven studies designed specifically to identify curative procedures and processes, which will promote improvements in response to CBT; (4) more research on the relative contribution of behavioral and cognitive procedures to outcome, especially when patient subtype is taken into account (e.g., not just right OCD concerns vs. consequence driven compulsions); (5) development of innovative treatment for OCD subtypes and related disorders, such as obsessional slowness or hoarding disorder, that do not respond well to EX/RP; (6) developing treatment innovations to target specific factors, such as externalizing comorbidity or irritability, that constrain the application of CBT to patients with OCD; (7) once past initial treatment, the management of partial response, treatment resistance, treatment maintenance, and discontinuation; and (8) exporting research treatments to divergent clinical settings and patient populations in order to judge the acceptability and effectiveness of CBT as a treatment for child and adolescent OCD in real-world settings.

Although the possibilities that such initiatives will yield are exciting, it is imperative to identify, develop, and foster new sources of funding for these and even more ambitious clinical research endeavors, since it is becoming increasingly evident, in the United States at least, that federal funding for clinical trials is more and more difficult to procure. In many ways it is striking that, after fifteen years of focused research on CBT's efficacy and effectiveness, there is still so much yet to be done: replication studies are few and far between, critical questions about the optimal sequencing of CBT and medication have yet to be answered definitively, crucial theoretical issues such as the relative contributions of behavioral versus cognitive explanations and techniques have not been dismantled, and precious little is known that can inform our recommendations about which treatment to provide to which patients having which characteristics and under which circumstances. Clinical trials are expensive, and those that would permit us to examine next stage research issues such as treatment sequencing effects may be even more so than a standard efficacy study. Without further commitment of research funding, it will be very difficult to make substantive progress in addressing the major gaps that still exist in our knowledge base, which in turn weakens confidence in the clinical recommendations we can make at present when discussing treatment alternatives with families suffering from OCD. That said, some of our most forward thinking scientists have given serious thought to the future of our field and see great potential in modularized psychosocial treatment components that will target corresponding central nervous system information processes and their functional behavioral consequences (March, 2009). Collectively we look forward to the prospect of seeing applied clinical research efforts provide the information we still need to help further alleviate the suffering that is all too familiar to youth with OCD.

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