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The relationship between homework adherence and outcome in family-based cognitive-behavioral therapy for early-onset obsessive compulsive disorder

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ABSTRACT

Family-based cognitive behavioral therapy (CBT) is an effective treatment for obsessive compulsive disorder (OCD), but not all children respond. Children with early-onset OCD may exhibit poorer outcomes, possibly due to developmental factors that affect treatment engagement and distress tolerance, which may ultimately affect treatment dose. Homework adherence between sessions can increase treatment dose and predict improved outcome. However, no studies have specifically examined the effect of homework adherence on treatment outcome for early-onset OCD. This study examined homework adherence during family-based CBT for young children ($N = 63$) with early-onset OCD. Caregiver and child homework adherence were rated weekly by clinicians and symptom change was assessed at multiple timepoints across treatment. Caregivers and children were both rated as highly adherent with homework, although caregivers were rated as more adherent than children. Structural equation modeling indicated that early homework adherence predicted later homework adherence, which predicted improved treatment outcome.

1. Introduction

Obsessive compulsive disorder (OCD) is an impairing condition that often onsets in childhood or adolescence (Walitza et al., 2011) and may lead to significant impairment in adulthood when left untreated (Kameg, Richardson, & Szpak, 2015). Children with early-onset OCD (i.e., the development of OCD before the age of 8; Garcia et al., 2009; Geller et al., 2001) are at a particularly high risk for developmental consequences from OCD and continued functional impairment later in life (Piacentini, Bergman, Keller, & McCracken, 2003; Valderhaug & Ivarsson, 2005). Fortunately, family-based cognitive behavioral therapy (CBT) has been well-established as an effective treatment for early-onset OCD (Freeman et al., 2018). Specifically, exposure to feared stimuli and the subsequent resistance of compulsive behaviors (i.e., exposure and response prevention; ERP) represents the core procedural ingredient of CBT for OCD (Conelea & Freeman, 2015). However, some patients do not respond or only partially respond to this treatment. Children with early-onset OCD may present with greater symptom severity (Geller et al., 2001) and/or exhibit poorer treatment outcome (Micali et al., 2010), but the precise reason for these findings remains unclear. More research is needed to understand the multiple factors that may contribute to poorer treatment outcomes among children with early-onset OCD.

Early-onset OCD represents a unique clinical presentation that requires developmentally tailored intervention. Generally, across many diagnoses and clinical presentations, delivering CBT with young children presents challenges. Young children are often less cognitively developed than older children (Richardson, Lisandrelli, Riobueno-Naylor, & Saxe, 2018), and thus may not be able to fully absorb psychoeducation or other abstract cognitive material presented in treatment. Children may demonstrate less motivation for treatment if

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they do not understand their symptoms, if they do not view their symptoms as problematic, and/or if their caregivers are initiating treatment on their behalf. Poor insight into symptoms is common among young children (Becker-Haimes, Jensen-Doss, Birmaher, Kendall, & Ginsburg, 2018), especially those whose families provide significant accommodation of OCD symptoms (Futh, Simonds, & Micali, 2012). Furthermore, young children may exhibit low treatment engagement due to age-related attention difficulties (Betts, Mckay, Maruff, & Anderson, 2006). Poor treatment engagement may reduce the already limited time (e.g., one hour per week) that a patient typically spends with an outpatient clinician. Lastly, young children may demonstrate low distress tolerance (Selles et al., 2018) and/or poor response inhibition (Best & Miller, 2010; Espy & Bull, 2005; Penades et al., 2007), which may impede successful exposure completion (both in and outside of session) even among children who are generally engaged in treatment. Limited insight, poor treatment engagement, low distress tolerance, and poor response inhibition may function to decrease treatment dose and prolong or preclude treatment response for children with early-onset OCD.

To address these developmental differences, CBT for young children usually involves less cognitive work and more focus on behavioral exercises such as exposure and behavior management. CBT for young children also typically places less emphasis on the child as an individual client and more emphasis on caregivers and their role in maintaining or reducing children's symptoms. Family-based CBT for young children teaches caregivers to use behavioral management skills such as active ignoring of undesired behaviors and labeled praise and rewards for desired behaviors. For early-onset OCD, caregivers can use these skills to actively ignore rather than accommodate OCD symptoms and to reward children's resistance of compulsive behaviors. Family involvement is important for treatment success, as caregivers are taught to act as "exposure coaches" to ensure exposure completion outside of session and titrate exposure tasks for their children (Freeman et al., 2012; Freeman, Garcia, et al., 2014).

In this vein, an integral component of family-based CBT for young children with OCD is the continued use of skills outside of session, including the completion of planned and naturalistic exposure tasks. Treatment "homework" completed outside of session is a core component of CBT (Kazantzis, Busch, Ronan, & Merrick, 2007) that functions to support continued skill utilization and content generalization (Huppert, Roth Ledley, & Foa, 2006), increase treatment dose, and subsequently improve treatment outcomes. Despite its clear relevance to treatment outcome research, existing literature has inconsistently named, defined, and measured treatment homework completed outside of session. Past studies have used the terms "homework compliance" and "homework adherence" to refer to the extent to which patients engage in assigned between-session tasks. Studies examining "homework compliance" or "homework adherence" often do not include operational definitions of these constructs, presenting a considerable limitation for this line of research (Wheaton & Chen, 2021). For example, some research using these terms has emphasized the importance of homework completion quality, while other research focuses only on quantity of homework completion. Moreover, there does not currently exist a widely used, standardized measure of treatment homework completed outside of session (Mausbach, Moore, Roesch, Cardenas, & Patterson, 2010; Wheaton & Chen, 2021). Many past studies have measured this construct using clinician-rated Likert-type scales (e.g., Lewin, Peris, Bergman, McCracken, & Piacentini, 2011; Selles et al., 2018), although a few studies have used patient-report data (e.g., Westra, Dozois, & Marcus, 2007), and a few have used objective measures such as the number of homework assignments turned in (e.g., Woods, Chambless, & Steketee, 2002). In this study, we opt to use the term "homework adherence" rather than "homework compliance" to more clearly acknowledge the existence of barriers to homework completion and reduce undue emphasis on the motivation of patients and families. We define "homework adherence" as including both quantity and quality of homework completed outside of session, and we will measure this construct using a clinician-rated Likert-type scale used in previous studies of pediatric OCD (e.g., Franklin, Foa, & March, 2003; Franklin et al., 2011).

Despite these limitations for this field of study, previous meta-analytic research suggests a significant effect of homework adherence during CBT on symptom improvement for adults with a range of mental health concerns ($r = 0.22$ to 0.26; Kazantzis, Deane, & Ronan, 2000; Mausbach et al., 2010). For adults with OCD, many studies have found a relationship between clinician-rated homework adherence and improved ERP treatment outcomes (Anand, Sudhir, Math, Thennarasu, & Janardhan Reddy, 2011; Simpson et al., 2011, 2012, 2021; Wheaton, Gershkovich, Gallagher, Foa, & Simpson, 2018; Whittal, Thordarson, & McLean, 2005). De Araujo, Ito, and Marks (1996) found that homework adherence within one week of starting treatment (measured as the quantity of homework assignments completed) was the best predictor of treatment outcome for adults with OCD, which may suggest that patients who complete homework early in treatment demonstrate a positive treatment response trajectory. Moreover, Simpson et al. (2012) found that clinician-rated homework adherence (defined as encompassing both quantity and quality of homework completed) predicted OCD treatment outcome not only immediately after treatment completion but also at 6-month follow-up, indicating a lasting effect of homework adherence during treatment on symptom severity after treatment ends.

Research on homework adherence within pediatric populations is more limited but has generally yielded similar findings. Park et al. (2014) found that clinician-rated homework adherence (including both quantity and quality) was associated with improved treatment outcomes for youth ages 8 to 17 with OCD. Similarly, Olatunji et al. (2015) found that greater clinician-rated homework adherence (including both quantity and quality) measured at one treatment session was associated with lower OCD symptom severity at the next session for patients ages 12 to 18 receiving ERP plus medication. This study also found that OCD symptom severity did not predict homework adherence in the following week, indicating that symptom improvement was not the reason for increased homework adherence, but rather that homework adherence was preceding improvement in OCD symptoms. These findings suggest that homework adherence plays a key role in youth OCD treatment outcomes, possibly by increasing treatment dose and allowing for more opportunities to generalize session content. Still, current research literature examining homework adherence in pediatric populations with OCD is limited, and to date, no studies have examined homework adherence for young children with early-onset OCD. More research is needed to further examine homework adherence in pediatric populations, particularly for children with early-onset OCD.

In summary, children with early-onset OCD represent one group of patients at increased risk of poor treatment outcome, possibly due to developmental factors that affect treatment engagement and distress tolerance. Family-based CBT aims to address these developmental limitations by training caregivers to employ treatment skills outside of session. This treatment "homework" can function to increase treatment dose and skill generalization for caregivers and children who are homework adherent. Previous research supports the notion that homework adherence is associated with improved OCD treatment outcome for both adults and children, and some studies suggest that homework adherence precedes OCD symptom improvement. Still, no studies have examined homework adherence during family-based CBT for early-onset OCD.

The current study aimed to address this gap by examining caregiver and child homework adherence during family-based CBT for early-onset OCD. First, we aimed to describe and compare caregiver and child homework adherence during family-based CBT. We hypothesized that both caregivers and children would be rated as moderately adherent throughout treatment, as is consistent with previous research on homework adherence during CBT (e.g., Gaynor, Lawrence, & Nelson-Gray, 2006; Park et al., 2014), but that caregivers would be rated

as more highly adherent than children given young children's often limited ability to independently generalize treatment lessons to contexts outside of treatment. We also hypothesized a strong, positive association between caregiver and child homework adherence, as is consistent with the theory that caregivers who complete homework influence their children to do the same. Second, we aimed to examine the relationship between family homework adherence and OCD symptom improvement over the course of treatment. We hypothesized that high homework adherence would be associated with and precede reduction in OCD symptom severity over the course of treatment. Finally, we conducted a post-hoc analysis to assess whether results of our second aim differed when caregiver and child homework adherence were examined individually.

2. Method

2.1. Participants

Participants included 63 children ages 5 to 9 ($M = 7.4$, $SD = 1.2$) who received a primary diagnosis of OCD and received family-based CBT with their caregiver(s) as part of a randomized controlled trial (Freeman, Sapyta, et al., 2014). Participants were enrolled in the randomized controlled trial across three different study sites: Brown University ($n = 23$), Duke University Medical Center ($n = 18$), and University of Pennsylvania ($n = 22$). The sample of participants was 62% female, 94% White, and 95% non-Hispanic. The average CY-BOCS severity score at baseline was 25, indicating severe OCD symptoms. Participants lived either with one (6%) or both (91%) biological parents. The majority of mothers (81%) and fathers (70%) had at least a Bachelor's-level college degree. The average annual family income for participants in the sample was $80,000 to $90,000 ($SD$ = $20,000 to $30,000). See Table 1 for additional demographic information and see Table 2 for additional diagnostic information.

2.2. Measures

Homework Adherence. Caregiver homework assigned during treatment included the completion of planned exposure activities (which often involved a planned decrease in caregiver accommodation) with their child as well as naturalistic reduction in accommodation outside of the context of planned exposure tasks. Child homework assigned during treatment included the completion of planned exposure activities without engaging in avoidance or compulsive behavior, as well as naturalistic reduction in avoidance and compulsive behavior outside of the context of planned exposure tasks. Clinicians were instructed to rate caregiver and child homework adherence using the following prompt: "In reviewing homework with the family, the therapist should globally assess both the quality and quantity of the family's practice of techniques learned in session." Clinicians used clinical judgement to assess quality of homework adherence, such as by assessing the extent to which a caregiver provided accommodation during exposure and the extent to which a child engaged in compulsions during exposure. Clinicians rated caregiver and child homework adherence individually using a three-point Likert-type scale with items "Little or no compliance" (e.g., completing no assigned tasks, completing few tasks of poor quality; scored as 0), "Some compliance" (e.g., completing half of all assigned tasks; scored as 1), and "Completely or mostly compliant" (e.g., completing most or all assigned tasks with high quality; scored as 2). Clinicians were also given the option to indicate "Not applicable to protocol" if caregivers or children were not expected to complete homework during a given week. Of note, this measure does not allow for a clear differentiation between patients who completed a high quantity of low-quality homework and those who completed a low quantity of high-quality homework. While the psychometric properties of the homework adherence measure used in this study have not yet been established, this measure has been used in past studies examining homework adherence during CBT for pediatric anxiety and OCD (e.g., Franklin et al., 2003; Franklin et al., 2011).

Table 1
Demographic characteristics of the study sample.

	Frequency/N	Percent
Child race		
White	59/63	94%
Black	1/63	2%
Multi-racial	1/63	2%
Asian	0/63	0%
Not reported	2/63	3%
Child ethnicity		
Non-Hispanic	60/63	95%
Hispanic	3/63	5%

Table 2
Diagnostic characteristics of the study sample at baseline.

	Frequency/N	Percent
Obsessive Compulsive Disorder	63/63	100%
Anxiety Disorder	30/63	48%
Separation Anxiety Disorder	8/63	13%
Specific Phobia	16/63	25%
Social Anxiety Disorder	4/63	6%
Generalized Anxiety Disorder	12/63	19%
Depressive Disorder Not Otherwise Specified	1/63	2%
Tic Disorder	13/63	21%
Tourette's Disorder	7/63	11%
Chronic Motor Tic Disorder	2/63	3%
Chronic Vocal Tic Disorder	1/63	2%
Externalizing Disorder	18/63	29%
Attention Deficit Hyperactivity Disorder	8/63	13%
Oppositional Defiant Disorder	12/63	19%
Enuresis	2/63	3%

Symptom Severity. The Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Scahill et al., 1997) was administered by independent evaluators to assess child OCD severity at baseline, week 5, week 9, and post-treatment (week 14). The CY-BOCS is considered the 'gold--standard' clinician-rated measure of OCD severity in youth and its psychometric properties are well established (Rapp, Bergman, Piacentini, & Mcguire, 2016; Storch et al., 2004). Clinicians rated the CY-BOCS using caregiver and patient reports of OCD symptoms, although the extent to which patients could report on their OCD symptoms varied by age and developmental ability. Only total severity scores on the CY-BOCS were examined in the current study.

2.3. Procedure

Treatment procedure. Informed consent was obtained from all participants in the study. All participants received family-based CBT as part of a randomized controlled trial. Treatment consisted of once weekly outpatient visits with doctoral-level psychologists. Treatment content included caregiver and child education on the nature and treatment of OCD, instruction in and completion of exposure and response prevention during treatment sessions, and caregiver behavioral management training. Caregiver behavioral management training included instruction in providing differential attention towards child's OCD symptoms (e.g., ignoring rituals, rewarding exposure practice) and modeling and scaffolding of treatment tools. The treatment model was tailored to fit the sample's young age. Developmental modifications included the simplification of abstract treatment content to facilitate child understanding, increased caregiver involvement in treatment, and focus on the ways in which caregivers respond to children's OCD symptoms. Treatment was provided for up to 12 sessions delivered over 14 weeks. The treatment model included weeks 11 and 13 as "skip weeks," during which sessions were not held, in order to prepare patients for the end of treatment. Participants also had the option to end treatment early and

still complete study assessments. Eight participants (13%) ended treatment before week 14. Additional treatment procedures, as well as recruitment and assessment procedures and primary outcomes of the randomized controlled trial, are described elsewhere (Freeman, Sapyta, et al., 2014; Skriner et al., 2016).

Data collection procedure. At each applicable treatment session, treating clinicians rated caregivers' and children's homework adherence over the past week. Caregivers were not expected to complete homework during week 1 as homework would not have been assigned before treatment started, and children were not expected to complete homework during weeks 1, 2 and 3 because these first weeks of treatment focused on caregiver psychoeducation and behavioral management training. Homework adherence ratings were likewise not collected during weeks 11 and 13, because no treatment sessions were held on these weeks. Thus, these timepoints were rated as "Not applicable to protocol" and were excluded from analysis.

Data analysis procedure. We used SPSS version 26 (IBM, 2019) to examine homework adherence and the association between caregiver and child homework adherence. First, we examined frequencies of homework adherence ratings and conducted an independent samples *t*-test to compare caregiver and child homework adherence. Second, we estimated a Pearson's correlation to examine the association between caregiver and child homework adherence. Lastly, we used structural equation modeling in Mplus version 8.2 (Muthén & Muthén, 2012) to examine the effects of homework adherence on child OCD symptom severity throughout treatment. A weighted least squares estimator (WLSMV) was used for the model, as is appropriate for categorical and non-normally distributed data (Brown, 2006) such as the homework adherence ratings. Latent variables ("Homework Adherence Weeks 2–5, " "Homework Adherence Weeks 6–9," and "Homework Adherence Weeks 10–14") were created using caregiver and child homework adherence ratings from weeks 2–5, 6 to 9, and 10 to 14, respectively. We controlled for covariance between caregiver and child homework adherence ratings for each week (e.g., Caregiver Homework Adherence Week 1 with Child Homework Adherence Week 1). CY-BOCS severity scores at baseline, week 5, week 9, and week 14 were also included in the model. Paths were estimated between CY-BOCS severity scores and subsequent homework adherence (to assess whether improvement in symptoms enforced homework adherence) and between homework adherence and subsequent CY-BOCS severity scores (to assess whether homework adherence led to improvement in symptoms). We obtained fully standardized estimates with respect to the means and variances of observed dependent, independent, and latent variables using Mplus STDYX output. We evaluated the model fit using the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI). We inferred good model fit with values of less than 0.08 for the RMSEA and greater than 0.90 for the CFI and TLI. Missing data were minimal (2%–3%) and were excluded from data analysis.

3. Results

3.1. Aim 1: Rate of and relationship between caregiver and child homework adherence during family-based CBT for OCD

Both caregivers and children were generally rated as highly homework adherent. Across all weeks of treatment, 74% of homework adherence forms indicated that caregivers were "mostly or completely compliant" and 68% indicated that children were "mostly or completely compliant." See Table 3 for frequencies of caregiver and child homework adherence ratings. Caregiver homework adherence was strongly and positively associated with child homework adherence ($r = 0.72$, $p < .001$). An independent samples *t*-test indicated that, on average, caregivers ($M = 1.7$, $SD = 0.5$) were more homework adherent than children, ($M = 1.62$, $SD = 0.6$; $t(1014) = 2.49$, $p = .013$). Homework adherence was stable over treatment course for caregivers and children (see Fig. 1).

Table 3
Caregiver and child homework adherence ratings across all treatment sessions.

	Frequency/N	Percent	Valid Percent
Caregiver			
Completely or mostly compliant (2)	458/693	66.1%	74.0%
Some compliance (1)	138/693	19.9%	22.3%
Little or no compliance (0)	23/693	3.3%	3.7%
Not applicable to protocol	2/693	0.3%	
Missing due to early discharge	52/693	7.5%	
Missing data	20/693	2.9%	
Child			
Completely or mostly compliant (2)	340/693	49.1%	67.7%
Some compliance (1)	132/693	19.0%	26.3%
Little or no compliance (0)	30/693	4.3%	6.0%
Not applicable to protocol	130/693	18.8%	
Missing due to early discharge	50/693	7.2%	
Missing data	11/693	1.6%	

Note: Valid Percent excludes missing data.

3.2. Aim 2: Relationships between family (caregiver and child) homework adherence and OCD symptom severity over treatment course

The structural equation model fit the data well, (RMSEA = 0.06; CFI = 0.95, TLI = 0.94). CY-BOCS symptom severity at baseline was significantly and positively associated with CY-BOCS symptom severity at week 5, CY-BOCS symptom severity at week 5 was significantly and positively associated with CY-BOCS symptom severity at week 9, and CY-BOCS symptom severity at week 9 was significantly and positively associated with CY-BOCS symptom severity at week 14 (post-treatment). Similarly, homework adherence from weeks 2–5 was significantly and positively associated with homework adherence from weeks 6–9 and homework adherence from weeks 6–9 was significantly and positively associated with homework adherence from weeks 10–14. Homework adherence from weeks 2–5 and 6 to 9 were not associated with CY-BOCS symptom severity at week 5 or week 9, but homework adherence from weeks 10–14 was significantly and negatively associated with CY-BOCS symptom severity at week 14 (post-treatment). Model paths are presented in Fig. 2. Path coefficients are presented in Table 4.

3.3. Post-hoc analysis: Relationships between caregiver and child homework adherence, individually, and OCD symptom severity over treatment course

Examined separately, both caregiver-only (RMSEA = 0.05; CFI = 0.96, TLI = 0.95) and child-only (RMSEA = 0.08; CFI = 0.91, TLI = 0.88) structural equation models fit the data fairly well. Results of these models did not differ from those of the combined caregiver and child model examined in Aim 2. Path coefficients for caregiver-only and child-only models are presented in Tables 5 and 6, respectively.

4. Discussion

These findings provide insight into the nature and importance of caregiver and child homework adherence during family-based CBT for early-onset OCD. In our sample, the majority of caregivers and children demonstrated high homework adherence. The rate of homework adherence was higher than expected and contrasts previous studies that have found lower rates of homework adherence during CBT (e.g., Gaynor et al., 2006; Park et al., 2014). It is likely that the high rate of homework adherence found in this study is due in part to unique characteristics of the participant sample (e.g., higher caregiver education level and higher socioeconomic status, which may be associated with greater mental health literacy, more free time to complete homework, and/or fewer life stressors that impede homework adherence). The high rate of homework adherence in this sample may also be explained by unique characteristics of the clinicians delivering the intervention. This

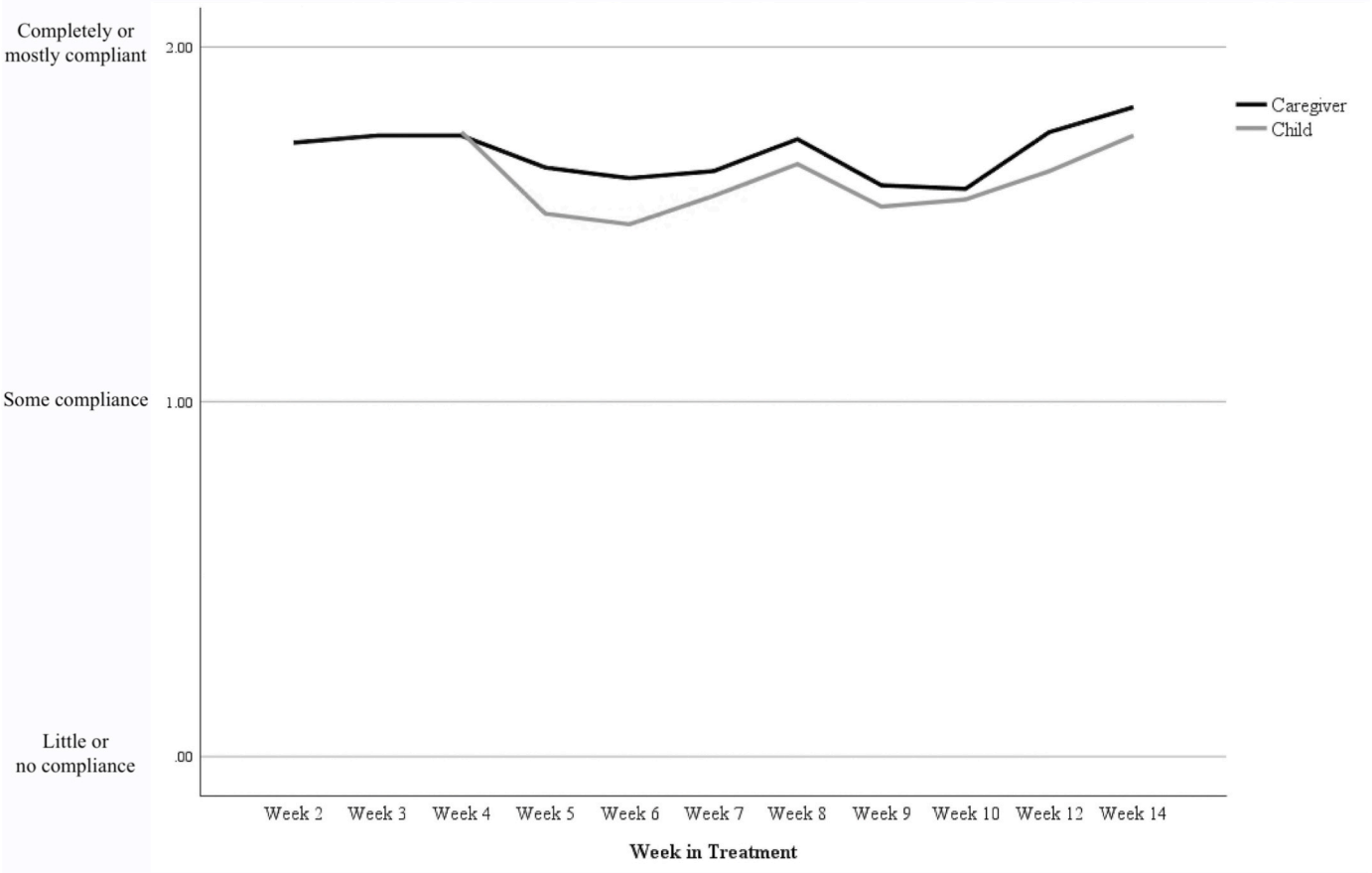

Fig. 1. Average clinician ratings of caregiver and child homework adherence over treatment course.

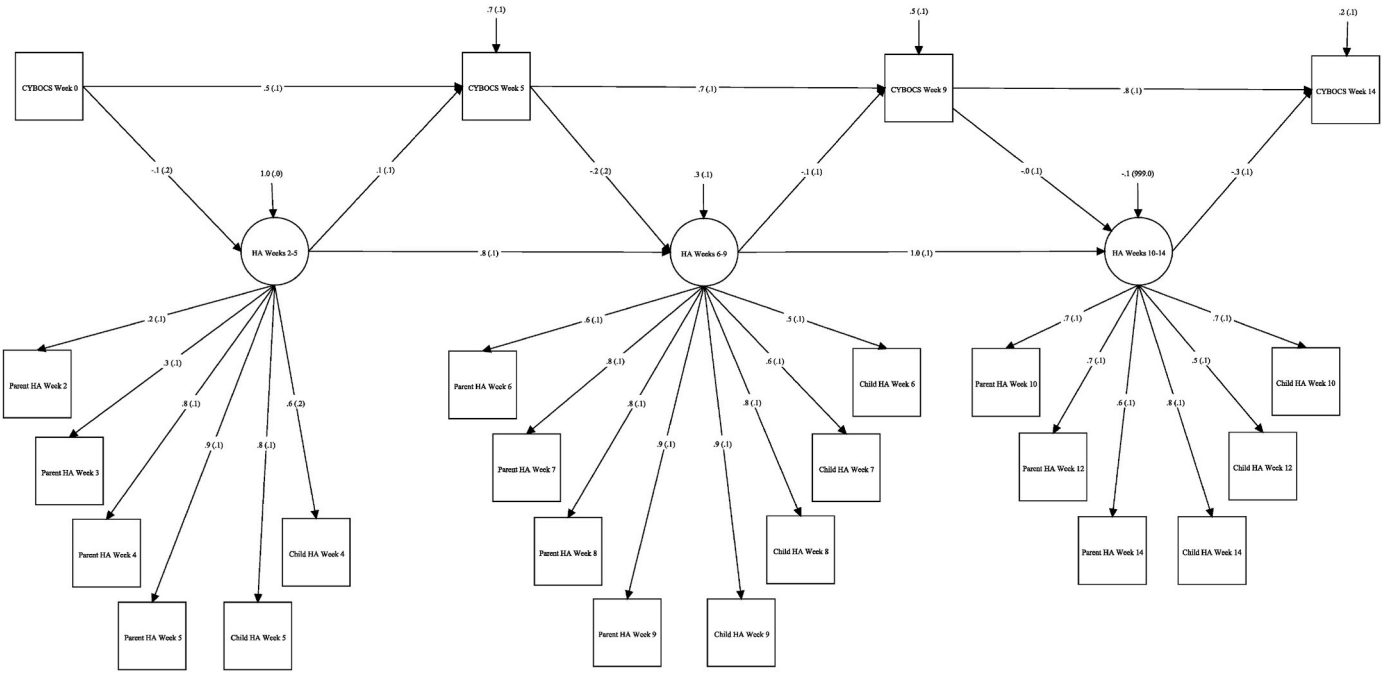

Fig. 2. Structural equation model path diagram of associations between family homework adherence and CY-BOCS symptom severity over treatment course. Note: HA = Homework Adherence (Caregiver and child).

Table 4
Structural equation model path estimates of associations between family homework adherence and OCD symptom severity over treatment course.

Path	Estimate	Standard Error	Two-tailed p value
CY-BOCS Week 0 to Family Homework Adherence Weeks 2–5	−0.09	0.18	0.61
CY-BOCS Week 0 to CY-BOCS Week 5	0.54	0.10	<.001[a]
Family Homework Adherence Weeks 2–5 to CY-BOCS Week 5	0.09	0.14	0.53
Family Homework Adherence Weeks 2–5 to Family Homework Adherence Weeks 6–9	0.81	0.09	<.001[a]
CY-BOCS Week 5 to Family Homework Adherence Weeks 6–9	−0.16	0.15	0.29
CY-BOCS Week 5 to CY-BOCS Week 9	0.72	0.07	<.001[a]
Family Homework Adherence Weeks 6–9 to CY-BOCS Week 9	−0.08	0.08	0.33
Family Homework Adherence Weeks 6–9 to Family Homework Adherence Weeks 10–14	1.04	0.08	<.001[a]
CY-BOCS Week 9 to Family Homework Adherence Weeks 10–14	−0.04	0.12	0.74
CY-BOCS Week 9 to CY-BOCS Week 14	0.76	0.08	<.001[a]
Family Homework Adherence Weeks 10–14 to CY-BOCS Week 14	−0.29	0.07	<.001[a]

[a] Indicates statistical significance.

Table 5
Structural equation model path estimates of associations between caregiver homework adherence and OCD symptom severity over treatment course.

Path	Estimate	Standard Error	Two-tailed p value
CY-BOCS Week 0 to Caregiver Homework Adherence Weeks 2–5	−0.08	0.18	0.66
CY-BOCS Week 0 to CY-BOCS Week 5	0.52	0.10	<.001*
Caregiver Homework Adherence Weeks 2–5 to CY-BOCS Week 5	0.16	0.12	0.19
Caregiver Homework Adherence Weeks 2–5 to Caregiver Homework Adherence Weeks 6–9	0.73	0.10	<.001*
CY-BOCS Week 5 to Caregiver Homework Adherence Weeks 6–9	−0.18	0.16	0.26
CY-BOCS Week 5 to CY-BOCS Week 9	0.74	0.07	<.001*
Caregiver Homework Adherence Weeks 6–9 to CY-BOCS Week 9	−0.05	0.08	0.49
Caregiver Homework Adherence Weeks 6–9 to Caregiver Homework Adherence Weeks 10–14	1.09	0.11	<.001*
CY-BOCS Week 9 to Caregiver Homework Adherence Weeks 10–14	0.08	0.13	0.56
CY-BOCS Week 9 to CY-BOCS Week 14	0.79	0.07	<.001*
Caregiver Homework Adherence Weeks 10–14 to CY-BOCS Week 14	−0.28	0.07	<.001*

* Indicates statistical significance.

Table 6
Structural equation model path estimates of associations between child homework adherence and OCD symptom severity over treatment course.

Path	Estimate	Standard Error	Two-tailed p value
CY-BOCS Week 0 to Child Homework Adherence Weeks 4–5	−0.18	0.17	0.27
CY-BOCS Week 0 to CY-BOCS Week 5	0.49	0.10	<.001*
Child Homework Adherence Weeks 4–5 to CY-BOCS Week 5	−0.08	0.24	0.75
Child Homework Adherence Weeks 4–5 to Child Homework Adherence Weeks 6–9	1.40	0.49	.004*
CY-BOCS Week 5 to Child Homework Adherence Weeks 6–9	0.05	0.38	0.89
CY-BOCS Week 5 to CY-BOCS Week 9	0.68	0.07	<.001*
Child Homework Adherence Weeks 6–9 to CY-BOCS Week 9	−0.14	0.09	0.11
Child Homework Adherence Weeks 6–9 to Child Homework Adherence Weeks 10–14	0.92	0.09	<.001*
CY-BOCS Week 9 to Child Homework Adherence Weeks 10–14	−0.11	0.11	0.29
CY-BOCS Week 9 to CY-BOCS Week 14	0.71	0.09	<.001*
Child Homework Adherence Weeks 10–14 to CY-BOCS Week 14	−0.33	0.08	<.001*

* Indicates statistical significance.

study was conducted as part of a larger treatment trial (Freeman, Sapyta, et al., 2014), which was conducted following a series of other CBT treatment trials (Franklin et al., 2003, 2011) over the course of which clinician training and subsequent intervention adherence improved (Franklin et al., 2013). It is possible that the clinician training and high intervention adherence may explain higher rates of family homework adherence in this study and that these results may not be replicated in other samples. Caregiver and child homework adherence were strongly and positively correlated, possibly indicating that caregivers who complete treatment homework influence their children to do the same (e.g., if a caregiver's "homework" is to complete exposures with their child). As hypothesized, we found that caregivers were more homework adherent than children, which may be explained by young children's often limited motivation for treatment and ability to independently generalize session content to other contexts. Put together, these findings point to the possibility that caregiver homework adherence is necessary but not always sufficient for child homework adherence during family-based CBT for early-onset OCD.

Most importantly, this study provides evidence that homework adherence during family-based CBT is associated with improved treatment outcome for young children with early-onset OCD. Specifically, high homework adherence early in treatment was associated with high homework adherence in the middle of treatment, high homework adherence in the middle of treatment was associated with high homework adherence at the end of treatment, and high homework adherence at the end of treatment was associated with lower OCD symptom severity at post-treatment. There were no effects of OCD symptom severity during treatment on subsequent homework adherence, indicating that homework adherence, and not symptom reduction, was driving the relationship. Findings did not differ when we examined caregiver and child homework adherence individually. These findings are consistent with previous research in older youth (Olatunji et al., 2015; Park et al., 2014) and adult (Kazantzis et al., 2000; Mausbach et al., 2010) populations, and suggest a cumulative effect of homework adherence on treatment outcome. It is possible that homework adherence early in treatment was reinforcing (e.g., if successful homework adherence early in treatment lead to increased likelihood of future adherence) and/or that the adherence to "easier" exposure homework early in treatment paved the way for the adherence to "harder" exposure homework later in treatment, which then resulted in symptom reduction. Still, contrary to our hypothesis, there was no association between early or mid-treatment homework adherence and improvement in OCD symptom severity measured during treatment (before post-treatment). This finding supports the notion of a cumulative rather than immediate effect of homework adherence on treatment outcome. In other words, homework completed early or mid-treatment did not immediately elicit OCD symptom change in the following weeks, but rather lead to more homework adherence that ultimately improved OCD symptoms at the end of treatment. The lack of association between early and mid-treatment homework adherence with early and mid-treatment OCD symptom severity suggests that homework adherence must be sustained for many weeks in order to elicit a decrease in OCD symptoms. However, it is also possible that other variables may partially explain these findings. For example, it is likely that the difficulty of assigned homework tasks increased across treatment course such that homework assigned

later in treatment yielded a more potent dose of exposure compared to homework assigned earlier in treatment. It is also possible that families who were homework adherent throughout most weeks of treatment but exhibited reduced homework adherence at the end of treatment experienced treatment fatigue. Future research should examine whether treatment fatigue may act as a third variable that affects both homework adherence and OCD symptom outcomes. Alternatively, the lack of association between early and mid-treatment homework adherence and symptom improvement may suggest that other factors are more important than the completion of planned homework tasks for symptom improvement early in treatment. Homework adherence may be less important for symptom improvement early in treatment when session content focuses heavily on in-session exposure completion but may become more important for symptom improvement later in treatment as session content shifts towards skill generalization and relapse prevention. Lastly, it is possible that there does exist a true relationship between early and mid-treatment homework adherence and symptom improvement that was unable to be detected in the present study due to limited variability in homework adherence in this sample.

Findings from the present study can inform efforts to tailor treatment for children with early-onset OCD. Given the importance of caregiver and child homework adherence in treatment outcome, additional focus on caregiver psychoeducation early in treatment may help to support caregiver homework adherence and implementation of the treatment model outside of session. Providing this psychoeducation earlier rather than later in treatment may help to jumpstart homework adherence and put patients on a positive treatment trajectory. Clinicians should also set the expectation for caregivers that homework adherence may not result in immediate symptom reduction, but rather may have a cumulative effect on treatment outcome. Setting clear expectations related to homework adherence early in treatment may prevent caregiver or child discouragement when homework does not go as planned or does not elicit immediate symptom change. Caregiver psychoeducation may be supplemented with caregiver training on how to model distress tolerance, reduce accommodation as to promote naturalistic exposure completion, and respond effectively when a child is reluctant or unable to complete planned exposure homework (Peris & Piacentini, 2013). In this vein, caregiver training-focused interventions may be equally as effective as family-based treatment at reducing pediatric anxiety symptoms in younger children (Lebowitz, Marin, Martino, Shimshoni, & Silverman, 2020) and may lead to greater reductions in caregiver accommodation (Lebowitz et al., 2020) which may function to better sustain symptom improvement after treatment termination. Treatment may also benefit from additional session time devoted to assessing and addressing barriers to homework adherence, both on the part of the caregiver and the child. Such efforts can aid in supporting homework adherence to ultimately improve treatment outcomes for children with early-onset OCD.

This study has several limitations worth noting. First, the sample of participants included in this study lacked racial, ethnic, and socioeconomic diversity, which may limit the generalizability of the results. In our study, 93.6% of participants identified as White, which is discrepant from the US Census data from 2010 in Durham, North Carolina (49.2% White), Philadelphia, Pennsylvania (40.7% White), and Providence, Rhode Island (55.1% White) where the study took place (U.S. Census Bureau, n.d.-b). Furthermore, caregivers of participants included in this study had a higher average education level (70–80% with a Bachelor's degree or higher) than the national average (29.3%; Nietzel, 2021) and the average income (M = $80,000 to $90,000, *SD* = $20,000 to $30,000) of our sample was well above the national average of $68,259 (inflation-adjusted dollars) in 2010 (U.S. Census Bureau, n.d.-a). Our results may overestimate the typical rate of homework adherence during family-based CBT if families who participated in this study differ from other families in a way that enabled them to be more homework adherent (e.g., if higher caregiver education level or higher socioeconomic status may be associated with greater mental health literacy, more free time to complete homework, and/or fewer life stressors that impede homework adherence). A second study limitation is the lack of variability in baseline symptom severity, symptom improvement, and homework adherence among participants in the study. Participants who were included in the randomized controlled trial were those who met criteria for a primary clinical diagnosis of OCD, but whose symptoms were not so severe as needing a higher level of care beyond weekly outpatient treatment. As such, the findings would be most generalizable to other OCD specialty clinics and outpatient levels of care and may not apply to patients receiving inpatient OCD treatment or patients with multiple comorbid diagnoses and multiple treatment targets demanding energy and time (e.g., patients whose treatment homework includes both exposure for OCD and behavioral activation for depression). A majority of participants were rated as highly homework adherent and a majority of participants exhibited symptom improvement, and this variability may have decreased our power to detect true relationships among variables (i.e., false negative). While we were still able to detect a relationship between homework adherence and outcome, it is possible that there are true relationships between homework adherence and symptom improvement during treatment that we were unable to detect in the current study. Past studies have reported greater variability in homework adherence during CBT (e.g., Olatunji et al., 2015; Simpson et al., 2012) which may have allowed for greater power to detect true relationships between homework adherence and symptom outcomes across treatment course. Similarly, the restricted range of the scale used to measure homework adherence in this study (allowing only three possible rating options: "Little or no compliance", "Some compliance", and "Completely or mostly compliant") also likely limited the variability of homework adherence data in this study. This study is also limited in that we were unable to separately examine quantity and quality of homework completion, but rather examined adherence broadly using one clinician-rated item. There may be important differences between patients who complete a large quantity of low-quality homework and patients who complete a small quantity of high-quality homework that were not able to be examined in the current study. Lastly, as previously mentioned, research on homework adherence is limited by the absence of a widely used, standardized measure of this construct. In this vein, the psychometric properties of the homework adherence measure used in the study have not been established and we did not examine clinician reliability in rating homework adherence. However, this measure has been used in many other studies examining homework adherence during outpatient CBT for youth (e.g., Franklin et al., 2003; Franklin et al., 2011).

Future research should address these limitations and continue to examine the role homework adherence plays in treatment outcomes for children with OCD. Specifically, studies should assess homework adherence across different racial, ethnic, cultural, and socioeconomic populations to examine whether these factors affect the rate of homework adherence and/or the effects of homework adherence on treatment outcome. Further research should also examine the rate and effects of homework adherence for youth with more severe OCD symptoms (e.g., those who receive inpatient treatment). In addition, studies should examine third variables such as caregiver distress tolerance that affect homework adherence and potentially mediate the relationship between homework adherence and treatment outcome. Additional studies should examine novel ways to measure quantity and quality of homework completion, such as by using ecological momentary assessment to collect data from patients and caregivers throughout the week in between treatment sessions rather than relying on patient and caregiver recall during weekly treatment sessions. Finally, future research should examine barriers to homework adherence (e.g., family understanding of the treatment model, distress tolerance, treatment fatigue) and strategies to improve homework adherence for patients and caregivers who report low adherence (e.g., additional caregiver training in exposure). Through this research, we can facilitate skill utilization outside of session and improve treatment outcomes for children with OCD.

Declaration of interest

Given Dr. Martin Franklin's role on the Editorial Board for the Journal of Obsessive Compulsive and Related Disorders, he will have no involvement in the peer-review of this article and will have no access to information regarding its peer-review. All other authors have no competing interests to report.

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Author statement

Michael Walther conceptualized the study topic and design, conducted preliminary analyses, and reviewed the manuscript. Lauren Milgram conducted data cleaning and analysis and wrote the Method and Results sections of the manuscript. Grace Cain conducted the literature review and wrote the Introduction section of the manuscript. Kate Sheehan assisted with the literature review and wrote the Discussion section of the manuscript. Richard N. Jones provided statistical counsel, assisted with data analysis, and reviewed the manuscript. Jennifer Herren, Kristen Benito, and Abbe Garcia assisted with data collection in the larger trial of which this study is part. Jeffrey Sapyta, Martin Franklin, Jennifer Freeman conducted the larger trial of which this study is part, assisted with study design, reviewed the manuscript and provided edits.

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