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Research Article

THE IMPACT OF NEUROPSYCHOLOGICAL FUNCTIONING ON TREATMENT OUTCOME IN PEDIATRIC OBSESSIVE–COMPULSIVE DISORDER

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Background: *Scant research has examined the effect of neuropsychological (NP) functioning on treatment outcome in pediatric obsessive–compulsive disorder (OCD). This study sought to address this gap in existing research.* **Methods:** *A total of 63 youths were included in this study and asked to complete the Rey-Osterrieth Complex Figure (ROCF) and specific subtests of the Wechsler Intelligence Scale for Children, Third Edition (WISC-III).* **Results:** *Analyses suggest that 5 min recall accuracy (raw score) and percent recall from the ROCF, assessed before treatment may be predictors of treatment response among children with OCD. What is more, exploratory post hoc analyses indicated that performance on these ROCF tasks is particularly relevant among youths receiving cognitive-behavior therapy (CBT) alone. These results may be driven by executive functioning ability. Additional analyses suggest a relationship between age, symptom severity, and NP functioning on select tasks from both the ROCF and WISC-III.* **Conclusions:** *Although alternative explanations exist, these findings suggest that poorer performance on the ROCF and, in turn, poorer response to treatment, particularly among those youths receiving CBT alone, may be due to executive functioning difficulties. Clinicians and researchers should be sensitive to this fact and may warrant modification(s) to existing treatment protocols. Limitations to this study, however, suggest the need for replication and extension of these findings in the future. Depression and Anxiety 27:365–371, 2010.*

Key words: *OCD; children; neuropsychological; treatment; executive functioning*

Obsessive–compulsive disorder (OCD) is characterized by intrusive thoughts, impulses, or images resulting in significant distress or anxiety (e.g., obsessions) and a myriad of circumscribed behaviors (e.g., compulsions or rituals)[1] designed to reduce or eliminate these obsessions. Research suggests that OCD runs a chronic and impairing course and affects between 1.5 and 2.2 million children and adolescents (hereafter referred to as youths) in the United States (2–3% prevalence rate).[2,3] Recently, a small yet growing body of research has developed examining neuropsychological (NP) functioning in these youths in an attempt to better understand the etiology of this disorder and, germane to the present investigation, how NP functioning may impact treatment efficacy.

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Neuroimaging and neurobiological research in adult OCD has indicated abnormalities in frontal–striatal circuits.[4] NP studies of adults with OCD have demonstrated impairment in a number of cognitive domains, including visual memory[5,6] and organization [as assessed via the Rey-Osterrieth Complex Figure (ROCF)].[7] However, few studies have examined these impairments in youths.[8–10] Recently, Andres et al.[8] compared the NP functioning of 35 youths with OCD to that of 35 age- and gender-matched controls. Results revealed that those with OCD performed significantly worse on verbal and visual memory (as assessed via the Logical Memory and Visual Reproductive tests of the Wechsler Memory Scale and the ROCF), perceptual organization (as assessed via the ROCF), set shifting and flexibility (as assessed via the Wisconsin Card Sort Test), and velocity tasks (as assessed via time to copy ROCF). After controlling for the possible confounding effects of depressive symptoms, however, deficits in verbal memory were no longer present. These authors also found that deficits were not related to age, symptom severity, or pharmacological treatment. Additional research has noted the absence of or only minimal difference in NP functioning among youths with OCD and controls.[9–11] This absence of differences could be related to the fact that no study, to our knowledge, has examined NP functioning among youths with OCD with a sample greater than 35 participants. Discrepancy between available empirical evidence and small sample sizes highlights the need for additional research in this area.[12] Given recent findings by Andres et al.[8] and similar findings within the adult OCD literature, further examination as to the role executive functioning (i.e., organizational ability) plays in OCD is warranted.

As alluded to above, due to scant research, important questions have yet to be answered regarding the role of NP functioning in childhood OCD. In particular, markedly little is known regarding the impact of NP functioning on treatment outcome. Several studies, however, have examined this topic among adults with OCD.[13–16] These findings are mixed. Katrin Keulz et al.[14] found that, at baseline, adults with OCD exhibited significantly greater impairment in several areas of NP functioning than healthy controls, most notably relating to set-shifting (e.g., Trail Making Test B), organization and nonverbal memory (e.g., ROCF), and set shifting and flexibility (e.g., Trail Making Test B). Twelve weeks later, after those in the OCD group completed a course of cognitive-behavior therapy (CBT) for their symptoms of OCD, a group (i.e., controls versus OCD) × time interaction was found with respect to tasks of nonverbal memory (i.e., ROCF-30-min delayed recall), organization (i.e., ROCF-organization), set shifting, and flexibility. In particular, participants classified as "major responders" ($n = 15$) performed comparably to healthy controls on all cognitive measures at post-treatment (12-week) follow-up. Conversely, Nielen and den Boer[16] found no changes in NP functioning from pre- to post-treatment with fluoxetine. One potential explanation for these discrepant findings may be that cognitive functions corresponding to the orbitofrontal feedback-loop are more sensitive to CBT.[14] In turn, changes in this feedback-loop may have a direct effect on symptoms of the disorder. Given the dearth of childhood OCD literature in this area, it would be interesting to examine the impact of a child's NP functioning on treatment outcome.

To date, only one study has sought to examine the influence of NP functioning on treatment outcome in pediatric OCD,[17] although two other studies have examined changes in the brain following treatment using magnetic resonance imaging.[18,19] Recently, Andres et al.[17] compared youths with OCD ($n = 29$) to healthy controls ($n = 22$) and found that those with OCD performed worse on tests of memory, processing speed, and executive functions at pre-treatment. However, these group differences were no longer present after 6 months of CBT and are similar to analogous research conducted among adults. However, to date, this is the lone study to examine, to any degree, the effect of any form of treatment on NP functioning among youth with OCD. Therefore, additional research is clearly warranted. In particular, it would be interesting to assess, as has already been undertaken in adult OCD research,[13] the impact of NP functioning at pre-treatment on treatment outcome. In addition, researchers should explore possible differential effects among youths receiving CBT compared to pharmacotherapy. To our knowledge, research of this nature does not exist within either the child or adult OCD literature and will be addressed in the present study.

This study is exploratory in nature. Based, in part, on prior child and adult OCD research, this study seeks to further examine organization and immediate visual memory [as measured by the ROCF[20]] among youths with OCD. Processing speed, working memory, and visuoconstructional ability [as measured by specific subtests of the Wechsler Intelligence Scale for Children, Third Edition (WISC-III)[21]] will also be assessed within a smaller sample. This assessment battery will provide an opportunity to examine whether differences in NP functioning (as assessed via the ROCF and WISC-III subtests described above) at pre-treatment exist between youths receiving treatment for their symptoms of OCD classified as treatment responders and nonresponders. In an exploratory analysis, this study will also examine whether differences are more marked among children receiving CBT alone, pharmacotherapy alone, or combination (i.e., CBT+pharmacotherapy). Finally, to provide some basis for comparison to earlier research,[8] we will also examine the relationship between symptom severity, and NP functioning.

METHODS

PARTICIPANTS

Participants were recruited as a part of a larger study, the Pediatric OCD Treatment Study (POTS), examining the efficacy of CBT alone, pharmacotherapy alone (i.e., sertraline), and combined therapy, as compared to placebo for the treatment of youths (7–17 years of age) with OCD.[22] The background, rationale, and procedures for the POTS have been described elsewhere.[23] Before participation in the study, informed consent was obtained.

Inclusion and exclusion criteria for the POTS have been documented in detail elsewhere.[22,23] Of note, participants were required to obtain an intelligence quotient (IQ) greater than 80 extrapolated from the block design and vocabulary subtests (scaled score > 6) of the WISC-III.[21] If participants underwent prior NP testing, a report verifying an IQ greater than 80 or, if this report was not available, verbal confirmation by the parent as to the child's IQ was required for inclusion into the POTS. For this study, participants were also required to have completed the ROCF[20] during their baseline assessment. In total, 63 youths met inclusion criteria for this study. The sample was 50.8% boys ($n = 32$) and predominantly Caucasian 93.7% ($n = 59$). Participants ranged in age from 7 to 17 years old ($M = 11.8$, $SD = 2.6$). Per data obtained via administration of the Anxiety Disorder Interview Schedule for Children (ADIS-C),[24] generalized anxiety disorder (GAD: 39.7%, $n = 25$), specific phobia (28.6%, $n = 18$), separation anxiety disorder (SAD: 17.5%, $n = 11$), tic disorder (17.5%, $n = 11$), ADHD (14.3%, $n = 9$), and oppositional defiant disorder (ODD: 11.1%, $n = 7$) were among the most common comorbid diagnoses.

INSTRUMENTS

Children's Yale-Brown Obsessive–Compulsive Scale (CY-BOCS)[25]. The CY-BOCS is a clinician-administered instrument assessing OCD symptom severity in youths. The scale demonstrates good psychometric properties.[25] The protocol set forth in the POTS study employed CY-BOCS ratings based on data collected from both the child and his/her parent(s) jointly. Therefore, data reported herein represent consensus data provided by both parties as obtained via an independent evaluator (IE), who was blind to treatment condition.

Conners' Parents Rating Scale—Revised: Long (CPRS-R: L)[26]. The CPRS-R: L is an 80-item parent-report measure assessing various domains of relevance to ADHD and demonstrates good psychometric properties.[27] For the purposes of this study, only the ADHD index score subscale was utilized to provide a measurement of ADHD symptomatology.

Child Depression Inventory (CDI)[28]. The CDI is a 27-item self-report scale assessing depression in children and demonstrates good psychometric properties.[28]

Wechsler Intelligence Scale for Children, Third Edition (WISC-III)[21]. The WISC-III is designed to assess intellectual functioning in youths between the ages of 6 and 17 years and demonstrates good psychometric properties.[21] For the purposes of the POTS study, only the Vocabulary, Information, Block Design, Object Assembly, and Coding subtests were administered. These subtests assess a variety of domains related to intellectual functioning in children, including crystallized intelligence (e.g., Information and Vocabulary), processing speed (aka Coding), and visual processing (e.g., Block Design and Object Assembly).[29]

ROCF[20]. The ROCF is designed to assess planning and organizational skills, problem solving, motor functioning, and perceptual and memory abilities.[30,31] Participants were asked to copy the figure and reproduce it from memory after 5 min (5 min recall) without prior warning.[1]

Accuracy for the copy and 5 min recall conditions was scored using a system in which the figure is broken down to 18 elements. The elements are given 0.5–2.0 points depending on distortion, accuracy, and location of reproduction for a total of 36 points. Normative data for ages 6 and older from Kolb and Whishaw[32] was used to derive standard scores for the copy accuracy condition. Raw data were used for the 5 min recall accuracy condition, because adequate normative data are not available for children.

Organizational strategy used for both the copy and 5 min recall conditions was also assessed.[7] Participants obtained up to six points for drawing different structural elements (base rectangle, vertical midline, horizontal midline, diagonals, vertex of triangle) as unfragmented units during the copy and immediate recall tasks.[7] Raw scores were used for examining organization, because normative data were unavailable. Percent recall was calculated [(ROCF 5 min recall raw score/ROCF copy raw score) $\times$ 100] in an attempt to remove the effects of the levels of participants' performances on the copy administration from the memory performance.[33]

PROCEDURE

Entrance into the larger study[22] took an average of 2–3 weeks and proceeded through 4 entry gates: (1) telephone screening, (2) review of youth- and parent-report measures, (3) consent and assessment of all inclusion and exclusion criteria, and (4) baseline assessment and randomization to treatment condition. Consequently, administration of the WISC-III (if applicable) and its subtests occurred during Gate 3, while administration of the ROCF (copy and 5 min recall) occurred during Gate 4 (baseline assessment). Patients were randomly assigned to treatment conditions. All youths were assessed at baseline and at 4-, 8-, and 12-weeks (including administration of the CY-BOCS) though these later time points did not include administration of any NP measures.

Reliability. All IEs were trained to reliability on the ADIS-C and CY-BOCS through joint interviews, videotape reviews, and discussion and all were blind to treatment condition.[23] Inter-rater reliability data were also computed for scoring of the ROCF. Twenty-one percent ($n = 13$) of the ROCFs were scored by both a primary (AA) and secondary rater blind to treatment condition (CAF) with reliability assessed for both the organization and accuracy raw score totals at Time 1 (copy) and Time 2 (immediate recall). The secondary rater was blind to the primary rater's scores. Reliability was high for both the organization ($r = .87$ and .89) and accuracy raw score ($r = .92$ and .98) totals, respectively. Consequently, all subsequent analyses utilized the primary rater's scores.

Statistical analyses. To examine the study's primary aim, youths were classified into two groups (treatment responders versus nonresponders) based on post-treatment (12-week) CY-BOCS scores. Treatment responders were determined using criteria set forth in earlier research.[22] Specifically, youths demonstrating a CY-BOCS score less than or equal to 10 (corresponding to clinical remission or only trace symptoms of OCD) at their 12-week (end of acute treatment) assessment were categorized as a "treatment responder." Subsequently, analyses of variance or covariance (ANOVAs or ANCOVAs, respectively) were used to examine whether NP

[1]Although the basic procedure involves asking a participant to reproduce the figure again after 30 min (delayed recall), this part of the procedure was not performed as the purposes of this study were more focused on assessing one's organizational and encoding ability as opposed to one's ability to hold visual information in memory over time.

functioning differed between youths classified into these two groups. Among those dependent variables revealing statistically significant differences between groups, responders were compared to nonresponders with respect to POTS active treatment conditions (i.e., CBT alone, pharmacotherapy alone, and combination).[2] Youths randomized to the placebo group were excluded from these analyses due to too few responders ($n = 1$). To examine this study's tertiary aim, linear regression analyses were conducted to examine whether NP functioning predicted symptom severity (as measured via CY-BOCS rating at baseline). Due to the exploratory nature of this study, an α level of .05 was used to determine statistical significance.

Identification of possible covariates. Appropriate parametric (i.e., independent samples *t*-test, Pearson correlations) and nonparametric (i.e., χ^2) testing was conducted to examine (1) whether symptoms of ADHD (as assessed via the CPRS), depression (as assessed via the CDI), age, or treatment site (i.e., University of Pennsylvania, Duke University) demonstrated a relationship to NP functioning and (2) whether participant age or treatment site were related to responder status. Only those possible covariates demonstrating a statistically significant relationship with NP functioning or treatment responder status were used as covariates. What follows is a brief overview of covariate analyses.

ADHD index scores. Results demonstrated a significant relationship between ADHD index scores and copy organization, 5 min recall organization, and percent recall on the ROCF, and the Coding and Block Design subtests of the WISC-III.

CDI scores. No statistically significant relationships were found between CDI scores and NP functioning.

Age. Results demonstrated a significant relationship between copy organization, 5 min recall accuracy (raw), copy accuracy, and age. No additional statistically significant relationships or differences were found with respect to either NP functioning or treatment responder status.

Treatment site. Five-minute recall organization score demonstrated statistically significant differences across sites. No additional statistically significant differences were found with respect to either NP functioning or treatment responder status.

RESULTS

DESCRIPTIVE DATA

ROCF. Table 1 provides descriptive statistics for participant's performance on both ROCF and WISC-III tasks. Copy accuracy standardized scores fell within the low average range. On an average, participants took 201 ($SD = 82.7$) and 138 sec ($SD = 51.6$) to complete the copy and 5 min recall tasks of the ROCF, respectively. Copy accuracy data were analyzed further to reveal that 28.6% ($n = 18$) of participants ($N = 63$) were classified as experiencing deficits [i.e., standard score>1.5 *SD*s *below* the mean (100)] on copy accuracy, while no participants demonstrated strengths (i.e., standard scores>1.5 *SD*s *above* the mean) on this task.

TABLE 1. Performance on neuropsychological measures (entire sample)

NP test	Raw score	Standardized/scaled score
ROCF conditions ($n = 63$)		
Organization: Copy	2.4 (1.3)	–
Organization: Immediate recall	2.5 (1.7)	–
Accuracy: Copy	25.5 (1.5)	85.0 (16.6)
Accuracy: Immediate recall	15.6 (6.0)	–
Percent recall	59.9% (15.5)	–
WISC subtests ($n = 43$)		
Information	19.2 (5.6)	12.2 (2.9)
Coding	56.5 (17.5)	11.5 (3.4)
Block design	41.1 (14.8)	10.2 (3.9)
Vocabulary	36.1 (9.5)	11.7 (2.5)
Object assembly	28.8 (7.7)	9.8 (2.7)

WISC-III. WISC-III subtest data were only available from 43 participants (68.3%). Results indicated that subtest scores typically fell within the average range. These data suggest that 2.3% ($n = 1$) of participants were classified as experiencing deficits [i.e., scaled scores>1.5 *SD*s *below* the mean (10)] on the Information and Coding subtests of the WISC-III with no deficits noted on the remaining subtests. In addition, 18.6% ($n = 8$), 11.1% ($n = 7$), 11.1% ($n = 7$), 7.9% ($n = 3$), and 2.4% ($n = 1$) participants demonstrated strengths (i.e., scaled scores>1.5 *SD*s *above* the mean) on the Coding, Vocabulary, Information, Block Design, and Object Assembly subtests, respectively.

TREATMENT RESPONDERS VERSUS NONRESPONDERS

ROCF. Table 2 provides descriptive data for omnibus comparisons between responders and nonresponders with respect to both ROCF and WISC-III scores. Results revealed statistically significant differences between responders and nonresponders with respect to percent recall (using ADHD scores as a covariate) [$F(1,44) = 8.54$, $P = .005$, $d = .80$] such that nonresponders were more impaired in their performance. Additional analyses revealed no significant differences between groups with respect to copy or 5 min recall accuracy (standard and raw scores, respectively) or copy and 5 min recall organization.

A follow-up hierarchical regression analysis was conducted to examine the role of copy and 5 min recall organization (i.e., tasks thought to more directly examine executive functioning ability) as predictors of 5 min recall accuracy (raw score). For this analysis, age was entered in step 1 ($R^2 = .45$, $P \leq 001$) and copy and

[2]We considered collapsing youth receiving some form of CBT or pharmacotherapy (i.e., combination) in the CBT and pharmacotherapy alone groups, respectively to increase statistical power. However, we decided against that strategy for several reasons. Most notably, results from the original POTS study suggest that individuals receiving combined treatment benefitted most with regards to reduction in their OCD-related symptoms compared to CBT alone, pharmacotherapy alone, or placebo. As a result, it is plausible to suggest that receipt of combination therapy may have buffered the impact of NP functioning on treatment outcome. Therefore, we decided it most appropriate to conduct analyses on each treatment condition separately.

TABLE 2. Neuropsychological differences between treatment responders and non-responders

NP test	Treatment responder	Non-responder	*P*-value
ROCF conditions			
Organization: Copy	3.0 (1.7); $n = 17$	23 (1.0); $n = 30$	0.243
Organization: Immediate recall	3.2 (2.2); $n = 17$	2.3 (1.4); $n = 30$	0.114
Accuracy: Copy	81.2 (16.6); $n = 18$	84.8 (17.3); $n = 37$	0.788
Accuracy: Immediate recall (raw)	17.6 (6.2); $n = 18$	14.3 (5.0); $n = 37$	0.128
Percent recall	67.0 (11.8) $n = 17$	54.7 (15.5); $n = 30$	0.005
WISC-III subtests (*scaled scores*)			
Information	13.2 (3.4); $n = 14$	11.4 (2.2); $n = 26$	0.054
Coding	11.7 (4.0); $n = 13$	11.4 (3.0); $n = 21$	0.997
Block design	11.5 (4.2); $n = 13$	10.1 (2.6); $n = 21$	0.351
Vocabulary	12.3 (1.8); $n = 14$	11.1 (2.6); $n = 26$	0.139
Object assembly	10.5 (3.0); $n = 14$	9.6 (2.6); $n = 26$	0.318

ADHD index scores, participant age, and/or treatment site (when appropriate) used as covariates in these analyses.

5 min recall organization scores in step 2. This analysis suggested that only age ($P = .003$) and 5 min recall organization ($P \leq .001$) were significant predictors of immediate recall accuracy. The final regression model (including both age and 5 min recall organization scores as predictors) accounted for 47% of the variance in 5 min recall accuracy.

In a series of exploratory analyses, responders ($n = 5$, 6, and 6, respectively) were compared to nonresponders ($n = 10$, 6, and 5, respectively) in each of the active treatment conditions (i.e., sertraline alone, CBT alone, and combination therapy) with respect to percent recall (using ADHD index scores as a covariate). Table 3 provides descriptive data with regards to treatment responders and nonresponders across each treatment condition.[3] Results revealed statistically significant differences between responders ($M = 66.9$, $SD = 11.6$) and nonresponders ($M = 47.4$, $SD = 17.1$) in the CBT alone group [$F(1,9) = 6.68$, $P = .029$, $d = 1.38$] such that nonresponders were more impaired in their performance on the percent recall task. Additional results revealed no significant differences between groups with respect to the sertraline alone or combination therapy conditions.

WISC-III. Results revealed no statistically significant differences between groups with respect to WISC-III subtests.

TABLE 3. Means and standard deviations on percent recall among treatment responders and non-responders randomized to CBT alone, pharmacotherapy alone, or combination treatment

Treatment condition	Responders	Nonresponders
CBT alone*	66.9 (11.6); $n = 6$	46.3 (18.5); $n = 6$
Pharmacotherapy alone	66.2 (10.8); $n = 5$	59.8 (8.7); $n = 10$
Combination	67.7 (16.4); $n = 5$	56.3 (13.4); $n = 4$

*$P < 0.05$.

SYMPTOM SEVERITY

A series of regression analyses were conducted to examine whether various facets of NP functioning predicted OCD severity. Results revealed that the Coding subtest (i.e., assessing processing speed) significantly predicted OCD symptom severity (as assessed via the CY-BOCS), $\beta = -.456$, $P = .002$[4] suggesting that poorer performance on this subtest was associated with more severe symptoms of OCD. No remaining ROCF tasks or WISC-III subtests were found to significantly predict symptom severity.

DISCUSSION

Few studies have sought to examine NP functioning among youths with OCD. This study is only the second study to examine the effect of NP functioning on treatment outcome among this population. Findings from this study suggest that performance on the percent recall task of the ROCF may be a useful predictor of response to treatment and, in particular, CBT, the most efficacious behavioral intervention for youths with OCD.[34] Data collected herein also contradict earlier research suggesting the absence of a relationship between participant age, symptom severity, and NP functioning.[8] Also, descriptive data suggest that a sizeable proportion of youths with OCD experience weaknesses on copy accuracy of the ROCF. The level of empirical investigation described herein is

[3]Outliers were examined for each treatment conditions. Where appropriate (i.e., sertraline alone, combination), analyses were conducted again excluding outliers. In each instance, no statistically significant differences were found between treatment responders and nonresponders on percent recall.

[4]ADHD index scores were originally included in this regression analysis. However, results from the initial model suggested that ADHD index scores was not a significant predictor of CY-BOCS scores at baseline. Therefore, reported data reflect a regression model with only one predictor variable (i.e., Coding subtest).

made possible via recruitment of a sample size ($n = 63$) nearly double that of earlier efforts.[8]

Taken together, these findings suggest that participants diagnosed with OCD who responded well to treatment demonstrated significantly better percent recall at pre-treatment than nonresponders even after controlling for symptoms of ADHD. When data were analyzed further, results suggested that nonresponders receiving CBT alone demonstrated more impaired performance than responders. Of note, organizational ability when copying the figure during the 5 min recall task (along with participant age) predicted ability to recall the information subsequently (i.e., 5 min recall accuracy). As such, it is plausible to suggest that poorer performance on the ROCF and, in turn, poorer response to treatment, particularly among those youths receiving CBT alone, may be due to executive functioning and is supported not only by empirical evidence from the current study but also evidence from the adult and recent longitudinal literature.[7,35]

Executive functioning difficulties involving the ROCF have been found in the adult OCD literature, particularly by Savage et al.[7] Savage et al. found that immediate nonverbal memory difficulties in adult OCD participants were mediated by impaired organizational strategies used during initial copy of the figure, consistent with theories indicating frontal–striatal dysfunction in OCD. More recently, a study by Grisham, Anderson, Poulton, Moffitt, and Andres[35] examined performance on NP tests among a cohort of children at 13 years of age and again at 32 years of age. Results revealed that individuals diagnosed with OCD showed premorbid impairment in visuospatial and executive functioning compared to controls. We have found similar impairments among our sample of youths with OCD.

Taken together, the findings from this study suggest several potential research and treatment implications. Future research may explore specific factors that may preclude children with executive functioning deficits from fully benefiting from behavioral treatment. Those utilizing psychotherapeutic treatment approaches to OCD may want to include strategies that address concurrent NP deficits, such as impaired organizational ability. These strategies might include outlining a succinct number of goals for treatment at the beginning and end of sessions, so that children with OCD may have an easier time with "seeing the big picture." Also, highlighting the "take home message" for each session may be helpful so that children with OCD understand the main points of each session and do not get "caught up in the details" or overwhelmed. However, it is important to note that the difference described above may also be attributable to visuospatial or other aspects of NP functioning, rather than purely executive functioning. Also, this study's ability to adequately detect significant effects specific to individual treatment conditions is limited due to small sample sizes and is in need of replication with a larger sample.

Thirty percent of the current sample evidenced deficits in copy accuracy of the ROCF. However, relatively few youths demonstrated deficits in other areas of NP functioning. These findings appear to contradict earlier research suggesting intact copy accuracy abilities on the ROCF.[8] However, that study consisted of a small total sample size of 35 participants. Collectively, data from this study do support research that suggests deficits in spatial-perceptual functioning[9] in youths with OCD, despite Andres et al.[8] results showed no differences between youths with OCD and control participants on subtests of the WISC-R, specifically Block Design and Digit Span. Of note, the parameters set forth in the POTS study (i.e., Vocabulary and Block Design scaled scores>6)[22] and the strong relationship between WISC-III subtests decreased the likelihood of participants in this study demonstrating marked deficits on other subtests. More research should be performed to clarify whether the deficits in copy accuracy noted in our study in youths with OCD are due to spatial–perceptual deficits or underlying executive functioning weaknesses.

Several limitations to this study are noteworthy. First, although the sample size is nearly double that of earlier research, relatively few youths were randomized to various treatments groups (i.e., placebo, sertraline alone, CBT alone, and combination therapy) thereby prohibiting firm conclusions about the associations with treatment responder status. Second, data for intellectual testing (i.e., WISC-III subtests) were not collected from slightly more than 30% of the current sample and consequently weakened our power to detect significant relationships/differences. These data were deemed randomly missing, and therefore we do not think it introduced bias into the results. In addition, limitations to the scope of measures administered as a part of this study preclude confirmation that participant's performance on the ROCF is due solely to executive functioning deficits. That is, it is possible that weaknesses in graphomotor skills or visual–perceptual analysis may have individually or collectively contributed to performance and suggests the need for additional research. Third, this study did not employ the use of an age- and/or gender-matched control group as has been utilized in several earlier studies.[8–11] Finally the lack of follow-up NP testing at post-treatment is an additional limitation and area for further research.

Despite the limitations noted above, this study provides an important addition to the existing empirical literature examining pediatric OCD and NP functioning among youths with OCD. The current findings suggest that organizational, and thus executive functioning, ability may play an important role in predicting treatment response, particularly among youths receiving CBT. The possible clinical implications of these findings warrant replication and further research such as obtaining a better understanding of the role cognitive ability plays in the treatment process will help clinical researchers develop new, more efficacious treatments

for pediatric OCD. It is only through continued research of this nature that we will be able to obtain a better understanding of the etiology, neuropsychology, phenomenology, and treatment of OCD.

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