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Abstract

According to the metacognitive theory, maladaptive metacognition is associated with the development and maintenance of emotional disorders. This study is the first to explore maladaptive metacognition in a sample of children and adolescents (7-17 years) with obsessive-compulsive disorder (OCD) in the context of cognitive behavioral therapy (CBT). A total of 114 children and adolescents were included in the study. Of these 56 were OCD patients who were assessed on metacognition (*Metacognitions Questionnaire - Child Version*) and OCD symptom severity (*Children's Yale-Brown Obsessive Compulsive Scale*) before and after 14 sessions of individual CBT. Fifty-eight children and adolescents without any psychiatric diagnoses constituted a control group and were assessed on metacognition temporally corresponding to the OCD group. Results showed that the OCD group had significantly elevated maladaptive metacognition relative to the control group with the exception of positive beliefs about worry. The maladaptive metacognition in the OCD group was significantly reduced from pre- to post-treatment. Additionally, the reduction in the total level of maladaptive metacognition was significantly larger than that reported by the control group. However, it remained significantly elevated relative to controls at post-treatment. Furthermore, lower post-treatment OCD severity was associated with larger reductions in negative beliefs about worry, beliefs about the need to control thoughts, and cognitive self-consciousness, as well as with a higher pre-treatment level of positive beliefs about worry. Overall, age group (children vs adolescents) did not moderate these results. Collectively, the results suggest that amending maladaptive metacognition in children and adolescents with OCD might be important considering the associations between reductions in maladaptive metacognition and favorable treatment outcome.

Keywords: Obsessive-Compulsive Disorder; Metacognition; Cognitive Behavioral Therapy; Children; Adolescents.

Highlights

- Maladaptive metacognition in pediatric OCD patients was reduced after CBT
- Maladaptive metacognition remained higher in patients compared to controls post CBT
- Reduction in maladaptive metacognition was associated with a favorable CBT outcome
- Higher pre-treatment positive beliefs about worry predicted a favorable CBT outcome

Introduction

Obsessive-compulsive disorder (OCD) has an estimated prevalence of 2-3% in childhood and adolescence (Atladottir et al., 2015; Canals et al., 2012; Heyman et al., 2003; Ruscio et al., 2010), and is associated with functional impairments (Piacentini et al., 2003) and poor quality of life (American Psychiatric Association, 2009). The treatment of choice for pediatric OCD is exposure-based cognitive behavioral therapy (CBT), either alone or in combination with pharmacotherapy (Franklin et al., 2015; Geller & March, 2012; NICE, 2005; Thomsen, 2000;

Torp et al., 2015). Even though CBT has a good overall effect for many children and adolescents with OCD (Ivarsson et al., 2010; Thomsen et al., 2013), approximately 30% do not achieve complete remission (Öst et al., 2016). Among those who do, roughly 15% experience a relapse within a year after treatment (Højgaard et al., 2017). Better understanding of the underlying mechanisms associated with the persistence of obsessive-compulsive (OC) symptoms, along with predictors of treatment outcome, could potentially improve therapeutic processes and outcomes.

In an effort to understand the mechanisms in the development and maintenance of OCD, different models have been put forward. One such model is the transdiagnostic metacognitive model which suggests that maladaptive metacognition (including beliefs and strategies) lies at the core of emotional disorders, including OCD (Wells, 2009; Wells & Matthews, 1996). According to the metacognitive model, intrusive thoughts are part of normal cognitive activity and experienced by most people. However, these thoughts can become problematic when they coincide with dysfunctional metacognitive beliefs about the *importance*, *meaning* and *power* of these thoughts. The intrusions will then trigger the deployment of metacognitive strategies such as worry, rumination, thought suppression, attentional biases, and cognitive self-consciousness. Such metacognitive strategies can lead to higher sensitivity to intrusive thoughts and increased occurrence of intrusions into consciousness, resulting in greater persistence of intrusions and OC symptoms (Bacow et al., 2009; Cartwright-Hatton et al., 2004; Cartwright-Hatton & Wells, 1997; Wells, 2009; Wells & Matthews, 1996; Wells & Papageorgiou, 1998). The transdiagnostic metacognitive model include the following domains of maladaptive metacognition: 1) *positive beliefs* about the benefits of using worry as a strategy to cope with or avoid problems in the future (PBW); 2) *negative beliefs* about the uncontrollability and danger of worry (NBW); 3) *beliefs about the need to control thoughts*, including the perceived consequences of not doing so (NCT); and 4) *cognitive self-consciousness,* referring to the strategy of being overly attentive to thought processes (CSC; Cartwright-Hatton et al., 2004; Cartwright-Hatton & Wells, 1997; Wells & Matthews, 1996).

Empirical support for the role of maladaptive metacognition in OCD and OC symptomatology in adults has been provided by numerous studies (for an overview of studies, see Wells et al., 2017; additionally, for a meta-analysis on comparison of OCD patients to non-clinical controls, see Sun et al., 2017). Furthermore, in non-clinical pediatric samples, numerous studies have shown a positive association between maladaptive metacognition and self-rated OC symptoms (Boysan et al., 2016; Cartwright-Hatton et al., 2004; Crye et al., 2010; Esbjørn et al., 2013; Irak, 2012; Jacobi et al., 2006; Matthews et al., 2007; Stevanovic et al., 2016; Wilson & Hall, 2012; Wolters et al., 2012). However, research using pediatric OCD samples is comparatively scarce. One study found that maladaptive metacognition was positively associated with clinician-rated OCD severity among adolescents (n = 20) but not among younger children (n = 24; Farrell et al., 2011). A second study found that maladaptive metacognition was higher in adolescents with OCD (N = 40, aged 12-18 years) relative to non-clinical controls (N = 317), and that maladaptive metacognition was positively associated with self-rated OC symptoms but not with clinician-rated OCD severity (Wolters et al., 2012). A third study (N = 142, aged 7-17 years) found similar results showing that maladaptive metacognition was positively associated with self-rated OC symptoms but not with clinician-rated OCD severity (Rizvi et al., 2021). Contrary to the first study, age did not moderate results. Based on the results, the authors concluded that maladaptive metacognition appears clinically relevant to pediatric OCD (Rizvi et al., 2021).

As a logical implication of the metacognitive model, it has been advocated that OCD treatment should focus on modifying maladaptive metacognition (Wells, 2009; Wells & Matthews, 1996). Some adult OCD research has provided support for this. One study (*N* = 83) found significant reductions in the maladaptive metacognition from pre- to post-treatment, and that the greater reductions in PBW and NCT were associated with lower post-treatment OCD severity (Solem et al., 2009). A second study (*N* = 40) supported these results and additionally found that maladaptive metacognition was reduced during follow-up. Moreover, a reduction in NBW was also associated with lower post-treatment OCD severity (Sunde et al., 2021). Furthermore, in pediatric anxiety samples, two studies reported reductions in maladaptive metacognition after CBT (Normann et al., 2016; Wolenski et al., 2021), and the results indicated that higher reductions in total levels of maladaptive metacognition (Normann et al., 2016) as well as in NBW and NCT, but not PBW or CSC (Wolenski et al., 2021), were associated with higher reduction in anxiety symptoms. However, two studies found that cognitively focused treatment (Holmes et al., 2014) and CBT (Hearn et al., 2018) did not effectively reduce PBW and NBW from pre- to post-treatment. No previous studies have examined whether reductions in maladaptive metacognition are associated with treatment outcome in pediatric OCD.

In addition to metacognitive change during treatment, pre-treatment maladaptive metacognition could be a predictor of treatment outcome. Specifically, maladaptive metacognition has been proposed to predict treatment outcome because it might interfere with the patient's ability to use CBT strategies such as cognitive restructuring (Wolenski et al., 2021) or willingness to stop performing compulsions (e.g. by thinking repeatedly washing is adaptive and protecting [Park et al., 2020]).

In adult OCD research, one study (*N* = 132) found that lower levels of pre-treatment PBW was a significant predictor of treatment response four weeks into pharmacological treatment with serotonin reuptake inhibitor (Park et al., 2020). Furthermore, in pediatric anxiety samples, one study found significantly higher pre-treatment NBW (but not PBW) in children and adolescents (aged 7-18 years) who retained their social anxiety diagnosis after treatment with online CBT (Hearn et al., 2018). Another study found that higher pre-treatment CSC predicted more anxiety symptoms in children (aged 6-7 years), whereas in adolescents (aged 12-16 years) higher pre-treatment CSC predicted less anxiety symptoms after treatment with CBT (Wolenski et al., 2021). No previous studies have examined pre-treatment maladaptive metacognition as a predictor of CBT outcome in pediatric OCD.

To summarize, from a theoretical perspective, maladaptive metacognition may be an important factor in the etiology and treatment of OCD, and some empirical findings have lent support to this assumption. However, research in pediatric OCD is limited. Thus far, no studies have examined maladaptive metacognition in pediatric OCD in the context of CBT despite the prospect of improving treatment by identifying possible mechanisms of change and predictors of treatment outcome.

Therefore, the overall aim of this study was to explore maladaptive metacognition in pediatric OCD patients treated with CBT. First, we examined pre- and post-treatment maladaptive metacognition in children and adolescents with OCD, as well as the change in metacognition from pre- to post-treatment, relative to a non-clinical control group. Second, we tested whether CBT outcome was associated with 1) pre- to post-treatment change in metacognition, and 2) pre-treatment metacognition. Furthermore, due to the inconsistent results observed in previous studies regarding the influence of age in the association between metacognition and OCD severity, we further explored whether age group (children vs adolescents) moderated of the results. While the study was exploratory, hypotheses were formulated based on theoretical considerations as well as research involving adult OCD and pediatric anxiety samples. It was hypothesized that greater reductions and lower pre-treatment levels of maladaptive metacognition would be associated with lower post-treatment OCD severity.

Material and methods

The present study was based on previously collected data from a study examining executive function in pediatric OCD (EF study; Hybel, Mortensen, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Thastum, et al., 2017). The EF study was an add-on study to The Nordic Long-term OCD Treatment Study (NordLOTS; www.controlled-trials.com ISRCTN66385119 [Thomsen et al., 2013; Torp et al., 2015]) using the NordLOTS design (incl. clinical assessment and treatment procedure) with additional assessments (e.g., executive function and metacognition). Inclusion for the EF study continued using the same design for an additional 13 months after NordLOTS inclusion ended.

Participants

The study included 114 children (7-12 years) and adolescents (13-17 years): 56 had a primary DSM-IV OCD diagnosis (OCD group) and 58 were typically developing children and adolescents without any psychiatric diagnoses (control group). All participants were recruited in the Central Denmark Region from September 2010 to November 2013. Participants in the OCD group were consecutively referred to a specialized public community child and adolescent psychiatry OCD outpatient clinic, whereas participants in the control group were recruited via invitation letters send to local schools.

The OCD group

A total of 217 Danish children and adolescents referred to a specialized OCD clinic were screened for eligibility. Of these, 17 (8%) declined participation and 143 were excluded before data collection according to pre-defined criteria for the EF study (Hybel, Mortensen, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Thastum, et al., 2017): Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) OCD severity <16 (n = 31); DSM-IV neurodevelopmental or depressive disorder (n = 26); IQ <85 (n = 4); psychotropic medication or CBT within six months prior to inclusion (n = 43); inadequate Danish language proficiency (n = 3); and co-occurring DSM-IV mental health condition with a higher treatment demand than OCD (n = 36).

Data were thus collected from 57 children and adolescents who all met the inclusion criteria for the present study: DSM-IV (American Psychiatric Association, 2009) OCD diagnosis, CY-BOCS total OCD severity ≥ 16, and adequate Danish language proficiency. One participant was excluded from the analyses because the Metacognitions Questionnaire - Child Version (MCQ-C; Bacow et al., 2009) was not administered. As a result, the final sample consisted of 56 children and adolescents with OCD. Out of this sample, a total of 34 also participated in the NordLOTS (Thomsen et al., 2013; Torp et al., 2015). Sample characteristics are presented in **Table 1.**

The control group

A total of 154 Danish children and adolescents accepted contact and participation. Of these, a total of 95 were excluded before data collection according to pre-defined criteria for the EF study (Hybel, Mortensen, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Højgaard, et al., 2017; Hybel, Mortensen, Lambek, Thastum, et al., 2017): previous participation in neurological studies (n = 7); having a psychiatric diagnosis (n = 4); sibling participated in the study (n = 23); declined to participate/non-attendance (n = 7); practical/logistic reasons (n = 8); no OCD age and gender match (n = 46).

Data were thus collected from 59 children and adolescents. They all fulfilled the inclusion criteria for the present study: no previous or current psychiatric diagnosis; no referral to community mental health services within one year of participation in the study; adequate language proficiency; and no family history of OCD in close relatives (parents and siblings). One participant was excluded from the analyses because the MCQ-C (Bacow et al., 2009) was not administered. As a result, the final control group sample consisted of 58 children and adolescents without psychiatric disorders. Sample characteristics are presented in **Table 1.**

Table 1

Sample characteristics

	OCD group (N = 56)	Control group (N = 58)
Age		
Age in years, M (SD)	13.13 (2.17)	13.14 (2.12)
Children (7-12 years), n (%)	18 (32%)	19 (33%)
Adolescents (13-17 years), n (%)	38 (68%)	39 (67%)
Sex		
Male, n (%)	17 (30%)	17 (29%)
Female, n (%)	39 (70%)	41 (71%)
Socioeconomic status		
Parental average education in years, M (SD)	13.24 (2.52)	15.04 (1.94)
OCD symptom severity (CY-BOCS)		
Total symptom severity, M (SD)	25.38 (5.11)	-
Obsession severity, M (SD)	12.70 (2.63)	-

Compulsion severity, *M* (*SD*)	12.68 (2.78)	-
Co-morbid diagnoses (K-SADS-PL)		
Anxiety disorders, *n* (%)	10 (17,6%)	-
Dysthymic disorder, *n* (%)	1 (1.8%)	-
Attention Deficit Hyperactive Disorder, *n* (%)	1 (1.8%)	-
Oppositional Defiant Disorder, *n* (%)	1 (1.8%)	-
Tourette's or tic disorder, *n* (%)	4 (7%)	-
Number of co-morbid diagnoses (K-SADS-PL)		
None, *n* (%)	40 (71%)	-
One, *n* (%)	15 (27%)	-
Two, *n* (%)	1 (2%)	-
Three or more, *n* (%)	0 (0%)	-

Note: OCD = obsessive-compulsive disorder; CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale (Scahill et al., 1997); K-SADS-PL = Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version (Kaufman et al., 1997).

Instruments

The Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version for DSM-IV (K-SADS-PL; Kaufman et al., 1997) is a clinician-rated diagnostic interview assessing child and adolescent DSM-IV (American Psychiatric Association, 2009) mental health disorders. The psychometric properties are well-established with good reliability and validity (Kaufman et al., 1997; Kragh et al., 2019; Lauth et al., 2010). Only present diagnoses rated as "*certain*" were included.

The Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) is a clinician-rated interview assessing OCD symptoms and severity (range 0-40) in children and adolescents. It is a well-established measure with good psychometric properties (Iniesta-Sepúlveda et al., 2014; Scahill et al., 1997).

Socio-economic status was assessed with questions about the parents' education. The average length of the parents' education was used (range 5-17.5 years).

The Metacognitions Questionnaire - Child Version (MCQ-C; Bacow et al., 2009) is a self-rated questionnaire to assess metacognition in children and adolescents (7-17 years). It includes four subscales measuring positive meta-worry (also referred to as positive beliefs about worry (PBW)); negative meta-worry (also referred to as negative beliefs about worry (NBW)); superstitious, punishment and responsibility beliefs (also referred to as beliefs about the need to control thoughts (NCT)); and cognitive monitoring (also referred to as cognitive self-consciousness (CSC)). The items are answered on a four-point ordinal scale (1 = *do not agree* to 4 = *agree very much*). There are six items on each subscale (range: 6-24) which can be combined to a total scale (range: 24-96). A higher score indicates more maladaptive metacognition. The questionnaire was translated into Danish by an experienced child and adolescent clinician (the second author) and back-translated by a professional translator as suggested by Gudmundsson (2009). The back-translation was commented on, adjusted, and approved by the original first author of the MCQ-C (Bacow et al., 2009) in collaboration with the second author. Psychometric evaluations of the MCQ-C have shown mostly good psychometric properties, including adequate to good internal reliability for the total scale (Cronbach's Alphas ranging from 0.73 to 0.87 across studies [Myers et al., 2019]) and good to excellent test-retest reliability [Irak, 2012]. For the subscales, however, variation in internal reliability has been reported (Cronbach's Alphas ranging from 0.25 to 0.86 across studies [Myers et al., 2019]). In the present study, Cronbach's Alpha for the total scale was 0.85 (PBW: 0.69; NBW: 0.69; NCT: 0.66; and CSC: 0.77) in the OCD group. For children the scores were 0.74-0.88, and for adolescents the scores were 0.58-0.85. In the control group, Cronbach's Alpha for the total scale was 0.86 (PBW: 0.62; NBW: 0.62; NCT: 0.52; and CSC: 0.81), and test-retest correlation for the total scale was 0.75 (PBW: 0.64; NBW: 0.56; NCT: 0.73; and CSC: 0.76).

Procedure

The OCD group was initially assessed with the K-SADS-PL and the CY-BOCS to determine diagnostic status and OCD severity. Ratings were based on information provided by the child/adolescent and the parents separately (K-SADS-PL) and together (CY-BOCS). The control group was screened via parent telephone interviews in order to exclude those with a psychiatric diagnosis.

All participants completed the MCQ-C, and the parents completed the socio-economic questionnaire online during another visit within two weeks after the clinical assessment. The children were given the option to have the MCQ-C questions read aloud by a research assistant and to get brief explanations of their meaning. If the children still did not understand the questions, the items were considered as missing. Any difficulties in comprehending the questions were registered by the research assistant. The participants were re-assessed with the MCQ-C (OCD and control group) and CY-BOCS (OCD group only) after the OCD group completed 14 sessions of CBT. Time between pre- and post-treatment MCQ-C assessment was 90-150 days (M = 113.04; SD = 15.07) in the OCD group and 89-154 days (M = 111.98; SD = 13.06) in the control group.

All clinical assessments were conducted by independent evaluators who were experienced clinicians (psychiatrists or clinical psychologists) and trained in the use of K-SADS-PL and CY-BOCS. Repeated assessments of individual participants were performed by the same evaluator. The CY-BOCS assessments were audiotaped, and a random sample of 30 (11.2 %)

audiotapes from the original NordLOTS sample was evaluated showing good reliability with an intraclass correlation coefficient of 0.92 for the total score (for further information, see Torp et al., 2015).

Treatment

The treatment followed a standardized CBT manual for child and adolescent OCD (Thomsen et al., 2013; Torp et al., 2015; Weidle & Hove Thomsen, 2015) and was conducted by clinical psychologists with at least five years of clinical experience and prior experience with exposure-based CBT. The treatment consisted of 14 weekly individual sessions of 75 minutes. Parents participated partly (30 minutes) in eight of the sessions, with or without the child, and fully in six of the sessions together with the child. During the first three sessions, the treatment included psycho-education, introduction to cognitive restructuring techniques, externalization, and symptom hierarchies. Starting in the third session and continuing in the subsequent sessions, focus was on gradual exposure and response prevention. Towards the end there was an emphasis on generalizing skills and relapse prevention (for further information, see Thomsen et al., 2013; Torp et al., 2015; or Weidle and Thomsen, 2015).

Data analysis

Sum scores for the MCQ-C scales (total and subscales) were calculated. In the OCD group, one participant had two missing items at pre-treatment, and one participant had one missing item at post-treatment due to not understanding the questions. These missing items were replaced by individual subscale means. Six participants with OCD dropped out during treatment and one participant did not complete post-assessments, resulting in seven missing post-treatment scores. Independent *t*-tests showed that there were no significant differences in pre-treatment measures of age, socio-economic status, OCD severity, or metacognition between these participants and the participants who did complete post-treatment assessment (all *p*'s > .05).

Change scores were calculated by subtracting pre-treatment from post-treatment MCQ-C sum scores. All analyses were conducted using Stata/MP 17.0 (StataCorp. 2021. Stata Statistical Software: Release 17. College Station). A statistical significance level of $p < .05$ was used.

The OCD group and the control group were compared on maladaptive metacognition at pre- and post-treatment using independent *t*-tests. Cohen's *d* (Cohen, 1988) was used as a measure of effect size (small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$)) for the differences. Furthermore, we examined age group (children vs. adolescents) differences in the OCD group by comparing pre-treatment maladaptive metacognition between age groups using independent *t*-tests. Additionally, we compared children and adolescents with controls using independent *t*-tests, separately for each of the age groups.

Linear mixed models with a random intercept at participant level and a group/time interaction in the model were used to examine change in metacognition from pre- to post-treatment in the OCD group and the control group as well as change in maladaptive metacognition in the OCD group relative to the change in metacognition in the control group. Separate models were run for the total scale and all four subscales. Models were adjusted for age group (children vs. adolescents), sex, and time between pre- and post-treatment assessment. The models handled missing data using the maximum likelihood method, and the total sample was used. Furthermore, age group was examined as a moderator of the change in maladaptive metacognition in the OCD group by including age-group/time interaction in the model.

To test whether changes in maladaptive metacognition were associated with treatment outcome, linear regression models were used with post-treatment OCD symptom severity as the dependent variable and change in maladaptive metacognition as the independent variable. Separate models were run for each scale (total and subscales) followed by a model including all metacognitive subscale change scores. All models were adjusted for age group (children vs adolescents), sex, and pre-treatment OCD symptom severity. Delta R^2 for each of the metacognitive scales was found by comparing the R^2 from each model with R^2 from a linear regression model including post-treatment OCD symptom severity as the dependent variable, and age group (children vs adolescents), sex, and pre-treatment OCD symptom severity as the independent variables. Only participants with both pre- and post-treatment data were included in the analyses (n = 49). Age group was examined as a moderator of the association by including the interaction between metacognitive change and age group in the model.

To test whether pre-treatment maladaptive metacognition predicted treatment outcome, linear regression models were used with post-treatment OCD symptom severity as the dependent variable and pre-treatment maladaptive metacognition as the independent variable. Again, separate models were run for each scale, followed by a model including all metacognitive subscales at pre-treatment. All models were adjusted for age group (children vs adolescents), sex, and pre-treatment OCD symptom severity. Delta R^2 values were calculated using the same procedure as described above. Only participants with both pre- and post-treatment data were included in the analyses (n = 49). Age group was examined as a moderator of the association by including the interaction between pre-treatment metacognition and age group in the model.

Results

Descriptive results

Paired samples *t*-tests showed a significant reduction in OCD symptom severity (t = 11.06, p <.001) from pre-treatment (M = 25.38; SD = 5.11) to post-treatment (M = 13.22; SD = 7.96) in the OCD group, with results indicating a large effect (Cohen's d = 1.76).

Independent *t*-tests showed that at pre-treatment, the OCD group had significantly higher total maladaptive metacognition, NBW, NCT, and CSC (all p's < .001), but not PBW (p > .05), compared to the control group. Furthermore, at post-treatment, the OCD group had significantly higher total maladaptive metacognition, PBW, NBW, NCT, and CSC (all p's < .05) than the control group. These results are presented in **Table 2**.

Independent *t*-tests showed no significant differences in total level of maladaptive metacognition between children (M = 50.50; SD = 2.81) and adolescents (M = 51.53; SD = 1.71) with OCD (t = -0.33; p = .745). There were also no significant differences on any of the subscales (p ranged from .534 to .760). Furthermore, independent *t*-tests for each of the two age groups showed significantly higher total maladaptive metacognition, NBW, NCT, and CSC in children (all p's < .05) and adolescents (all p's < .001) with OCD relative to controls at pre- and post-treatment. Furthermore, the children with OCD had higher post-treatment PBW than controls (p = .043).

Table 2

Metacognition in children and adolescents (7-17 years) with obsessive compulsive disorder (OCD group) and without psychiatric disorders (control group) before and after the OCD group completed 14 sessions of cognitive behavioral therapy.

	OCD group	Control group	Group comparisons		
	M (*SD*), Range	*M* (*SD*), Range	*t*	*p*	Cohen's *d*
Pre-treatment MCQ-C	*N* = 56	*N* = 58			
Total	51.20 (10.89), 32-73	37.03 (8.48), 25-69	7.76	<.001	1.45
PBW	9.38 (3.19), 6-18	8.47 (2.24), 6-16	1.75	.083	0.33
NBW	13.68 (3.74), 6-22	9.67 (2.74), 6-16	6.54	<.001	1.23
NCT	12.52 (3.70), 6-23	8.28 (2.02), 6-15	7.56	<.001	1.43
CSC	15.63 (3.93), 6-22	10.62 (3.62), 6-22	7.07	<.001	1.32
Post-treatment MCQ-C	*N* = 49	*N* = 58			
Total	43.96 (9.85), 26-70	33.29 (7.14), 24-57	6.31	<.001	1.26
PBW	8.27 (2.37), 6-16	7.43 (1.86), 6-13	2.04	.043	0.40
NBW	11.76 (3.51), 6-18	8.91 (2.43), 6-18	4.78	<.001	0.96
NCT	10.76 (3.36), 6-20	7.60 (1.73), 6-13	5.94	<.001	1.21

CSC	13.18 (3.75), 6-22	9.34 (3.40), 6-18	5.55	<.001	1.08

Note: OCD = obsessive-compulsive disorder; CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale (Scahill et al., 1997); MCQ-C = The Metacognitions Questionnaire - Child Version (Bacow et al., 2009). PBW = positive beliefs about worry; NBW = negative beliefs about worry; NCT = need to control thoughts; CSC = cognitive self-consciousness.

Change in metacognition after cognitive-behavioral therapy

Linear mixed model analyses showed that the OCD group had a significant reduction in total maladaptive metacognition, PBW, NBW, NCT, and CSC (all p's < .01) when controlling for age group, sex, and time between pre-and post-treatment assessments. Furthermore, the OCD group had a significantly greater pre- to post-treatment reduction than the control group in total maladaptive metacognition (p < .05), but not PBW, NBW, NCT, and CSC (all p's > .05). Results are presented in **Table 3.**

Age group was not a significant moderator of change in total level of maladaptive metacognition (p = .543) or in any subscale scores (p ranging from .171 to .929).

Table 3.

Change in metacognition in children and adolescents (7-17 years) with obsessive compulsive disorder (OCD group, $N = 56$) and without psychiatric disorders (control group, $N = 58$) after the OCD group completed 14 sessions of cognitive behavioral therapy.

	Change				Group change differences			
MCQ-C	Mean Change	95% CI	*z*	*p*	Change contrast	95% CI	chi^2	*p*
Total (OCD)	-6.99	-9.32; -4.67	-5.89	<.001	3.25	0.09; 6.41	4.06	.044
Total (Control)	-3.74	-5.88; -1.60	-3.42	.001				
PBW (OCD)	-1.16	-1.84; -0.48	-3.35	.001	0.12	-0.80; 1.04	0.07	.792
PBW (Control)	-1.03	-1.66; -0.41	-3.25	.001				
NBW (OCD)	-1.73	-2.55; -0.90	-4.12	<.001	0.97	-0.15; 2.08	2.88	.090
NBW (Control)	-0.76	-1.52; -0.00	-1.97	.049				
NCT (OCD)	-1.72	-2.55; -0.90	-4.10	<.001	1.05	-0.07; 2.17	3.39	.066
NCT (Control)	-0.67	-1.43; 0.08	-1.74	.082				
CSC (OCD)	-2.38	-3.30; -1.46	-5.07	<.001	1.10	-0.15; 2.35	2.99	.084

CSC (Control)	-1.28	-2.12; -0.43	-2.95	.003

Note. predicted values from linear mixed-model analysis adjusted for age-group, sex, and time between pre- and post-assessment. MCQ-C = The Metacognitions Questionnaire - Child Version (Bacow et al., 2009). PBW = Positive beliefs about worry; NBW = Negative beliefs about worry; NCT = Beliefs about the need to control thoughts; CSC = Cognitive self-consciousness.

Associations between change in metacognition and cognitive behavioral therapy outcome

Separate linear regression models showed that greater pre- to post-treatment reductions in total maladaptive metacognition, CSC, NBW, and NCT were significantly associated with lower post-treatment OCD symptom severity when adjusting for age group, sex, and pre-treatment OCD symptom severity (all *p*'s < .05). Pre- to post-treatment change in PBW was not significantly associated with CBT outcome (*p* > .05). Results are presented in **Table 4**.

When including all subscales in the same model, only the effect of change in CSC remained significant (β = 0.38; *t* = 2.08; *p* = .044).

Age group was a significant moderator of the association between post-treatment OCD severity and change in NCT (*p* = .021). Among children, a greater reduction in NCT was significantly associated with lower post-treatment OCD severity (β = 1.09; *t* = 3.46; *p* = .001) whereas among adolescents, there was no significant association (*p* = .799). Age group was not a significant moderator of the association between post-treatment OCD severity and change in total maladaptive metacognition, PBW, NBW, or CSC (*p* ranging from .286 to .981)

Table 4

Associations between post-treatment OCD symptom severity (CY-BOCS) and change in maladaptive metacognition in pediatric (7-17 years) OCD patients treated with cognitive behavioral therapy.

	Unstandardized coefficients		Standardized coefficients			95% CI for *B*		Model Summary	
Δ MCQ-C	*B*	*SE*	β	*t*	*p*	Lower Bound	Upper Bound	R^2	ΔR^2
Total	0.32	0.09	0.44	3.60	.001	0.14	0.50	0.34	0.18
PBW	0.48	0.36	0.19	1.32	.194	-0.25	1.20	0.19	0.03
NBW	0.69	0.30	0.31	2.32	.025	0.09	1.29	0.25	0.09
NCT	0.59	0.25	0.31	2.37	.022	0.09	1.09	0.25	0.09
CSC	0.86	0.23	0.46	3.73	.001	0.40	1.32	0.36	0.20

Note: CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale (Scahill et al., 1997); MCQ-C = The Metacognitions Questionnaire - Child Version (Bacow et al., 2009). PBW = positive beliefs about worry; NBW = negative beliefs about worry; NCT = need to control thoughts; CSC = cognitive self-consciousness. Separate linear regression analyses adjusted for age group, sex, and pre-treatment OCD symptom severity with continuous CY-BOCS score at post-treatment as outcome. Analyses were conducted with complete cases only (n = 49); ΔR^2 is the increase in R^2 when the model is compared to a model including age group, sex and pre-treatment OCD symptom severity without including maladaptive metacognition (R^2 = 0.16). A positive B-value indicates that a lower post-treatment OCD severity was associated with a stronger reduction (negative change) in maladaptive metacognition.

Pre-treatment metacognition as predictors of cognitive behavioral therapy outcome

Separate linear regression models showed that higher pre-treatment PBW significantly predicted lower OCD symptom severity at post-treatment when adjusting for age group, sex, and pre-treatment OCD symptom severity (p < .05). Pre-treatment total maladaptive metacognition, NBW, NCT or CSC were not significant predictors of CBT outcome (all p's > .05). Results are presented in **Table 5**.

When including all subscales in the same model, the effect of pre-treatment PBW remained significant (β = -0.29; t = -2.10; p = .042).

Age group was not a significant moderator of the association between post-treatment OCD severity and pre-treatment total maladaptive metacognition, PBW, NBW, NCT, or CSC (p ranging from .093 to .818)

Table 5

Prediction of post-treatment OCD symptom severity (CY-BOCS) from pre-treatment maladaptive metacognition (MCQ-C) in pediatric (7-17 years) OCD patients treated with cognitive behavioral therapy.

	Unstandardized coefficients		Standardized coefficients			95% CI for B		Model Summary	
Pre-treatment MCQ-C	B	SE	β	t	p	Lower Bound	Upper Bound	R^2	ΔR^2
Total	-0.12	0.10	-0.17	-1.21	.234	-0.33	0.08	0.19	0.03
PBW	-0.81	0.35	-0.32	-2.31	.025	-1.52	-0.11	0.25	0.09

NBW	0.14	0.30	0.07	0.48	.636	-0.45	0.74	0.17	0.01
NCT	-0.25	0.30	-0.11	-0.81	.420	-0.85	0.36	0.17	0.01
CSC	-0.38	0.29	-0.18	-1.31	.191	-0.95	0.20	0.19	0.03

Note: CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale (Scahill et al., 1997); MCQ-C = The Metacognitions Questionnaire - Child Version (Bacow et al., 2009). PBW = positive beliefs about worry; NBW = negative beliefs about worry; NCT = need to control thoughts; CSC = cognitive self-consciousness. Separate linear regression analyses adjusted for age group, sex, and pre-treatment OCD symptom severity with continuous CY-BOCS score at post-treatment as outcome. Analyses were conducted with complete cases only (n = 49). ΔR^2 is the increase in R^2 when the model is compared to a model including age group, sex and pre-treatment OCD symptom severity without including maladaptive metacognition (R^2 = 0.16).

Discussion

This is, to the best of our knowledge, the first study to explore maladaptive metacognition in pediatric OCD in the context of CBT. Overall, the results indicated that maladaptive metacognition in children and adolescents with OCD was reduced after CBT, although remained higher than in a group of typically developing children and adolescents. This finding may have clinical implications, as the study substantiated our first hypothesis that a greater reduction in maladaptive metacognition is associated with lower post-treatment OCD severity. The results did not support our second hypothesis regarding higher pre-treatment levels of maladaptive metacognition being associated with higher post-treatment OCD severity. On the contrary, higher pre-treatment PBW was associated with a lower post-treatment OCD severity. The study findings offer some important steps in understanding the role of metacognition in pediatric OCD and treatment by extending previous research as discussed below.

First, the comparison of maladaptive metacognition in children and adolescents with OCD relative to a control group without any psychiatric disorders revealed that the OCD group exhibited significantly higher levels of maladaptive metacognition than the control group at pre-treatment. This is in line with previous results from Wolters and colleagues (2012). However, when looking at the sub-domains, results showed significant group differences in NBW, NCT, and CSC in our study whereas the study by Wolters and colleagues (2012) also showed significant differences on PBW. These differences might be due to generally higher scores on PBW in their sample (i.e. M = 10.60) than in the present sample (i.e. M = 9.38). The differences in results do not seem to be contingent on the age group included in the studies (i.e. adolescents vs. children and adolescents), as we did not observe significant PBW group differences when examining the adolescents subsample only. These inconsistencies in results do, however, seem to correspond to findings in adult OCD studies, where some studies have found higher scores on PBW in OCD compared to controls whereas others have not (Sun et al., 2017). In their meta-analysis, Sun and colleagues (2017) found that the PBW group difference effect (OCD vs control) went from large to mild when outliers were excluded. This suggests that the impact of PBW on OCD might be limited, whereas the effect on the other subscales remained large. However, further research into the importance of PBW in pediatric OCD appears to be warranted. We further extended previous research by comparing the groups at post-treatment. The results indicated that, even after completing 14 sessions of CBT, the OCD group still exhibited elevated levels of maladaptive metacognition relative to the control group.

Second, the exploration of pre- to post-treatment change in metacognition revealed significant reductions in total levels of maladaptive metacognition as well as reductions in all four sub-domains: PBW, NBW, NCT, and CSC. However, the mean changes on the subscales were modest, ranging from 1 to 2 points. When including the control group in the analyses, only the reductions in total level of maladaptive metacognition was significantly larger than what was found in the control group, suggesting little clinical significance of the reductions in the sub-domain. The present study is the first to examine change in metacognition across treatment in pediatric OCD. Nonetheless, the findings are in line with the results from previous studies, which have also reported reductions in maladaptive metacognition after treatment with CBT in adult OCD (Solem et al., 2009; Sunde et al., 2021), and pediatric anxiety (Normann et al., 2016; Wolenski et al., 2021). Furthermore, the findings correspond to the findings of Holmes and colleagues (2014) as well as Hearn and colleagues (2018) who reported that the subscales PBW and NBW did not exhibit significant reductions from pre- to post treatment in pediatric anxiety.

Third, we found a significant association between the reduction in maladaptive metacognition and a decrease in OCD symptom severity after treatment. This included reductions in total MCQ-C, NBW, NCT, and CSC, but not PBW. However, pre-treatment PBW was not notably higher in the OCD group compared to the control group, suggesting limited potential for improvement. The results align with previous studies that have found an association between reductions in maladaptive metacognition and a favorable CBT outcome in adult OCD (Solem et al., 2009; Sunde et al., 2021) and pediatric anxiety (Normann et al., 2016; Wolenski et al., 2021). Nonetheless, differences emerge across studies when analyzing the metacognitive sub-domains. In our study, changes in CSC accounted for a greater proportion of the variance (20%) in post-treatment OCD symptom severity compared to the variance explained by changes in the other subscales (3-9%). Furthermore, only the association between CBT outcome and changes in CSC remained significant when accounting for the effect of the other subscales. In contrast, results from the adult OCD studies pointed to the significance of the reduction in PBW, NBW, and NCT (Solem et al., 2009; Sunde et al., 2021). Similarly, the pediatric anxiety study pointed to the importance of reduction in NBW and NCT (Wolenski et al., 2021). These differences in results between studies might stem from measurement errors within the subscales which have exhibited inconsistent internal reliability across various studies. Yet, it could also indicate genuine differences between the samples. The CSC subscale has been found to be particularly important in relation to OCD when compared to other types of psychopathology (Sun et al., 2017). Therefore, CSC may have a stronger influence on symptoms in our sample of children and adolescents with OCD who had low levels of co-occurring disorders than it does on symptoms among children and adolescents with anxiety disorders or among adults with OCD from a sample who had higher levels of co-occurring depressive and anxiety disorders (Sunde et al., 2021) than in the present sample. Indeed, our sample had higher pre-treatment CSC scores (i.e. $M = 15.63$) than in the adult sample for which the mean score was reported (i.e. $M = 13.42$ [Sunde et al., 2021]).

Fourth, we were not able to support the hypothesis that pre-treatment level of maladaptive metacognition would be positively associated with post-treatment OCD severity. Instead, results showed a negative association between pre-treatment PBW and post-treatment OCD severity. This seems contrary to one previous adult OCD study where lower PBW were found to predict a better early SRI response (Park et al., 2020). Differences in results might be caused by the different treatments and samples examined. Treatment with CBT might challenge and potentially disprove PBW among children and adolescents with high levels of PBW, although we found only small reductions in PBW on a group level. However, it is also possible that the differences in results is caused by the relatively low pretreatment level of PBW in the present study (i.e. the level was not higher than in the control sample). The subscale includes beliefs such as "*Worrying helps me to avoid problems in the future*" and "*Worrying helps me to solve problems*". These beliefs might be adaptive when only endorsed at a low level. The present study results also seem contrary to results from pediatric anxiety studies where CSC was a significant predictor of anxiety symptoms after CBT moderated by age (i.e. positive association in children and negative association in adolescents) in one study (Wolenski et al., 2021); and higher pre-treatment NBW was associated with retaining diagnosis after online CBT in another study (Hearn et al., 2018). Thus, more research seems necessary to reach conclusions regarding the pre-treatment metacognitive predictors of treatment outcome.

Fifth, in all the analyses we examined age group as a moderator of results. We found no significant differences between the two age groups in levels of maladaptive metacognition either on the total scale or on any subscales, and both groups differed significantly from the controls with the exception of PBW. Furthermore, age group was not a significant moderator of change in maladaptive metacognition across treatment. However, age group did significantly moderate the associations of change in NCT with treatment outcome (i.e. significant predictor of outcome in children but not in adolescents). This might be caused by developmental differences. However, these results should be interpreted carefully, due to the unacceptable internal reliability of this subscale in the adolescents group (Cronbach's Alpha = 0.58). Lastly, age group was not a significant moderator of the prediction of post-treatment severity from pre-treatment metacognition. The results are consistent with results suggesting that metacognitive development starts from an early age (Ellis & Hudson, 2010), and that maladaptive metacognition might also be relevant for psychopathology among children (for reviews, see Köcher et al., 2021 and Myers et al., 2019).

The present study demonstrates several strengths. These include the utilization of an OCD sample that underwent a comprehensive diagnostic assessment along with clinician-rated OCD severity. Moreover, the inclusion of a control group and the implementation of a well-defined treatment approach based on a CBT manual further add to its strength. However, it is important to acknowledge certain limitations of the study before reaching any conclusions. First, the study design precludes drawing any conclusions concerning the causality of the association between changes in maladaptive metacognition and treatment outcome. A low reduction in maladaptive metacognition could stem from a lower reduction in symptom severity and a less favorable treatment outcome, rather than the reverse. Second, there have been some concerns about the measure of maladaptive metacognition in children. Smith and Hudson (2013) found that six items from the MCQ-C posed comprehension difficulties among younger children. Metacognition is a challenging concept, especially for children, as the items tend to be quite abstract and of a more general nature. In this study, these potential challenges were duly acknowledged and registered. Only a few participants indicated issues with understanding the questions, consequently for these participants those specific items were regarded as missing in the present study. Nonetheless, even when participants believe they have comprehended the question, it remains uncertain whether their interpretation of the items aligns with the intended meaning of the questionnaire. Third, the Cronbach's Alphas for certain subscales were low, indicating potential issues with internal consistency. However, similar results have been found in previous studies as well (Myers et al., 2019). For the total scale, the internal consistency was good. Given the exploratory nature of the study, the decision was made to include the subscales in the analyses. However, the subscale results should be interpreted with this choice in mind. Despite the limitations, the study may offer some valuable insights.

First, it appears that while maladaptive metacognition is not a specific target in CBT, the treatment might reduce maladaptive metacognition to some extent. Nonetheless, the OCD group maintained higher levels of maladaptive metacognition relative to the control group at post-treatment, suggesting that the clinical significance of the reduction is limited. Hence, further reduction of maladaptive metacognition may be desired. It could be speculated that maladaptive metacognition would be more effectively reduced in treatments which has a specific focus on diminishing maladaptive metacognitive strategies and beliefs (e.g., metacognitive therapy [Wells, 2009]). Future studies could explore the effectiveness of different interventions in reducing maladaptive metacognition in pediatric OCD patients.

Second, the finding that a reduction in maladaptive metacognition is associated with a favorable treatment outcome offers some support to the hypothesis that maladaptive metacognition could play a role in maintaining OC symptoms. This finding might suggest that there is a need for incorporating the reduction of maladaptive metacognition as a treatment target. Nevertheless, a crucial question that remains unanswered is whether a reduction in maladaptive metacognition *leads* to a reduction in OCD symptom severity or whether it occurs as a *result* of the reduction in OCD symptom severity. If maladaptive metacognition is not playing a mediating role in treatment outcome, then explicitly targeting it during treatment might have limited importance. Future studies using longitudinal designs and incorporating multiple measurements of maladaptive metacognition as mediators during treatment would contribute to a clearer understanding of the mechanisms of change associated with CBT outcomes in pediatric OCD. Furthermore, it would be valuable to also investigate treatment outcomes or relapse at follow-up.

Third, the results might suggest that CBT is effective for children and adolescents with OCD, irrespective of variations in NBW, NCT, or CSC levels at pre-treatment. However, children and adolescents with higher PBW had a better treatment outcome. Since these results did not support our hypothesis, further research into metacognitive predictors seems necessary.

Fourth, since age group was not a moderator of results, this may suggest that maladaptive metacognition is clinically relevant to consider across both age groups. However, even though metacognitive development may start in pre-school children, it continues to progress with increasing age, highlighting the need for a deeper understanding of the development of maladaptive metacognition (Ellis & Hudson, 2010; Köcher et al., 2021; Myers et al., 2019). Future studies should include larger samples of children and adolescents to enhance the statistical power to identify potential age-related differences.

Conclusions

In conclusion, this study identified elevated levels of maladaptive metacognition, specifically NBW, NCT, and CSC, in children and adolescents with OCD relative to controls. These findings align with the metacognitive model, emphasizing the clinical relevance of maladaptive metacognition in the development and maintenance of OCD. Maladaptive metacognition exhibited a significant reduction from pre- to post-treatment. Nevertheless, it remained elevated in children and adolescents with OCD relative to controls after the conclusion of CBT. Further attention to reduction in maladaptive metacognition might be important given greater reductions in maladaptive metacognition, particularly NBW, NCT, and CSC, were associated with a lower post-treatment OCD severity. Furthermore, the effect of the treatment does not seem to be contingent upon the pre-treatment level of NBW, NCT, or CSC. However, patients exhibiting higher PBW, at least to the extent found in this study sample, experienced better outcome compared to those with lower levels of maladaptive metacognition. Overall, age group was not a moderator of results, suggesting that these conclusions are applicable to both children and adolescents. It is important to consider the exploratory nature of the study, which means that the conclusions are preliminary, thereby highlighting the need for replication of the results.

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