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Predictors of response to cognitive behavioural therapy (CBT) for individuals with obsessive-compulsive disorder (OCD): a systematic review

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Abstract

Background: Cognitive behavioural therapy (CBT) is considered the first-line treatment for obsessive-compulsive disorder (OCD). However, some individuals with OCD remain symptomatic following CBT, and therefore understanding predictors of outcome is important for informing treatment recommendations.
Aims: The current study aimed to provide the first synthesis of predictors of outcome following CBT for OCD in adults with a primary diagnosis of OCD, as classified by *DSM-5*.
Method: Eight studies ($n = 359$; mean age range = 29.2–37.7 years; 55.4% female) were included in the systematic review.
Results: Congruent with past reviews, there was great heterogeneity of predictors measured across the included studies. Therefore, a narrative synthesis of findings was conducted. Findings from this systematic review indicated that some OCD-related pre-treatment variables (i.e. pre-treatment severity, past CBT treatment, and levels of avoidance) and during treatment variables (i.e. poor working alliance and low treatment adherence) may be important to consider when making treatment recommendations. However, the results also indicate that demographic variables and psychological co-morbidities may not be specific predictors of treatment response.
Conclusions: These findings add to the growing body of literature on predictors of CBT treatment outcomes for individuals with OCD.

Keywords: CBT; cognitive behavioural therapy; obsessive-compulsive disorder; predictors; treatment outcome

Introduction

Obsessive-compulsive disorder (OCD) is characterized by recurrent and unwanted thoughts, images, or urges (obsessions), as well as time-consuming and repetitive compulsions (American Psychiatric Association, 2013). The disorder causes significant distress and can impair functioning for individuals in a number of different domains of psychosocial functioning (Eisen *et al.*, 2006). OCD typically has a chronic course (Melkonian *et al.*, 2022; Ruscio *et al.*, 2010), and the lifetime prevalence of the disorder is estimated to be around 2% (Kessler *et al.*, 2012; Ruscio *et al.*, 2010).

Cognitive behavioural therapy (CBT) incorporating exposure and response prevention (ERP) is typically considered the treatment of choice and the first step for treating individuals with OCD (American Psychiatric Association, 2007; National Institute for Health and Care Excellence, 2005). Multiple meta-analyses demonstrate that this treatment approach results in large effect sizes when results are pooled across studies (Olatunji *et al.*, 2013; Rosa-Alcázar *et al.*, 2008). Despite the efficacy of CBT reported in meta-analytic studies, there is significant variability in the efficacy of this treatment for individuals with OCD. For instance, in some studies the response rate is as high as 60% (Mataix-Cols *et al.*, 2022) and in others, as low as 40% (O'Connor *et al.*, 2006). This is further complicated by the differences in the classification of 'treatment response' used in the literature (e.g. Farris *et al.*, 2013; Mataix-Cols *et al.*, 2016; Tolin *et al.*, 2005). Despite this, given the variability in treatment outcomes, it is important to better understand who responds best to which treatments. Tailoring treatment using known patient predictors of outcome has the potential to improve outcomes for individuals with OCD, while also preventing the delivery of ineffective treatment.

To date, there have been a number of important reviews that have aimed to investigate the predictors of outcome to CBT for individuals with OCD (Keeley *et al.*, 2008; Knopp *et al.*, 2013; Reid *et al.*, 2021); however, these studies result in largely inconsistent findings. Keeley *et al.* (2008) conducted a narrative systematic review of 52 studies in adult and child populations and found that some of the most consistent predictors of poorer outcome include higher baseline OCD symptom severity, presence of hoarding symptoms, severe depressive symptoms, presence of co-morbid personality disorder, presence of family dysfunction, and lower levels of therapeutic alliance. The researchers reported that few studies found demographic variables to be predictors of treatment response. They also note that there were a number of variables studied that have an inconsistent relationship with outcomes: OCD-related variables, co-morbid psychiatric disorders, cognitive factors and treatment compliance. The authors of this study highlighted that there continues to be limited understanding of the predictors of outcome because of many methodological inconsistencies between the treatment outcome studies included (e.g. variety of measurement tools used for capturing OCD symptoms and differences in measuring symptom subtypes, inclusion/exclusion of individuals with co-morbid psychiatric presentations; Keeley *et al.*, 2008).

Several quantitative reviews have also been conducted. Firstly, Knopp *et al.* (2013) examined predictors and moderators of response to psychological therapies in adult populations. They included 38 studies and found that hoarding symptoms, greater baseline OCD symptom severity, higher baseline anxiety, unemployment, and being single/unmarried were reported tentatively as possible predictors of OCD outcome as they were not able to conduct meta-analytic methods to statistically examine their findings (Knopp *et al.*, 2013). Secondly, Olatunji *et al.* (2013) examined possible moderators of outcome for both adults and children who participated in randomized controlled trials (RCTs) with a control condition. In this meta-analysis of 16 studies, neither pre-treatment depression nor baseline OCD symptom severity were moderators of CBT treatment outcome. A number of other potential moderators including treatment-related variables and OCD-related variables (e.g. age of onset) were found to be unrelated to treatment outcome (Olatunji *et al.*, 2013). In this study, only age was found to moderate the effect size, with smaller effects observed for older age (Olatunji *et al.*, 2013). However, notably the authors completed subgroup analyses and indicated that the results for age were best explained by the variability in age groups in the studies they included (i.e. child *vs* adult samples). Thirdly, Reid *et al.* (2021) examined moderators of CBT with ERP treatment outcome for adults and children in 36 studies, but also included studies with an active treatment arm in their study as they reported this was a limitation of previous reviews, which may have accounted for exaggerated effect sizes for the active CBT treatment. Reid *et al.* (2021) found that age appeared to moderate outcomes, with younger people having better treatment outcomes (Reid *et al.*, 2021). However, as noted above, this may have been

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accounted for by the variability in age groups included in the study. This study also found that no other demographics, OCD-related or psychiatric predictors were found to predict outcomes.

A mega-analysis was conducted by Steketee *et al.* (2019) who used data from eight treatment clinics to increase sample size and power to understand predictors and moderators of OCD treatment outcomes for CBT, cognitive therapy (CT) and behavioural therapy (BT). They found that patients who improved most on clinical outcomes had lower pre-treatment depressive symptoms, as well as stronger beliefs about responsibility/threat and importance/control of thoughts (Steketee *et al.*, 2019). Moderator analyses yielded observations that higher baseline depression adversely affected outcomes for behavioural therapy (but not CT or CBT), while lower OCD severity and higher educational achievement were associated with positive outcomes for those receiving CBT and CT but not BT (Steketee *et al.*, 2019). These finding highlight possible treatment implications for individuals with co-morbid depression and those with lower OCD and higher education; if both of these findings are replicated it may inform treatment planning to include cognitive treatment components for these patient profiles.

In summary, these studies highlight that while age, presence of hoarding symptoms and pre-treatment OCD and depression symptom severity may be related to treatment outcome, findings were not consistent across studies. These inconsistencies may be related to methodological inconsistencies among the reviews as outlined above, but also may be related to some important methodological limitations in the existing reviews. For example, one of the most robust findings is that the presence of hoarding symptoms results in poorer treatment outcomes. However, as hoarding disorder (HD) is now recognized as a distinct disorder (American Psychiatric Association, 2013), and is characterized by significant co-morbidity (Frost *et al.*, 2011), it is likely that including individuals with primary hoarding symptoms within an OCD sample may exaggerate the findings but also may increase heterogeneity and reduce the likelihood of identifying predictors of outcome in individuals with primary OCD. To our knowledge, none of the studies discussed above has excluded studies with individuals with primary hoarding symptoms. Additionally, it is unclear if reviews conducted to date included studies utilizing a diagnostic interview as part of their inclusion criteria (Keeley *et al.*, 2008). Thus, it is unclear in many cases if the individuals included in the study did in fact meet diagnostic criteria for OCD.

Given the limitations of the existing literature described above, the aim of the current study was to provide the first synthesis of the predictors of CBT outcomes in adults with a primary diagnosis of OCD who do not have primary HD symptoms, that is, a sample of individuals with OCD according to *DSM-5-TR*. This is the first review of predictors of CBT outcomes to be conducted that ensures that the sample is consistent with *DSM-5-TR* criteria. This research has important research and clinical implications. The research implications of this study will contribute to our theoretical understanding of potential causal pathways for treatment outcomes for individuals with primary OCD. This will in turn lead to a better understanding of the factors that predict CBT outcomes for individuals with primary OCD, which will inform better clinical decision making and treatment planning for individuals with primary OCD.

Method

Study design

The review was undertaken using the Preferred Reporting Items for Systematic Reviews and Meta-analyses Guidelines (PRISMA; Moher *et al.*, 2009; Page *et al.*, 2021). A protocol for the review was registered with Prospero International prospective register of systematic reviews (PROSPERO; registration no. CRD42020185380). This study was conducted in accordance with the Declaration of Helsinki.

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Search procedure

Articles were identified through the following electronic databases: MedLine, PsycINFO, EMBASE, CINAHL and CENTRAL through to 8 November, 2021. The search terms included 'Obsessive Compulsive' OR 'OCD' AND 'cognitive behavio* therapy' OR 'CBT' OR 'behavio* therapy' OR 'exposure and response prevention' OR 'exposure' OR 'cognitive therapy' OR 'behavio*l experiments' AND 'treatment' or 'trial' or 'RCT' or 'random* controlled trial' AND 'predict*' OR 'moderat*'. The reference lists of previously completed meta-analyses on the predictors and moderators of OCD outcome were also reviewed (Knopp *et al.*, 2013; Reid *et al.*, 2021).

Study selection

In order to be included, studies were required to (1) include participants over the age of 18 years; (2) include participants with a primary diagnosis of OCD according to the *Diagnostic and Statistical Manual of Mental Disorders* (5th edn; *DSM-5*; American Psychiatric Association, 2013) criteria (or will have excluded individuals with primary hoarding symptoms if conducted prior to *DSM-5*); (3) use a structured diagnostic interview to assign a diagnosis; (4) use an open trial or RCT design to investigate the efficacy of CBT as a monotherapy; (5) assess symptoms at pre-treatment, post-treatment and/or follow-up; (6) incorporate a behavioural component as part of the treatment (for example, exposure response prevention, behavioural experiments, etc.) as this is within the guidelines for first step treatment of individuals with OCD (American Psychiatric Association, 2007; National Institute for Health and Care Excellence, 2005); (7) use the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS; Goodman *et al.*, 1989) as an outcome measure; (8) report at least one predictor of CBT outcome; and (9) be published in English in a peer-reviewed journal. Studies were excluded if the only predictors were neurobiological, as the assessment of these would not generally be part of standard care for individuals referred for CBT.

Data extraction

Study selection

The initial search was conducted by the first author (S.M.). The title and abstract search was conducted by the first author (S.M.) with 10% co-reviewed by the last author (B.W.). The same process was followed at the full text review stage. All final included articles were reviewed by the first and final authors to ensure they met inclusion criteria.

Data extraction and coding

Two authors (S.M. and B.W.) independently extracted data on study characteristics (e.g. country, overall *n*, treatment characteristics), main outcomes (e.g. post-treatment Y-BOCS, change scores) and predictor variables. Extraction of predictor variables was based on a previous review (Knopp *et al.*, 2013). Predictor variables were extracted and categorized *post-hoc* into *pre-treatment* and *during treatment* variables by two authors (S.M. and B.W.) with 100% agreement. Pre-treatment variables included demographic variables (i.e. age, gender, etc.), OCD-related variables (i.e. baseline Y-BOCS, type of obsession/compulsion, age of onset, etc.), psychological variables (i.e. mental health co-morbidities, intelligence, quality of life, etc.), pharmacological variables (i.e. medication) and past psychological treatment (i.e. previous CBT treatment). During treatment variables included working alliance, mid-treatment measures of self-reported disgust and treatment adherence.

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Data analysis

As indicated in the PROSPERO registration, a quantitative synthesis using a meta-analytic approach was planned to summarize the strength of identified predictors across studies using Comprehensive Meta-Analysis (CMA) software. However, given the small number of studies included and insufficient data for quantitative synthesis, a narrative synthesis was conducted to better understand the predictors across studies. We examined predictors of the following outcomes: (1) Y-BOCS post-treatment score; (2) Y-BOCS change score at post-treatment; (3) responder status at post-treatment; (4) Y-BOCS follow-up score; and (5) Y-BOCS change score at follow-up.

Study quality and risk of bias of treatment studies

In order to appraise the quality of studies and potential risk of bias, version 2 of the Cochrane Risk of Bias (RoB) tool was used (Sterne *et al.*, 2019). The RoB assesses potential risk of bias in five domains: (1) risk of bias arising from the randomization process, (2) risk of bias due to deviations from the intended intervention, (3) risk of bias due to missing outcome data, (4) risk of bias in measurement of the outcome, and (5) risk of bias in selection of the reported result. Regarding the risks of bias regarding randomization and deviations from intended interventions, we omitted items from the RoB for the included studies with an open trial design (see Table A of the Supplementary material for specific items of the RoB, including those that were omitted for Open Trials). Within each domain across the RoB tool, the risk of bias was rated as either being low, having some concerns, or high. The risk of bias assessment was completed by two authors (S.M. and M.M.) with 100% agreement.

Quality of the predictor analyses

The checklist for predictors reported by Pincus *et al.* (2011) was used to report on the quality of the predictor analyses. The characteristics of this checklist include: whether the choice of analyses was *a priori*, how predictors were selected (evidence based or theory driven), whether measurement was prior to randomization, the validity of the measures, and whether interactions were explicitly tested. The quality assessment was completed by two authors (S.M. and M.M.).

Results

The initial search yielded 2541 articles; 1372 were duplicates and were removed before screening. A further 17 titles were found through the hand citation search. The abstracts were reviewed and a further 958 were excluded, resulting in 211 studies. These 211 studies were reviewed in full against the inclusion and exclusion criteria using a comprehensive coding sheet, and 203 were excluded, resulting in eight included studies in the systematic review. The study selection process is outlined in Fig. 1.

Study characteristics

The characteristics of each study are outlined in Table 1. In total, 359 individuals (mean age range 29.2–37.7 years; percentage female participants 25.0–76.2%; average 55.4%) were captured across eight studies. Studies were conducted in the following countries: United States of America (3/8; 37.5%), Australia (1/8; 12.5%), Japan (1/8; 12.5%), Korea (1/8; 12.5%), Norway (1/8; 12.5%) and Sweden (1/8; 12.5%). All the included studies used versions of the SCID (Structured Clinical Interview for DSM) for identifying primary OCD; most were based on *DSM-IV* (6/8; 75%) while an equal number were based on *DSM-5* (1/8; 12.5%) and *DSM-III-R* (1/8; 12.5%). An

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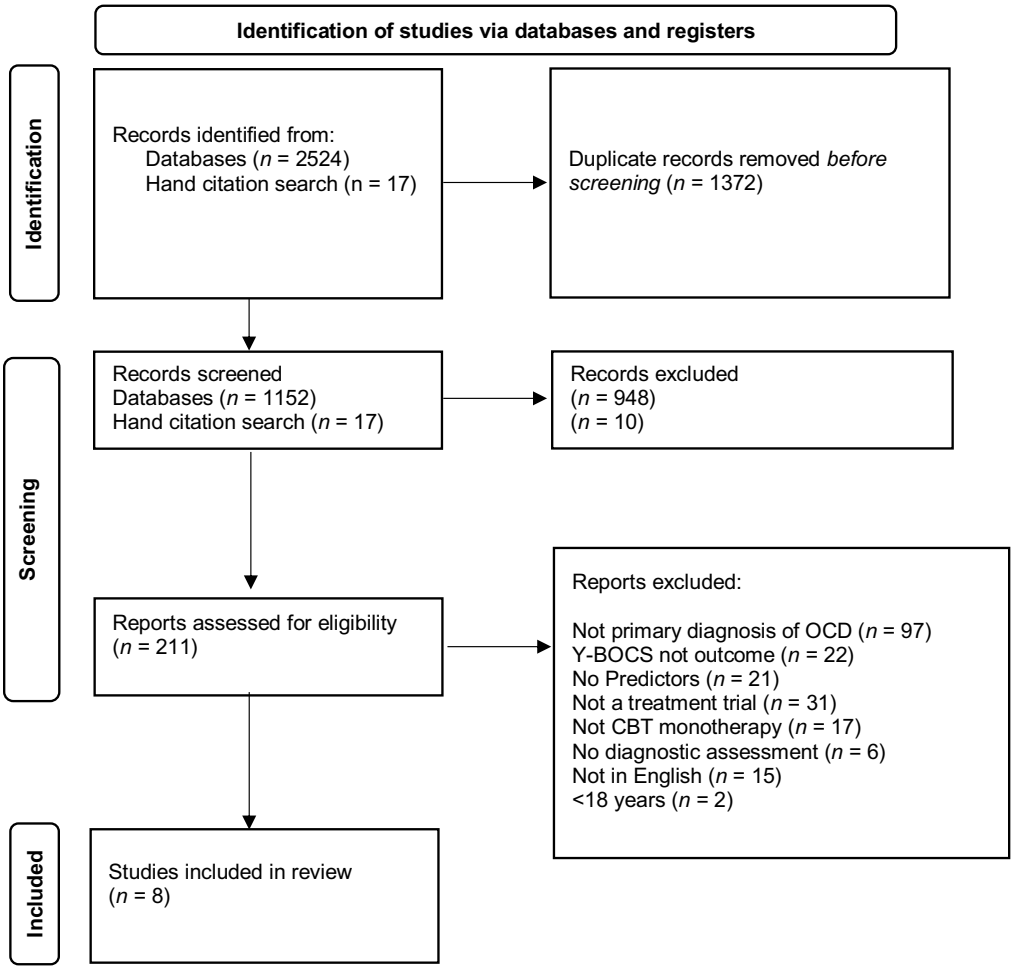

Figure 1. PRISMA flowchart of the study selection process.

equal number of studies were open trials (4/8; 50%) and controlled trials (4/8; 50%). An equal number of studies included face-to-face treatment (4/8; 50%) and online treatment (4/8; 50%). An equal number of studies used a cognitive behavioural treatment (4/8; 50%) or a behaviourally focused treatment (4/8; 50%).

Treatment outcomes

Treatment outcome varied across the studies, with five of the eight included studies examining predictors for a single outcome variable (6/8; 75%) and the remaining two out of eight studies looking at more than one outcome (2/8; 25%). Across all studies three out of the eight included studies examined predictors of post-treatment symptom score (3/8; 37.5%), four out of the eight studies examined predictors of pre-treatment to post-treatment symptom change scores (4/8; 50%), two of the eight studies examined predictors of follow-up symptom scores (one included 3-month follow-up and the other 24-month follow-up) and only one of the eight studies (12.5%) examined predictors of pre-treatment to follow-up change scores.

Three of the eight included studies examined predictors according to responder status. Responder status was defined as follows: one study used a score on the Y-BOCS of $\leq$12

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Table 1. Study characteristics

Study	Country	Trial type	*n*	Age (*M/SD*)	Female (%)	Tx type	Tx mode	Tx format	Tx length (weeks)	Type of analysis	Y-BOCS administration
Andersson *et al.* (2015)[1]	Sweden	RCT	101	34.93/12.72	66.3	CBT	Online	Individual	10	CA	Clinician
Kyrios *et al.* (2018)	Australia	RCT	89	32.59/9.86	65.2	CBT	Online	Individual	12	ITT	Clinician
Nakatani *et al.* (2005)	Japan	RCT	10	32.5/11.2	70	BT	F2F	Individual	12	CA	Clinician
Neziroglu *et al.* (2001)	USA	Open	20	37.7 (range 17–53)	25	BT	F2F	Individual (in-patient)	1 month (6/week)	ITT	Clinician
Seol *et al.* (2016)	Korea	Open	27	29.22/9.03	30	CBT	Online	Individual	11	CA	Self-report
Tjelle *et al.* (2021)	Norway	Open	42	30.1 /10.7	76.2	ERP	F2F	Individual/group	0.6	ITT	Clinician
Wheaton *et al.* (2018)[2]	USA	RCT	40	34.3/12.7	53	ERP	F2F	Individual	8	ITT	Clinician
Wheaton *et al.* (2021)[3]	USA	Open	30	36.61/11.13	57.5	CBT	Online	Individual	10	CA	Clinician

Tx, treatment; CBT, cognitive behaviour therapy; BT, behaviour therapy; ERP, exposure response prevention; CA, completer analysis; ITT, intention-to-treat. [1]Data analysed by this study were combined data from Andersson *et al.* (2014) and Andersson *et al.* (2012). [2]Data analysed by this study was a secondary analysis of data from Simpson *et al.* (2013). [3]Data analysed by this study was a secondary analysis of data from Patel *et al.* (2018).

(Wheaton *et al.*, 2018), a second study used a known criteria of clinically significant improvement (Jacobson and Truax, 1991) requiring a decrease of 4 points on the Y-BOCS and also an end-state score below 12 on the Y-BOCS (Andersson *et al.*, 2015). A third study reported two responder status outcomes; the first requiring a decrease of 10 points or greater or a score below 14, and the second a 35% reduction in Y-BOCS symptom score. However, when predicting outcomes, only the 35% reduction was used as the outcome measure for responder status in this final study (Seol *et al.*, 2016).

Predictors of treatment outcome

Most studies examining pre-treatment related predictors, while two studies also explored the impact of predictors measured during treatment (Andersson *et al.*, 2015; Tjelle *et al.*, 2021). Table 2 reports the results of predictors of post-treatment symptom score, post-treatment change score, and responder status for each of the individual studies. Table 3 presents the findings across the eight studies as grouped by predictor category. A narrative synthesis of the findings across the eight studies follows, broken down by category of predictor.

Demographic variables

Four out of eight studies (Kyrios *et al.*, 2018; Seol *et al.*, 2016; Tjelle *et al.*, 2021; Wheaton *et al.*, 2021) examined the role of demographic factors (e.g. age, gender, number of children, education, marital status, and ethnicity). None of the studies that predicted treatment outcome for the Y-BOCS revealed significant demographic predictors of treatment outcome (Kyrios *et al.*, 2018; Tjelle *et al.*, 2021; Wheaton *et al.*, 2021). However, the one study that compared responders (35% reduction in Y-BOCS symptom score) with non-responders found that treatment responders were significantly younger than non-responders in their study (Seol *et al.*, 2016).

OCD-related variables

Seven out of the eight studies (Andersson *et al.*, 2015; Kyrios *et al.*, 2018; Nakatani *et al.*, 2005; Seol *et al.*, 2016; Tjelle *et al.*, 2021; Wheaton *et al.*, 2018; Wheaton *et al.*, 2021) examined whether OCD-related variables were predictors of treatment outcome. Six out of eight studies examined pre-treatment Y-BOCS as a predictor of treatment outcome or change outcomes. Findings for pre-treatment Y-BOCs as a predictor of outcome were mixed; half of the studies found that pre-treatment Y-BOCS was a significant predictor of treatment outcome (Andersson *et al.*, 2015; Wheaton *et al.*, 2021), while the other half did not predict outcome (Tjelle *et al.*, 2021; Wheaton *et al.*, 2018). Two studies found that pre-treatment Y-BOCS was a significant predictor of pre-treatment to post-treatment change (Andersson *et al.*, 2015; Kyrios *et al.*, 2018). Two studies reported that pre-treatment Y-BOCS was a predictor of follow-up outcomes, with one study reporting this for outcomes at 3-month follow-up (Tjelle *et al.*, 2021), and a second study using both 24-month follow-up and pre-treatment to 24-month follow-up change scores as the outcome (Andersson *et al.*, 2015).

Lastly, three studies looked at pre-treatment Y-BOCS as a predictor of responder status (Andersson *et al.*, 2015; Seol *et al.*, 2016; Wheaton *et al.*, 2021), with only one study (Andersson *et al.*, 2015) finding that pre-treatment severity was a significant predictor of responder status.

Both studies that looked at pre-treatment Y-BOCS avoidance scores showed that it was predictive of post-treatment outcome (Wheaton *et al.*, 2018; Wheaton *et al.*, 2021) and responder status (Wheaton *et al.*, 2018). In contrast, no other OCD-related variables, including age at onset, duration of OCD, and other subtypes of OCD, were found to be significant predictors of treatment outcomes across the included studies.

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Table 2. Results of predictors of post-treatment outcome, post-treatment change score, and responder status

Study	Predictor	Measure	Y-BOCS post score	Y-BOCS post change score	Responder status (post)
Andersson *et al.* (2015)	Pre-treatment severity	Y-BOCS	+	+	+
	Hoarding	OCI-R: Hoarding	–	–	NA
	Obsessing	OCI-R: Obsessing	–	–	NA
	Therapeutic alliance	WAI	+	+	+
	Disgust	Self-report	+	+	NA
	Obsessive beliefs (importance and control thoughts)	OBQ (importance and control thoughts)	–	NA	NA
Kyrios *et al.* (2018)	Age	Self-report	NA	–	NA
	Gender	Self-report	NA	–	NA
	Number of children	Self-report	NA	–	NA
	Education	Self-report	NA	–	NA
	Marital status	Self-report	NA	–	NA
	Pre-treatment severity	Y-BOCS	NA	+	NA
	Functioning	GAF	NA	–	NA
	Depression severity	HAM-D	NA	–	NA
	Anxiety severity	HAM-A	NA	–	NA
	Medication	Self-report	NA	–	NA
	Number of hospitalizations	Self-report	NA	–	NA
Nakatani *et al.* (2005)	Content of obsessions (aggressive/contamination)	Y-BOCS	NA	–	NA
	Type of compulsions (checking/cleaning)	Y-BOCS	NA	–	NA
	Age at onset of OCD	Self-report	NA	–	NA
	Duration of OCD	Self-report	NA	–	NA
	Total IQ	WAIS-R	NA	–	NA
	Co-morbid disorder: major depression	SCID-P	NA	–	NA
	Depression severity	HAM-D	NA	–	NA
	Anxiety severity	HAM-A	NA	–	NA
	Clinical Global Impression	CGI	NA	–	NA
Neziroglu *et al.* (2001)	Overvalued ideas[1]	OVIS	NA	–	NA
	Overvalued ideas[2]	OVIS	NA	+	NA
Seol *et al.* (2016)	Age		NA	NA	+
	Pre-treatment severity	Y-BOCS	NA	NA	–
	Depression symptoms	BDI	NA	NA	–
	Anxiety symptoms	BAI	NA	NA	–
	Work and social adjustment	WSAS	NA	NA	–
	Executive function	WCST, total errors	NA	NA	+
	Executive function	WCST, perseverative errors	NA	NA	+
Tjelle *et al.* (2021)	Age	Self-report	–	NA	NA
	Gender	Self-report	–	NA	NA
	Pre-treatment severity	Y-BOCS	–	NA	NA
	Treatment adherence	PEAS (combined score)[3]	+	NA	NA
Wheaton *et al.* (2018)	Pre-treatment severity	Y-BOCS	–	NA	–
	Pre-treatment avoidance	Y-BOCS Avoidance	+	NA	+
	Treatment adherence	PEAS (clinician rating)	+	NA	NA
	Age	Self-report	–	NA	NA

(*Continued*)

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Table 2. (*Continued*)

Study	Predictor	Measure	Y-BOCS post score	Y-BOCS post change score	Responder status (post)
Wheaton *et al.* (2021)					
	Gender	Self-report	–	NA	NA
	Years of education	Self-report	–	NA	NA
	Race/ethnicity	Self-report	–	NA	NA
	Relationship status	Self-report	–	NA	NA
	Duration of OCD	Self-report	–	NA	NA
	Age at onset of OCD	Self-report	–	NA	NA
	Pre-treatment severity	Y-BOCS	+	NA	NA
	Pre-treatment avoidance	Y-BOCS: Avoidance	+	NA	NA
	Pre-treatment insight	Y-BOCS: Insight	–	NA	NA
	Hoarding	OCI-R: Hoarding	–	NA	NA
	Checking	OCI-R: Checking	–	NA	NA
	Ordering	OCI-R: Ordering	–	NA	NA
	Neutralizing	OCI-R: Neutralizing	–	NA	NA
	Washing	OCI-R: Washing	–	NA	NA
	Obsessing	OCI-R: Obsessing	–	NA	NA
	Co-morbid disorders	SCID	–	NA	NA
	Functioning	GAF	–	NA	NA
	Depression severity	HAM-D	–	NA	NA
	Quality of life	QLESQ-SF	–	NA	NA
	Past CBT for OCD	Self-report	+	NA	NA
	Current medication	Self-report	–	NA	NA

–, Non-significant result; +, significant result; NA, outcome was not assessed in the study. [1]Predicting Y-BOCS Obsessions subscale; [2]predicting Y-BOCS Compulsions subscale; [3]clinician and self-report combined score.

Psychological variables

Five out of eight studies (Kyrios *et al.*, 2018; Nakatani *et al.*, 2005; Neziroglu *et al.,* 2001; Seol *et al.*, 2016; Wheaton *et al.*, 2021) investigated a variety of psychological, psychosocial, and neuropsychological variables as predictors of treatment. Of these, only one study found that two measures of executive function (this included two outcomes from the Wisconsin Card Sort Test; total number of errors and total number of perseverative errors) were predictive of treatment response, with less errors on tasks measuring executive function predictive of treatment response (Seol *et al.*, 2016). One out of eight studies investigated whether over-valued ideation was predictive of outcome. This study found that individuals with over-valued ideas about their OCD symptoms were found to have less benefit from ERP for their compulsions at post-treatment (Neziroglu *et al.*, 2001). No other psychological variables were found to be predictive of treatment response.

Other variables

Two out of the eight studies (Kyrios *et al.*, 2018; Wheaton *et al.*, 2021) investigated whether medical variables (i.e. medication use, number of previous hospitalizations) were predictive of outcomes, and neither found that medical variables were predictive of treatment response. One out of eight studies investigated whether past CBT treatment was predictive of poorer outcomes and found that those who had previously received treatment had poorer outcomes (Wheaton *et al.*, 2021).

Three out of eight studies looked at factors measured *during* treatment as predictors of treatment outcome. One study found participant ratings of the working alliance with their clinician and self-reported disgust ratings during treatment were significant predictors of

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Table 3. Results of predictors of treatment outcome on the Y-BOCS

Predictor	Study	Y-BOCS post score	Y-BOCS post change score	Responder status post
Demographic variables				
Age	Seol *et al.* (2016)	NA	NA	+
	Kyrios *et al.* (2018)	NA	–	NA
	Tjelle *et al.* (2021)	–	NA	NA
	Wheaton *et al.* (2021)	–	NA	NA
Gender	Kyrios *et al.* (2018)	NA	–	NA
	Tjelle *et al.* (2021)	–	NA	NA
	Wheaton *et al.* (2018)	–	NA	NA
Education	Kyrios *et al.* (2018)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Marital status	Kyrios *et al.* (2018)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Number of children	Kyrios *et al.* (2018)	NA	–	NA
Race/ethnicity	Wheaton *et al.* (2021)	–	NA	NA
OCD-related variables				
Baseline Y-BOCS	Andersson *et al.* (2015)	+	+	+
	Kyrios *et al.* (2018)	NA	+	NA
	Seol *et al.* (2016)	NA	NA	–
	Tjelle *et al.* (2021)	–	NA	NA
	Wheaton *et al.* (2018)	–	NA	NA
	Wheaton *et al.* (2021)	–	NA	–
Y-BOCS: Avoidance	Wheaton *et al.* (2018)	+	NA	+
	Wheaton *et al.* (2021)	+	NA	NA
Y-BOCS: Insight	Wheaton *et al.* (2021)	–	NA	NA
Y-BOCS: Compulsions	Nakatani *et al.* (2005)	NA	–	NA
Y-BOCS: Obsessions	Nakatani *et al.* (2005)	NA	–	NA
Age at OCD onset	Nakatani *et al.* (2005)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Duration of OCD	Nakatani *et al.* (2005)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
OCR-R: Obsessing	Andersson *et al.* (2015)	–	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
OCI-R: Washing	Wheaton *et al.* (2021)	–	NA	NA
OCI-R: Checking	Wheaton *et al.* (2021)	–	NA	NA
OCI-R: Neutralizing	Wheaton *et al.* (2021)	–	NA	NA
OCI-R: Ordering	Wheaton *et al.* (2021)	–	NA	NA
OCI-R: Hoarding	Andersson *et al.* (2015)	–	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Clinical global impression	Nakatani *et al.* (2005)	NA	–	NA
Psychological/psychosocial variables				
Global assessment of functioning	Kyrios *et al.* (2018)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Comorbid disorder	Nakatani *et al.* (2005)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Depressive severity	Kyrios *et al.* (2018)	NA	–	NA
	Nakatani *et al.* (2005)	NA	–	NA
	Seol *et al.* (2016)	NA	NA	–
	Wheaton *et al.* (2021)	–	NA	NA
Anxiety severity	Kyrios *et al.* (2018)	NA	–	NA
	Nakatani *et al.* (2005)	NA	–	NA
	Seol *et al.* (2016)	NA	NA	–
	Wheaton *et al.* (2021)	–	NA	NA
OVIS: Overvalued ideas[1]	Neziroglu *et al.* (2001)	NA	–	NA
OVIS: Overvalued ideas[2]	Neziroglu *et al.* (2001)	NA	+	NA
Quality of life	Wheaton *et al.* (2021)	–	NA	NA
Total IQ	Nakatani *et al.* (2005)	NA	–	NA
Executive function (total errors on WCST)	Seol *et al.* (2016)	NA	NA	+

(*Continued*)

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Table 3. (*Continued*)

Predictor	Study	Y-BOCS post score	Y-BOCS post change score	Responder status post
Executive function (perseverative errors)	Seol *et al.* (2016)	NA	NA	+
Other				
Past CBT for OCD	Wheaton *et al.* (2021)	+	NA	NA
Medication	Kyrios *et al.* (2018)	NA	–	NA
	Wheaton *et al.* (2021)	–	NA	NA
Number of hospitalizations	Kyrios *et al.* (2018)	NA	–	NA
WSAS (work and social adjustment)	Seol *et al.* (2016)	NA	NA	–
Working alliance‡	Andersson *et al.* (2015)	+	+	NA
Disgust‡	Andersson *et al.* (2015)	+	+	NA
Treatment adherence‡	Tjelle *et al.* (2021)	+	NA	NA
	Wheaton *et al.* (2018)	+	NA	NA

–, Non-significant result; +, significant result; NA, outcome was not assessed in the study. [1]Predicting Y-BOCS obsessions subscale; [2]predicting Y-BOCS compulsions subscale. ‡Predictors measured during treatment; all others were measured at pre-treatment.

Y-BOCS at post-treatment, pre-treatment to post-treatment change, and 24-month follow-up, but not pre-treatment to 24-month follow-up change (Andersson *et al.*, 2015). A second study found that clinician ratings of treatment adherence taken *during* treatment predicted post-treatment symptom score (Wheaton *et al.*, 2018), while a third study found that treatment adherence ratings (a combined score from clinician and patient ratings) taken *during* treatment were significantly related to treatment outcome at post-treatment and was a significant predictor of treatment outcome at 3-month follow-up (Tjelle *et al.*, 2021).

Quality of treatment trials and risk of bias

Overall, none of the included studies was rated as having low risk of bias, followed by half of the included studies ($k = 4$; 50%) rated to have some concerns, while the remaining studies were rated as having high risk of bias ($k = 4$; 50%) (see Table B of the Supplementary material). Notably, two out of four open trials (50%) were rated as having high risk of bias despite omitting and modifying domains that did not apply to these studies (i.e. randomization). Studies generally performed adequately regarding the conduct and reporting of randomization with three studies (75% of RCTs assessed on this domain) assessed as low risk; the remaining study was assessed as having some concerns (due to the use of age-matching prior to randomization). Management of bias resulting from deviations from intended interventions was rated as low risk in two studies (50% of RCTs assessed on this domain), while the remaining two RCTs were assessed as having some concerns (as they conducted case analyses rather than intention to treat analyses to manage deviations from intended interventions). Half of the included studies ($k = 4$; 50%) used appropriate statistical measures to minimize bias due to missing data. All studies selected an appropriate primary outcome and measured it consistently across the treatment and control groups, with a majority rated as low risk ($k = 6$; 75%). The remaining two studies ($k = 2$; 25%) were rated as high risk as the measure was completed by self-report or the assessor was not blind to the treatment allocation. None of the included studies reported all planned analyses in the pre-registered treatment protocol. Few studies either documented a previously published or pre-registered treatment protocol, meaning we were unable to determine whether the outcome analyses and reporting was consistent with the author's pre-specified protocol.

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Quality of predictors analyses

The quality of predictor analyses varied considerably (see Table C of the Supplementary material). While most studies assessed predictors through validated measurement tools prior to randomization or pre-treatment, the majority of studies had lower than optimal case to variable ratios and therefore may have been under-powered to examine predictors of outcome. Further to this, less than half of the included studies stated hypotheses '*a priori*'. Four out of eight studies had empirical evidence to support their rationale for examining included predictors. Finally, six out of eight studies used but had not necessarily planned a robust test of interaction or other regression analyses to evaluate the predictor–outcome relationship.

Discussion

The aim of the present review was to provide a narrative synthesis to identify predictors of CBT outcome for adults with a primary diagnosis of OCD. The present review included eight studies examining a variety of predictors both across and within the individual studies. While there was insufficient consistency in the predictors examined across studies to conduct reliable meta-analyses, several findings did indicate promising directions for future research. Congruent with past reviews in this area, there was great heterogeneity of predictors measured and outcomes predicted across the included studies. While few studies examined the role of demographic factors there was little evidence that these factors influence treatment outcome. These results are consistent with previous reviews, which have demonstrated little impact for demographic factors (Olatunji *et al.*, 2013; Reid *et al.*, 2021). While further research is warranted, given the need for methodological improvements in this area, the outcomes are encouraging as it may be possible that individuals from a variety of backgrounds could equally respond to CBT for OCD.

Like many previous reviews, baseline OCD symptom severity was the most consistently measured predictor in this review, being measured by 75% of the included studies. Approximately half of the studies in the present review found baseline OCD symptom severity to be a significant predictor of one or more of the treatment outcomes. It is possible that the vast differences in methodological design of the studies included in the present review may have contributed to the discrepant findings for this predictor. Specifically, two studies (Andersson *et al.*, 2015; Kyrios *et al.*, 2018) that looked at pre–post change scores as a primary outcome found pre-treatment Y-BOCS to be a significant predictor, while the other studies did not look at this outcome. Similarly the only two studies (Andersson *et al.*, 2015; Tjelle *et al.*, 2021) that looked at outcomes at 3-month follow-up (Tjelle *et al.*, 2021) and 24-month follow-up (Andersson *et al.*, 2015) found pre-treatment Y-BOCS to be a significant predictor of treatment outcome. Notably, the studies that found pre-treatment Y-BOCS to be a predictor of outcome also had bigger sample sizes, and sample to predictor ratio indicated that they had greater power to detect predictors of outcome, which may account for the discrepancies. Nevertheless, our findings are consistent with the mixed findings in the literature, including past reviews (Keeley *et al.*, 2008; Knopp *et al.*, 2013; Turner *et al.*, 2018) and a mega-analysis (Steketee *et al.*, 2019) which identified that lower baseline symptom severity was a significant predictor of better treatment outcome, while others did not find baseline severity to predict treatment outcome (Olatunji *et al.*, 2013; Reid *et al.*, 2021). These findings have clinical implications in that pre-treatment severity alone is not a consistent predictor of treatment outcome, which suggests that CBT may be an appropriate treatment plan for all individuals presenting with OCD, not just those with a specific type or severity of symptoms.

The present study identified several novel predictors that have not received much attention in the literature to date, and which warrant further exploration. Firstly, recent studies have shown

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that individuals with greater baseline OCD-related avoidance (Wheaton *et al.*, 2018; Wheaton *et al.*, 2021) or who hold greater over-valued ideas about their OCD symptoms (Neziroglu *et al.*, 2001) may benefit less from CBT treatment. These finding are consistent with other research, which did not meet criteria to be included in our review. For instance, Diefenbach *et al.* (2015) found that baseline avoidance of OCD triggers was an important predictor of outcome. While Kozak and Foa (1994) were one of the first to highlight over-valued ideas as a predictor of poor treatment outcomes, Neziroglu *et al.* (2001) were the first to operationalize a tool to examine the predictive validity of this concept, and therefore it warrants more study in the future. If future research replicated the findings of baseline avoidance and over-valued ideas as predictors of poorer treatment outcome, this would have important clinical implications for treatment planning as it could imply that individuals should be pre-screened on these psychological variables before being given CBT as a first-line treatment.

Secondly, the present study identified that individuals who made less errors on tasks of mental flexibility respond better to CBT. Notably, findings of a previous review highlighted that executive functioning on non-verbal tasks is impaired among adults with OCD (Abramovitch *et al.*, 2013). While the role of executive functioning and mental flexibility warrants more study, if replicated in future studies then simple non-verbal tasks of executive functioning (e.g. Wisconsin Card Sort Test, Stroop) could serve as important screening tasks when considering appropriate first-line treatment for individuals presenting with primary OCD. For example, if this was replicated and found to be a robust predictor of CBT outcome, then one of these tasks could be easily added to an intake or initial assessment to inform whether the individual will likely benefit from CBT or not. In addition to replicating the current findings, this result also highlights an area for future research and reviews to explore the neurbiological predictors of outcome.

Third, a very recent study has found that individuals who have previously engaged with face-to-face CBT may not benefit from an internet-delivered CBT treatment (Wheaton *et al.*, 2021). While only one study in this review investigated this predictor, if this was examined and replicated in future studies it could have important implications for stepped care models of treatment. In line with this, a recent review by Turner *et al.* (2018) on predictors of CBT outcome for children and adolescents with OCD reported that for some non-responders to initial CBT (in particular for those with co-morbid tics), continuing with CBT was less effective than commencing a pharmacotherapy. If replicated, this could suggest that individuals who have already engaged with past face-to-face CBT treatment may be better triaged to an alternative, adapted or adjunctive treatment instead of standard internet-delivered CBT alone.

Interestingly, three studies examined predictors of outcome which were measured during the treatment period. Wheaton *et al.* (2021) in their recent study measured the participants' perception of the working alliance with their clinician and found that a working alliance that was rated as good was related to better treatment outcomes, which is a finding that is congruent with a previous review of predictors of outcome (Keeley *et al.*, 2008). Notably, two studies found that treatment adherence was a significant predictor of post-treatment symptoms. Wheaton *et al.* (2018) found that clinician rated treatment adherence was predictive of better outcomes, while Tjelle *et al.* (2021) found that a combined clinician and self-report rating of treatment adherence was predictive of better treatment outcomes. These findings are important as they suggest that it may be possible to know early in treatment who will likely benefit from treatment.

While the current study highlights some important factors to consider for future research and clinical practice, there are a number of limitations of this study which must be acknowledged. Firstly, only a small number of studies were included in the review, owing to the requirement for studies to have made a formal diagnosis of OCD using a known diagnostic tool and the requirement for OCD to be a primary diagnosis. However, employing these strict criteria is important for best understanding the predictors of primary OCD as it is currently defined in *DSM-5*. Notably, the included studies had a similar mean age and gender, and therefore the

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findings may not be generalizable to all individuals with OCD. Additionally, the studies included are heterogeneous in their characteristics of treatment delivery and also operationalization of treatment outcome and therefore, the outcomes could not be examined using meta-analysis and therefore have limited generalizability. First, the varying treatment lengths and delivery options make it hard to determine whether these factors have clinical implications for treatment outcome. Furthermore, three of the studies included used treatment responder status as an additional or alternative clinically meaningful indicator of outcome. While there is great heterogeneity in what was defined as treatment response in the included studies, this is an important finding that points to how future research would help us better understand who benefits from treatment. Research has shown that a Y-BOCS score $\leq$12 to define remission, is associated with a return to normal functioning, and greater life satisfaction (Farris *et al.*, 2013). Therefore, future research using responder status as a treatment outcome could employ this definition to ascertain more accurate remission rates.

Finally, the quality and risk of bias of the included studies was not optimal and therefore again the synthesis of the findings may also be biased. Nonetheless, what it highlighted is that research into the predictors of OCD treatment outcome has not been a primary interest in planning treatment studies, leaving them often with insufficient power to complete the analyses needed to detect predictors of outcome. This highlights an important need for future research in this area to prioritize planning *a priori* the predictors, and methods needed to examine predictors of treatment outcome and integrating these into clinical trial registration. Notwithstanding these limitations, this was the first synthesis of the literature that restricted the inclusion criteria to manage the limitations of previous reviews including heterogeneity of measurement of outcome, lack of structured diagnostic interview, inclusion of all ages, and most importantly, the inclusion of individuals with primary hoarding symptoms.

The results of the present study suggest that there may be a number of pre-treatment and during treatment variables that are important to consider when treatment planning for individuals with OCD. Specifically, if the findings of the present study were to be replicated, then it would be important to screen for pre-treatment predictors that may have an impact on the individual's engagement with CBT, such as over-valued ideas, severe avoidance and previous trials of CBT. The current findings could imply that individuals who screen high on psychological variables such as pre-treatment avoidance and over-valued ideas may find it difficult to engage with treatment components such as exposure, which require intentional and active participation in behavioural change. Similarly, if findings of the during treatment variables (e.g. working alliance, treatment adherence, disgust) were replicated, then it would be important to routinely measure these factors throughout treatment. These findings also identify factors which could be further explored in order to better understand the mechanisms by which CBT has its benefits and to improve treatment outcomes for a larger number of individuals with OCD. The review also highlights the need for major methodological improvements in the design, implementation and reporting of studies.

Despite the known efficacy of CBT for OCD, there remain considerable knowledge gaps regarding who would benefit most from CBT. Since the last reviews (Keeley *et al.*, 2008; Knopp *et al.*, 2013; Reid *et al.*, 2021), the field has continued to explore predictors of outcome, but the literature continues to show inconsistencies. It is promising, however, to see some studies emerging regarding predictors of treatment outcome, and it is likely that many studies utilizing *DSM-5* criteria have yet to be published. While some evidence shows that OCD-related symptoms, pre-treatment and some during treatment factors may be important to consider, there is near equivalent data that suggest that there may not be specific predictors that highlight treatment outcome, and therefore it is possible that CBT may work equally for everyone with OCD. Nonetheless, future research should continue to examine possible predictors and moderators of treatment outcomes in order to optimize treatment response for individuals with primary OCD.

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Supplementary material. To view supplementary material for this article, please visit: https://doi.org/10.1017/S1352465823000103

Data availability statement. The data that support the findings of this study are available from the corresponding author (S.M.), upon reasonable request.

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