

## Research paper

# Feeling more confident to encounter negative emotions: The mediating role of distress tolerance on the relationship between self-efficacy and outcomes of exposure and response prevention for OCD

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## ABSTRACT

**Background:** While exposure and response prevention (ERP) is the first-line treatment for obsessive-compulsive disorder (OCD), up to half of patients do not effectively respond. In an effort to better understand the mechanisms behind ERP, the inhibitory learning model emphasizes the roles of increasing perceived self-efficacy and distress tolerance. While self-efficacy and distress tolerance have separately been shown to predict OCD symptoms and treatment outcomes, no studies have assessed their joint effects in ERP. The current study examined distress tolerance as a mediator of the relationship between self-efficacy and ERP outcomes.

**Methods:** Patients in an intensive ERP-based treatment program ( $N = 116$ ) completed weekly self-report measures.

**Results:** Over the course of treatment, as OCD symptoms reduced, self-efficacy and distress tolerance both significantly increased. Importantly, increases in self-efficacy and distress tolerance mediated each other in explaining symptom reduction, suggesting a possible bi-directional effect.

**Limitations:** The temporal relationship between changes in self-efficacy and distress tolerance is worthy of further investigation. In addition, the current sample had limited racial diversity and might not be representative of patients receiving lower levels of care. Findings merit replication to be ascertained of their reliability.

**Conclusions:** Findings suggest that during ERP, patients gain confidence in their abilities both to cope with general challenges and to withstand distress, potentially helping them engage with exposures and overcome initial fears. These findings provide support for the inhibitory learning model and highlight the mechanistic roles of self-efficacy and distress tolerance in ERP. Clinical implications to target both in treatment are discussed.

## 1. Introduction

### 1.1. Exposure and response prevention (ERP) as a treatment for OCD

Obsessive-compulsive disorder (OCD) is one of the most functionally impairing psychological disorders (Baxter et al., 2014) and causes significant distress and substantial interference to one's life (Huppert et al., 2009; Markarian et al., 2010). Exposure and Response Prevention (ERP) therapy has been identified as the first-line treatment for OCD (Abramowitz, 2006; Franklin and Foa, 2002; Hezel and Simpson, 2019). In ERP, patients expose themselves to situations that potentially trigger their intrusive thoughts and distress, while not performing compulsions. While the efficacy of ERP has been proven in populations across various

cultures (Franklin and Foa, 2002; Hezel and Simpson, 2019; Storch et al., 2017), more than one-third of patients experience little to no benefit (Eddy et al., 2004; Fisher and Wells, 2005; Öst et al., 2015), and up to half of the patients do not meet the threshold for clinically significant change at post-treatment (Öst et al., 2015) and/or sustained remission after 6 months (Springer et al., 2018). One barrier to enhancing response rates is that the mechanisms behind ERP remain poorly understood, which is necessary to identify key treatment targets.

One leading theory of ERP mechanisms is the inhibitory learning model (Craske et al., 2008, 2014). This model proposes that as individuals are repeatedly exposed to stimuli that trigger fear in the absence of expected aversive outcomes, they associate those stimuli with new experiences; and in turn, these new experiences override the

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original fear response (Lang et al., 1999; Myers and Davis, 2007). Although the inhibitory learning model was based largely on basic pharmaceutical and neurobiological research using conditioning paradigms with rodents (e.g. Berman and Dudai, 2001; Cain et al., 2004; Harris and Westbrook, 1998; McNally, 2005) and human non-clinical samples (e.g. Eifert and Heffner, 2003; Karekla et al., 2004), the specific clinical indicators of fear learning in the context of ERP have received limited testing in actual patients with OCD.

Two critical and testable clinical constructs that have been implicated in the inhibitory learning model are perceived self-efficacy and distress tolerance (Craske et al., 2008). Perceived self-efficacy captures one's belief about how well they are able to cope with challenging situations in general (Bandura et al., 1999), while distress tolerance refers to one's belief about their ability to experience and withstand negative emotional states specifically (Simons and Gaher, 2005). Within an inhibitory learning framework, during ERP, patients may gain confidence in their ability to handle challenging situations, which offers them a sense of mastery over their fears and increases their willingness to face fearful situations without relying on obsessive rituals (Abramowitz, 2006). Patients then learn that distressing situations are bearable, and this new experience of being able to tolerate distress is what inhibits the previous obsessional fear, leading to the reduction of OCD symptoms (Abramowitz and Arch, 2014; Craske et al., 2008, 2014).

### 1.2. Perceived self-efficacy in OCD and ERP outcomes

Although research on the role of perceived self-efficacy as a mechanism of change remains limited, it has been associated with OCD and anxiety severity across cultures. Those with lower self-efficacy are more likely to use dysfunctional coping strategies under distress (Thomasson and Psouni, 2010), and lower perceived self-efficacy has been found to predict more severe OCD symptoms and lower quality of life in both clinical (Ezz-Eldin Prince Ali, 2020; Bhardwaj et al., 2022; Jones and Menzies, 1997) and non-clinical (Shafie kahani et al., 2022) populations. Similarly, lower self-efficacy is also related to higher levels of other anxiety symptoms, such as social anxiety (Gaudiano and Herbert, 2007; Thomasson and Psouni, 2010) and panic attack symptoms (Richards et al., 2002).

In line with how perceived self-efficacy is implicated in the inhibitory learning model, studies have also examined the specific role of perceived self-efficacy in fear learning. Research suggested that high self-efficacy facilitates fear extinction (Zlomuzica et al., 2015), while low self-efficacy impedes discriminative fear learning (Raeder et al., 2019). It is possible that as one feels more confident in their ability to cope with challenges, they might also become more open to face and likely to conquer their fears. Expectedly because of this, several studies have shown that improvement in patients' perceived self-efficacy predicted better outcomes of cognitive-behavioral therapies for anxiety and panic disorders (Bouchard et al., 2007; Brown et al., 2014; Gallagher et al., 2013).

To date, there have only been two empirical studies that investigated self-efficacy in the context of ERP for OCD. In a small pilot study ( $N = 19$ ), Kuckertz et al. (2019) demonstrated that increases in self-efficacy across ERP correlated with OCD symptom reduction. In a larger study, Voderholzer et al. (2020) found that ERP outcomes were mediated by enhanced perceived self-efficacy. Theoretically, it is probable that growing confidence in one's general ability could make the individual more willing and motivated to carry through exposures and endure the negative experiences brought by them; conversely, as one's OCD symptoms improved via ERP, this could also help them form a more positive belief that they are able to deal with challenges without relying on obsessions and compulsions (Abramowitz, 2006).

### 1.3. The potential mediating role of distress tolerance on perceived self-efficacy in ERP outcomes

Existing studies on perceived self-efficacy during exposure have not considered the role of self-efficacy alongside downstream mechanistic processes, such as distress tolerance. Like perceived self-efficacy, low distress tolerance has been studied as another vulnerability factor for OCD (Cougler et al., 2011; Lapsa et al., 2015; Michel et al., 2016). For those who are less able to tolerate negative emotions, when they experience the discomfort brought by their obsessions, they might be more vulnerable to alleviating that distress through performing compulsions. Furthermore, low distress tolerance has been increasingly recognized as a key factor that leads to the failure to participate in and adhere to ERP (McKay et al., 2015), and empirical evidence from a sample of OCD patients has also supported that distress tolerance significantly increases over the course of ERP (Garner et al., 2018). The repeated exposure to fears and the associated distress during ERP could help one become better at tolerating unpleasant emotions, and the improvement in this ability could also make them more prepared to face those fears and perform in ERP (Abramowitz and Arch, 2014; Craske et al., 2008, 2014).

Both perceived self-efficacy and distress tolerance capture one's perception about their own abilities - the former on a more general level about handling challenges in life, while the latter on the more specific domain about managing negative emotions. Surprisingly, despite this strong theoretical link, no studies have examined them together in relation to anxiety disorders. Given how both perceived self-efficacy and distress tolerance are shown to play important roles in OCD, we propose the importance of examining the change of both jointly in the context of ERP. Specifically, as one becomes more confident in their general ability to deal with challenges, this could also lead to a downstream increase in their perceived ability to withstand the negative emotions brought on by exposures, which consequently makes them more willing to face their fears, sit with the discomfort, and eventually experience symptom improvements through ERP.

### 1.4. Present study

In the present study, we sought to investigate the mechanistic roles of perceived self-efficacy and distress tolerance in treatment outcomes of ERP for OCD. We hypothesized that perceived self-efficacy and distress tolerance would increase over the course of treatment, and that these increases in self-efficacy and distress tolerance would correlate with reductions in OCD symptoms. Our main aim was to explore the mechanisms behind these changes by testing distress tolerance as a mediator of the relationship between perceived self-efficacy and ERP outcomes. That is, we hypothesized that the positive effect of perceived self-efficacy on ERP outcomes is mediated by improving distress tolerance.

## 2. Method

### 2.1. Participants

Participants in this study consisted of adult patients ( $N = 116$ ) receiving partial hospital or residential treatment at the McLean Hospital Obsessive Compulsive Disorder Institute in Belmont Massachusetts. Data were collected from patients who attended the treatment program between July 2020 and June 2023. The average length of stay in the program was 70.6 days ( $SD = 25.9$ , range 11–179), corresponding to about 10 weeks of treatment. The mean age of participants was 28.5 ( $SD = 10.2$ ; range 18–69), and the majority of participants (87.1 %) identified as non-Hispanic White. See Table 1 for detailed demographics.

Study inclusion/exclusion criteria were identical to standard admission criteria for the treatment program overall. Admission criteria for the treatment program was assessed by a masters-level clinician prior to admission. Specifically, patients must have a diagnosis of OCD and/or a similar diagnosis that was determined likely to benefit from ERP

**Table 1**  
Overall sample demographics (N = 116).

Variable	M (SD) or % (n)
Age	28.5 (10.2)
Length of stay (days)	70.6 (25.9)
Gender	
Female	51.7 % (60)
Male	39.7 % (46)
Gender non-conforming	1.7 % (2)
Nonbinary	2.6 % (3)
Transgender	2.6 % (3)
Not listed	1.7 % (2)
Race/ethnicity	
Asian	6.0 % (7)
Middle Eastern/North African	4.3 % (5)
Latinx/Hispanic (non-white)	1.7 % (2)
White	87.1 % (101)
Do not know	0.9 % (1)
Sexual orientation	
Asexual	4.3 % (5)
Bisexual	13.8 % (16)
Gay/lesbian	8.6 % (10)
Heterosexual	63.8 % (74)
Pansexual	0.9 % (1)
Queer	0.9 % (1)
Not listed	4.3 % (5)
Prefer not to answer	3.4 % (4)
Education	
Some high school	0.9 % (1)
High school graduate/General Educational Development degree	9.5 % (11)
Some college	28.4 % (33)
Bachelor's degree	39.7 % (46)
Associate's degree (community college or vocational/technical school)	5.2 % (6)
Graduate or professional degree	16.4 % (19)

Note. Abbreviations: M = mean; SD = standard deviation.

within our OCD-focused treatment program. Additionally, exclusion criteria were patients being at immediate risk to harming self or others (e.g., suicidal intent/plans, violent outbursts) or serious health concerns requiring higher levels of care (e.g., inability to feed oneself). Finally, participants were only included in the current study if they had data for all current study measures (YBOCS, GSE, DTS, DTS-SF) at pre- and post-treatment, see Section 2.4 Procedure.

Of the participants with available diagnostic data from the Structured Clinical Interview for DSM-5 Disorders (SCID-5;  $n = 74$ ; see Procedure for further explanation of missing data), the overwhelming majority of participants (97.3 %;  $n = 72$ ) received a primary diagnosis of OCD. The remaining participants ( $n = 2$ ) had primary diagnoses of post-traumatic stress disorder and secondary diagnoses of OCD. The most common comorbid diagnoses were major depressive disorder (27.6 %;  $n = 32$ ), social anxiety disorder (15.5 %;  $n = 18$ ), and persistent depressive disorder (11.2 %;  $n = 13$ ). At program admission, participants endorsed moderate to severe OCD symptoms on average (YBOCS M = 25.5, SD = 4.9, range = 8–39).

## 2.2. Treatment overview

In the program, each patient had their own treatment team that consisted of a behavioral therapist, family therapist, and psychiatrist. The treatment program was based primarily on an ERP framework, where patients completed up to four hours of either coached or self-directed ERP sessions daily. Additionally, patients also attended 2–4 therapy groups every day, which covered cognitive-behavioral and acceptance-commitment principles. In the current sample, most patients (66.4 %;  $n = 77$ ) attended the residential program and resided on the unit for the duration of treatment, whereas the remaining portion (33.6 %;  $n = 39$ ) attended a virtual partial hospital program and attended treatment via videoconference at their own accommodations.

Regardless of program type, the treatment required full-day commitment from Monday to Friday. For more information about the treatment program, refer to Krompinger et al. (2017). Independent samples *t*-tests revealed no significant differences in self-report study measures (YBOCS, GSE, DTS, and DTS-SF scores) between patients who attended the residential versus virtual program, at both pre- and post-treatment ( $ps > 0.14$ ).

## 2.3. Measures

### 2.3.1. Structured Clinical Interview for DSM-5 Disorders (SCID-5; First et al., 2015)

The SCID-5 is a structured clinical interview that assesses for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013). The SCID-5 has demonstrated excellent reliability, high specificity, and high clinical validity (Osório et al., 2019).

### 2.3.2. Yale-Brown Obsessive Compulsive Scale, Self-Report Version (YBOCS; Goodman et al., 1989; Steketee et al., 1996)

The YBOCS is a 10-item self-report that measures OCD symptom severity. The YBOCS consists of 5 items about obsessions and 5 items about compulsions, encompassing parameters including time spent (e.g. “How much of your time is occupied by obsessive thoughts?”), distress (e.g. “How much distress do your obsessive thoughts cause you?”), interference (e.g. “How much do your obsessive thoughts interfere with your social or work functioning?”), resistance against (e.g. “How much of an effort do you make to resist the compulsions?”), and control over those symptoms (e.g. “How much control do you have over the compulsive behavior?”). All items are in regard to participants’ experiences over the past week. Participants answered each item on a 5-point Likert scale ranging from 0 (not at all/none) to 4 (extreme) for a total score of 0–40, where higher scores indicate greater OCD severity. The YBOCS was initially developed as a clinician-administered version (Goodman et al., 1989), and since then the self-report version has demonstrated moderate to strong correlation to it (Federici et al., 2010; Hauschildt et al., 2019; Steketee et al., 1996; Storch et al., 2017). In the present sample, the internal consistency was good at pre-treatment ( $\alpha = 0.84$ ) and excellent at post-treatment ( $\alpha = 0.92$ ). Because the YBOCS was also administered on a weekly basis throughout treatment and the goal of the study was to examine within-person change processes, we also calculated longitudinal reliability using an extension of generalizability theory (Cranford et al., 2006; Revelle, 2020; Shrout and Lane, 2012). In the current study, the YBOCS showed excellent reliability ( $R_{KF} = 0.99$ ) for capturing between-person differences over time and acceptable reliability ( $R_C = 0.78$ ) for within-person variations over time.

### 2.3.3. General Self-Efficacy Scale (GSE; Schwarzer et al., 1995)

The GSE is a 10-item self-report measure of general self-efficacy, or one’s belief about their ability to cope with difficult situations (e.g. “I am confident that I could deal efficiently with unexpected events”). For each item, participants rated on a 4-point Likert scale for how well the statement describes them. All items are summed up to give a total score of 10–40, with higher scores corresponding to greater perceived self-efficacy. The GSE has demonstrated strong psychometric properties in populations across cultures (Luszczynska et al., 2005; Scholz et al., 2002). In the current study, the GSE was administered pre- and post-treatment and showed good internal consistency (pre-treatment  $\alpha = 0.86$ ; post-treatment  $\alpha = 0.88$ ).

### 2.3.4. Distress Tolerance Scale (DTS; Simons and Gaher, 2005)

The DTS is a 15-item self-report measure of one’s beliefs about their capacity to tolerate and withstand negative emotions. It assesses four dimensions: tolerance (three items, e.g. “Feeling distressed or upset is unbearable to me”), level of attentional absorption (three items, e.g. “When I feel distressed or upset, all I can think about is how bad I feel”),

effort put into the regulation (three items, e.g. “I’ll do anything to avoid feeling distressed or upset”), and appraisal (six items, e.g. “My feelings of distress or being upset are not acceptable”). Participants rated the extent to which they agree with each item on a 5-point Likert scale, giving a total score of 15–75. A higher score marks a better perceived ability to tolerate distress. The DTS has shown good psychometric properties (R. J. Brown et al., 2022; Simons and Gaher, 2005). In the current study, the DTS was administered pre- and post-treatment and demonstrated excellent internal consistency (pre-treatment  $\alpha = 0.92$ ; post-treatment  $\alpha = 0.92$ ).

2.3.5. Distress Tolerance Scale - Short Form (DTS-SF; Garner et al., 2018)

The DTS-SF is an abbreviated 4-item version of the original DTS. It contains one item from each of the four dimensions of the DTS (tolerance, absorption, regulation, and appraisal), yielding a total score of 4–20. The DTS-SF has demonstrated good psychometric properties in both populations with OCD (Garner et al., 2018) and non-clinical populations (Brown et al., 2022). In the current study, the DTS-SF was administered weekly during treatment. It exhibited good internal consistency at pre-treatment ( $\alpha = 0.84$ ) and post-treatment ( $\alpha = 0.87$ ). Across all treatment weeks, it also showed excellent reliability ( $R_{KF} = 0.99$ ) for capturing between-person differences and good reliability ( $R_C = 0.80$ ) for within-person variations over time.

2.4. Procedure

Study procedures received approval from the Mass General Brigham Institutional Review Board. Participants completed the study measures as part of a larger battery of assessments included in their treatment for ongoing clinical monitoring. All participants included in the current study provided informed consent. Participants were recruited during the first week of their treatment and given the option of giving consent to allow this clinical data to be used for research purposes. Participants were assured that participation in research does not affect their treatment.

Self-report study measures were completed online via REDCap electronic data capture tools (Harris et al., 2009, 2019). All self-report study measures were administered at admission (i.e. pre-treatment) and discharge (i.e. post-treatment), and a subset was administered weekly throughout treatment (YBOCS, DTS-SF). The GSE was not administered weekly to minimize participants’ burden, given the large amount of assessments that they were expected to complete amidst their ongoing intensive treatment. Participants had varying numbers of available weekly assessments due to reasons such as differing lengths of stay, scheduling conflicts with treatment meetings, holidays, and participant non-adherence. On average, participants had 9.4 available assessment time points ( $SD = 3.4$ , range = 2–22).

Diagnostic assessments were conducted within the first two weeks of using the SCID-5 by trained research staff and graduate students under the supervision of a licensed clinical psychologist. Most participants (63.8 %,  $n = 74$ ) completed the SCID-5 to categorize primary and comorbid diagnoses. However, it was not administered to 36.2 % of the sample ( $n = 42$ ) due to scheduling constraints or COVID-19 limitations.

2.5. Data analysis plan

Data analyses were conducted in R (R Core Team, 2023). Study code and output are available via the Open Science Framework (OSF; [BLINDED FOR REVIEW]).

To assess if study measures changed during treatment, we conducted within-subject *t*-tests to compare the pre-treatment scores with post-treatment scores. For measures with weekly data available (YBOCS and DTS-SF), we used mixed-effects models with the weekly total scores as the outcome variable, predicted by time (week in treatment) and nested within participants. To examine the association between changes in study measures over treatment, we ran Pearson’s correlation

coefficients between change scores (pre - post treatment). For measures with weekly data available, we also obtained the correlation between their weekly per-person change slopes. Mixed effects models in the current study utilized maximum likelihood estimation to handle missing data.

To verify the impact of the hypothesized mediator (change in distress tolerance) on subsequent OCD severity, we ran mixed models predicting YBOCS at each week from change in DTS-SF scores over the preceding week, while also controlling for the prior week’s YBOCS scores. Of note, we were not able to examine the impact of changes in GSE (self-efficacy) on subsequent timepoints for DTS or YBOCS because the GSE was only collected at pre- and post-treatment.

Finally, we tested the mechanistic pathway linking self-efficacy, distress tolerance, and OCD symptoms via a mediation model. Using model 4 of the PROCESS macro in R (Hayes, 2022), we input the change score of YBOCS as the outcome variable, with the change score of GSE as the independent variable and the change score of DTS as the mediator. As data were collected at the same time points and we could not, strictly speaking, examine temporal precedence in this mediation pathway, we also tested the reverse model, where the change in DTS was the independent variable and change in GSE was the mediator. For each mediation model, we computed an estimate of the indirect effects by bootstrapping, and the effects were considered significant if the confidence intervals did not include zero (Preacher and Hayes, 2004, 2008).

3. Results

3.1. Descriptive statistics

Table 2 displays the descriptive statistics and Pearson’s zero-order correlations between measures at pre- and post-treatment.

All study measures were significantly correlated with each other at pre- and post-treatment. The YBOCS was negatively correlated with all other measures ( $r = -0.37$  to  $-0.28$ , all  $p < .01$ ), indicating that more severe OCD symptoms were associated with lower levels of perceived self-efficacy and distress tolerance. Meanwhile, there was a positive and moderately strong correlation between GSE and DTS (pre-treatment  $r = 0.39$ ; post-treatment  $r = 0.45$ ), indicating that higher levels of perceived self-efficacy were associated with higher levels of perceived ability to tolerate distress.

Table 2 Descriptive statistics and correlations at pre- and post-treatment (N = 116).

Measure	M (SD)	Range	1	2	3	4
<i>Pre-treatment</i>						
1. YBOCS	25.5 (4.9)	8–39*	–	–0.28**	–0.28**	–0.29**
2. GSE	23.4 (5.2)	11–37	–	–	0.39***	0.34***
3. DTS	35.9 (12.9)	15–71	–	–	–	0.94***
4. DTS-SF	9.6 (3.9)	4–20	–	–	–	–
<i>Post-treatment</i>						
1. YBOCS	15.0 (5.7)	4–30	–	–0.31***	–0.37***	–0.36***
2. GSE	27.3 (4.6)	11–38	–	–	0.45***	0.39***
3. DTS	44.2 (12.8)	17–74	–	–	–	0.96***
4. DTS-SF	12.2 (4.1)	4–20	–	–	–	–
<i>Change from pre-treatment to post-treatment (pre minus post)</i>						
1. YBOCS	10.4 (5.5)	–1–26	–	–0.35***	–0.40***	–0.37***
2. GSE	–3.9 (5.0)	–20–8	–	–	0.39***	0.36***
3. DTS	–8.4 (12.8)	–46–41	–	–	–	0.92***
4. DTS-SF	–2.6 (3.8)	–14–12	–	–	–	–

YBOCS = Yale-Brown Obsessive Compulsive Scale, Self-Report Version; GSE = General Self-Efficacy Scale; DTS = Distress Tolerance Scale; DTS-SF = Distress Tolerance Scale - Short Form.

\*  $p \leq .05$ .  
 \*\*  $p \leq .01$ .  
 \*\*\*  $p \leq .001$ .

3.2. Change in processes over the course of treatment

Results revealed significant changes in each study measure (YBOCS, GSE, DTS) from pre- to post-treatment. Specifically, there was a significant reduction in OCD symptom severity [ $t(115) = 20.53, p < .001$ , Cohen's  $d = 1.91$ ] and improvement in both perceived self-efficacy [ $t(115) = -8.33, p < .001$ , Cohen's  $d = 0.77$ ] and distress tolerance [ $t(115) = -7.07, p < .001$ , Cohen's  $d = 0.66$ ]. As displayed in Table 2, decreases in YBOCS were correlated with increases in both GSE ( $r = -0.35, p < .001$ ) and DTS ( $r = -0.40, p < .001$ ), while increases in GSE and DTS were also correlated with each other ( $r = 0.39, p < .001$ ).

When examining weekly changes, we found that YBOCS scores decreased by 1.06 points each week [ $SE = 0.07, \beta = -0.69, t(970) = -15.93, p < .001$ ; overall model AIC = 5611.40, BIC = 5641.34]. DTS-SF scores increased by 0.27 every week [ $SE = 0.03, \beta = 0.26, t(848) = 7.63, p < .001$ ; overall model AIC = 4868.46, BIC = 4897.69]. Weekly decreases in YBOCS were moderately correlated with weekly increases in DTS-SF ( $r = -0.50, p < .001$ ).

Next, we examined whether changes in distress tolerance predicted changes in OCD symptoms. Results indicated that when controlling for YBOCS in the previous week, increases in distress tolerance over the preceding week predicted lower OCD symptom severity in the current week [ $B = 0.16, SE = 0.04, \beta = 0.09, t(632) = 4.09, p < .001$ ; overall model AIC = 3596.75, BIC = 3628.99].

3.3. Mediation analyses

To investigate how the changes in these processes mechanistically relate to each other during treatment, we tested the change in DTS as a mediator of the relationship between changes in perceived self-efficacy and OCD symptom severity. Fig. 1A displays the results from mediation analyses via testing of indirect effects. The 95 % confidence interval of the indirect path ( $ab$ ) did not include zero ( $ab = -0.13$ , lower limit =  $-0.24$ , upper limit =  $-0.03$ ) indicating a significant mediation effect.

We also tested the reverse mediation model (Fig. 1B), with the change in GSE as the mediator and the change in DTS as the independent variable. The 95 % confidence interval of the indirect path ( $ab$ ) did not include zero ( $ab = -0.04$ , lower limit =  $-0.08$ , upper limit =  $-0.01$ ) indicating a significant mediation effect.

4. Discussion

While both self-efficacy and distress tolerance have separately been found to be related to OCD symptoms and treatment outcomes, the mechanisms through which these two factors work together in promoting symptom improvement in ERP have been less clear. Using longitudinal, weekly data from a clinical sample receiving intensive residential care, we replicated previous findings that as patients' OCD symptoms reduced over the course of ERP-based treatment, their perceived self-efficacy (Kuckertz et al., 2019; Voderholzer et al., 2020) and distress tolerance (Garner et al., 2018) both significantly increased. Moreover, mixed effects models supported that the change in distress

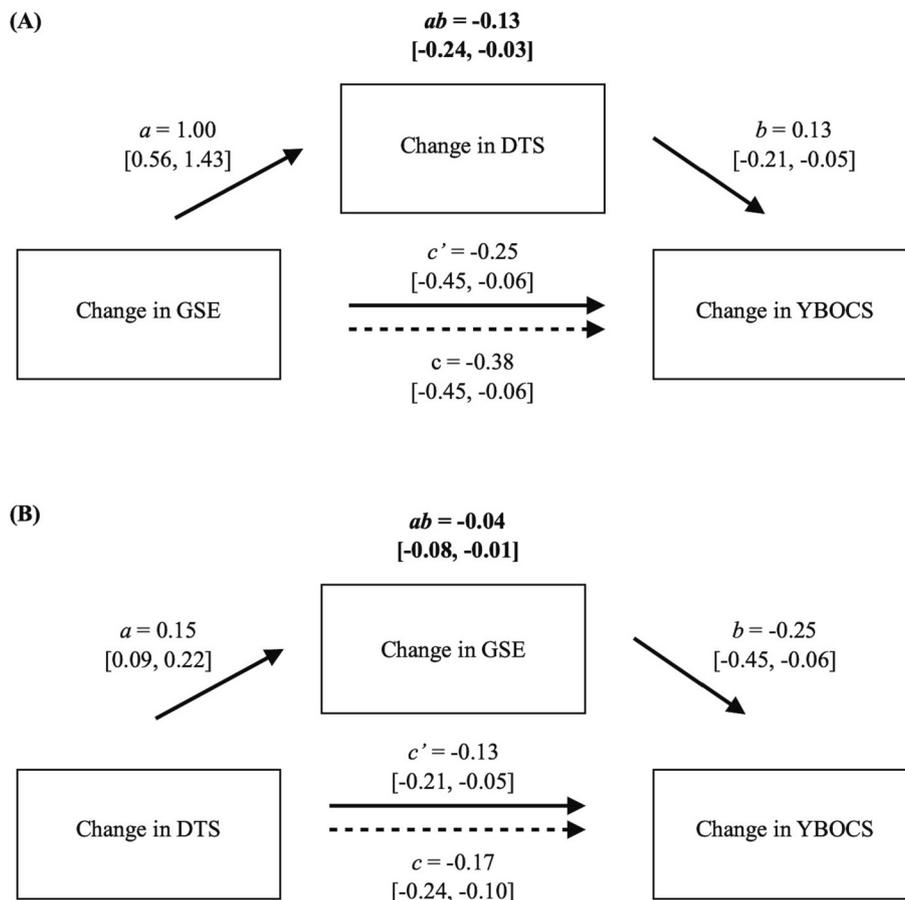


Fig. 1. Results from mediation analyses with (A) change in DTS as the mediator of the relationship between change in GSE and change in YBOCS; and (B) change in GSE as the mediator of the relationship between change in DTS and change in YBOCS. Note. The numbers in square brackets indicate the 95 % confidence interval of coefficients. YBOCS = Yale-Brown Obsessive Compulsive Scale, Self-Report Version; GSE = General Self-Efficacy Scale; DTS = Distress Tolerance Scale; DTS-SF = Distress Tolerance Scale - Short Form.

tolerance explained subsequent OCD symptom improvement.

Extending prior knowledge and as we hypothesized, increases in distress tolerance mediated the positive effect of increasing self-efficacy on OCD symptom improvement across treatment. In addition to our initial hypothesis, the reverse was also supported: growing self-efficacy was a significant mediator of the relationship between increasing distress tolerance and OCD symptom improvement, pointing to possible bi-directional effects. In other words, as patients gained confidence in their general ability to cope with challenges, they may have also become more confident in their ability to withstand negative emotions in particular; this could have helped increase their willingness to face their fears and tolerate the distress during ERP, leading to better treatment outcomes.

Current findings on the joint impact of self-efficacy and distress tolerance on OCD symptom improvement help delineate their mechanistic link in ERP, and provide further support for the inhibitory learning model (Craske et al., 2008, 2014). During ERP, patients learn that they are able to cope with challenges and also specifically to tolerate distress (i.e. increasing self-efficacy and distress tolerance); this new learning eventually leads to the extinction of fear response to triggers and reduce patients' reliance on obsessions and compulsions to alleviate distress. Notably, previous existing studies have mainly tested the inhibitory learning model using conditioning paradigms with rodents (e.g. Berman and Dudai, 2001; Cain et al., 2004; Harris and Westbrook, 1998; McNally, 2005), or human non-clinical samples (e.g. Eifert and Hefner, 2003; Karekla et al., 2004). The current study represented a critical step in this translation process with a focus on clinical constructs that are already familiar to clinicians and patients.

Specifically, by highlighting self-efficacy and distress tolerance as change factors in ERP, our findings inform clinical implications to target both when conducting treatment. Rather than a process of “getting rid of fears,” ERP could be more articulated to patients as a positive “learning” experience, through which patients gain improved abilities to cope with challenges and, in particular, negative emotions. In practice, clinicians could set up testable hypotheses (Craske et al., 2014, 2022) with patients at the beginning of each ERP session. Rather than revolving around whether fearful outcomes would actually happen (e.g. “Even if I do not wipe my table, I will not get sick”), these hypotheses could pertain to patients' beliefs about handling the uncertainty and distress associated with those outcomes (e.g. “If I do not wipe my table, I do not know if I will get sick, but I will be able to handle it regardless”). In turn, the process of testing such hypotheses during ERP could encourage patients to reflect on those internal beliefs and help them build greater distress tolerance and self-efficacy, which would be beneficial for both symptom reduction and navigating daily lives in general. Furthermore, given the significant roles of self-efficacy and distress tolerance on OCD symptom improvement, treatments could also consider incorporating extra interventions that specifically target these two constructs. For example, this could be in the form of single-session interventions upfront that increase self-efficacy (Schleider et al., 2019, 2022; Schleider and Beidas, 2022), which might then slowly transform into greater willingness to engage with distress and exposures. ERP-oriented treatment programs could also consider integrating principles from Acceptance Commitment Therapy (Hayes and Lillis, 2012) and Dialectical Behavioral Therapy (Linehan, 2015), both of which highlight and address the process of accepting and tolerating distress. In the future, it would also be meaningful to conduct follow-up studies to examine how effectively such changes in processes and improvement in OCD outcomes are sustained after treatment.

Because self-efficacy scores were not assessed weekly, we were only able to examine change scores collected at the same pre- and post-treatment time points in the meditation model. Thus, we were not able to parse out the temporal relationship between self-efficacy and distress tolerance. It is yet to be clarified if increasing self-efficacy led to downstream increases in distress tolerance (one first develops a more positive belief about their general ability, which then transforms into a

more domain-specific belief about handling negative emotions), or if growth in distress tolerance preceded self-efficacy (one first becomes better at tolerating negative emotions, and then generalize this confidence to more other areas). Further understanding this temporal relationship would offer deeper insights into the mechanistic link between self-efficacy and distress tolerance and inform clinical practice on when to most effectively target each construct in treatment, in order to maximize symptom improvement.

Furthermore, the current study attempted to tap into patients' beliefs about their own abilities from the perspectives of self-efficacy and distress tolerance, and findings suggested the growth in both over the course of ERP-based treatment. Self-efficacy encompasses one's beliefs about how well they are able to handle general challenges, while distress tolerance captures the more specific domain about handling negative emotions. Another interesting future direction, then, is to further disentangle distress tolerance and explore the specific forms of negative emotions that are involved in this process - is it about tolerating intrusive thoughts specifically, or more broadly tolerating anxiety or threats in general? In other words, is this experience of growing distress tolerance in ERP specific to reduce obsessions and compulsions, or might this change be more transdiagnostic by reshaping patients' narratives of themselves? To this end, it is also worth investigating this pattern of mediation between distress tolerance and self-efficacy in other related mental health conditions, especially the ones where both processes have been evidenced to influence symptom severity, such as other OC spectrum disorders (e.g. body dysmorphic disorder; Matheny et al., 2017), social anxiety (e.g., Gaudiano and Herbert, 2007; Laposa et al., 2015; Michel et al., 2016), and panic disorders (e.g. Gallagher et al., 2013; Michel et al., 2016).

In particular, considering the high comorbidity of depression in our sample, it would be intriguing to explore the influence of depression on current findings. Previous research has demonstrated a relationship between depression with reduced self-efficacy (Locke et al., 2017) and distress tolerance (Brown et al., 2022); research has also suggested that increases in self-efficacy may drive the improvement of depression symptoms during ERP (Zandberg et al., 2015). It would then be meaningful to examine the proposed mechanistic pathway through self-efficacy and distress tolerance on OCD and depression outcomes separately, to further clarify the specificity of current finding patterns among related internalizing conditions.

The racial and educational diversity in the sample was limited, which consisted of predominantly non-Hispanic White participants (87.1 %) with a generally medium to high education level (89.7 % with some college or higher). Studies have reported lower self-efficacy and lower distress tolerance among racial minorities compared to White participants (Assari, 2017; McIntosh et al., 2021) and among those with lower levels of education (Bonsaksen et al., 2019). It is uncertain whether our findings are generalizable to populations with more diverse racial and educational backgrounds. For example, since racial minority patients start with lower baseline levels, sessions targeting self-efficacy and distress tolerance early on might be particularly critical for symptom improvement in their ERP treatments. In a similar vein, current findings yielded from an intensive treatment setting (residential/partial hospitalization) might not be representative of patients receiving lower levels of care, namely outpatient ERP programs for OCD. While the average OCD severity of our current sample was roughly equivalent to that in outpatient settings (Steketee et al., 2019), less is also known about how the baseline levels of self-efficacy and distress tolerance compare and relate to ERP outcomes in intensive residential/partial hospitalization versus outpatient treatment settings. Patients may opt for residential and partial hospitalization treatment for a variety of factors (e.g. insurance acceptance; clinical complexity; limitations of resources or ERP providers in home location), leading to differences that are difficult to accurately assess or control for. Because of this, it is important to replicate the findings in outpatient settings to ascertain their reliability.

To our knowledge, this study is the first to examine the joint role of

perceived self-efficacy and distress tolerance in influencing ERP outcomes for OCD. Through revealing the bi-directional effects of how distress tolerance and self-efficacy mediated each other in improving treatment outcomes for ERP, these findings highlight the relationship between one's perception of their general abilities and one's engagement with negative emotions. This mechanistic link between self-efficacy and distress tolerance underscored both constructs as key treatment targets; furthermore, these findings represented a further clinical examination of the inhibitory learning model, which has been sparse in existing clinical literature. Ultimately, the goal of refining these theoretical models and their translation to clinical practice is to delineate mechanistic targets, leading to the development of more efficacious treatments for OCD.

### CRedit authorship contribution statement

**Junjia Xu:** Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Martha J. Falkenstein:** Methodology, Supervision, Writing – review & editing. **Jennie M. Kuckertz:** Conceptualization, Methodology, Supervision, Validation, Writing – review & editing, Formal analysis.

### Declaration of competing interest

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