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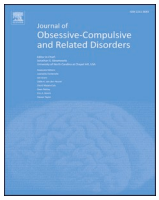

Comparison of patient-reported distress during harm avoidance and incompleteness exposure tasks for youth with OCD

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ABSTRACT

Exposure and response prevention is the front-line treatment for OCD, but many patients do not achieve symptom remission. Most theories of exposure mechanism suggest that eliciting and/or tolerating distress is necessary for exposure effectiveness. Moreover, research suggests that the type of distress may relate to treatment response, such that patients with "incompleteness" OCD symptom presentations exhibit poorer response than patients with "harm avoidance" symptom presentations. However, no studies have examined differences in distress during harm avoidance versus incompleteness exposure tasks. The current study examined differences in patient-reported distress during harm avoidance and incompleteness exposure tasks for 280 youth with severe OCD in a partial hospitalization program. Participants reported less distress and more often exhibited "flat," unchanging distress trajectories during exposure tasks targeting incompleteness compared to harm avoidance. Findings provide preliminary evidence of differences in emotional processes during harm avoidance versus incompleteness exposure tasks for youth with OCD.

1. Introduction

Obsessive-compulsive disorder (OCD) is a prevalent and impairing condition that often emerges in childhood or adolescence (Geller, 2006; Piacentini et al., 2003; Zohar, 1999) and, when left untreated, can persist into adulthood and lead to a range of other difficulties and marked functional impairment (Alonso et al., 2001; Stewart et al., 2004; Wewetzer et al., 2001). Cognitive behavioral therapy (CBT), with and without medication, has strong empirical support as the front-line treatment for OCD (Freeman et al., 2018; Geller & March 2012). Specifically, exposure and response prevention (ERP; i.e., behavioral treatment that involves planned contact with a feared stimulus while resisting avoidance or compulsive behavior) is the core component of CBT for OCD that prompts symptom change (Foa & McLean, 2016; McKay et al., 2010). Despite strong evidence that exposure-based CBT is an effective treatment for OCD, many patients do not respond or only partially respond to a typical treatment course (Freeman et al., 2018), and more research is needed to better understand treatment response and non-response to exposure-based CBT for OCD.

Multiple theories have been posited to explain the mechanism by which exposure elicits symptom change, most of which center on fear extinction learning. Emotional Processing Theory (Foa et al., 2006; Foa & Kozak, 1986) suggests that exposure allows a patient to experience a natural, gradual decrease of fear in the presence of the feared stimulus (i.e., habituation) and form a new memory that is incompatible with (or "replaces") the fear memory. Inhibitory Learning Theory (Craske et al., 2008, 2012) suggests that exposure facilitates distress tolerance and learning of new, non-threatening associations with the fear stimulus that can generalize across multiple contexts. According to Inhibitory Learning Theory, new learning does not "replace" fear associations, but rather may be made more readily retrievable over time. Both Emotional Processing Theory and Inhibitory Learning Theory—as well as other models such as Acceptance and Commitment Therapy (e.g., Twohig et al., 2015)—highlight the importance of experiencing distress for exposure effectiveness. Both theories also allude to the importance of distress change during exposure. Emotional Processing Theory emphasizes fear reduction or habituation within and between exposure tasks (Foa & Kozak, 1986), whereas Inhibitory Learning Theory describes the

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importance of variability in distress as a source of context variation that enhances later retrieval of new, non-threat memories (Craske et al., 2014). Indeed, some researchers argue that Emotional Processing Theory, Inhibitory Learning Theory, and other theories have more similarities than differences (Himle, 2015) and that change in distress during exposure may signal therapeutic learning and relate to treatment response (Benito & Walther, 2015).

Empirical research supports the notion that distress during exposure tasks is a relevant marker of treatment process. Many studies have found that the peak level of distress (or "fear activation") during exposure is associated with improved treatment response (Ball et al., 2017; Beckham et al., 1990; Kozak et al., 1988; Lang, 1971; Pitman et al., 1996; van Minnen & Hagenaars, 2002), although other studies have not demonstrated this effect (Kamphuis & Telch, 2000; Meuret et al., 2012; Sloan & Telch, 2002). Some studies have found that distress decrease during exposure is associated with better short-term symptoms (Oliver & Page, 2003) and treatment response (Beckham et al., 1990; Benito et al., 2018; Foa et al., 1983; van Minnen & Hagenaars, 2002), although others have not found evidence of such a relationship (Baker et al., 2010; Kamphuis & Telch, 2000; Kozak et al., 1988; Lang & Craske, 2000; Peterman et al., 2019; Pitman et al., 1996; Sripada & Rauch, 2015). Lastly, research has also demonstrated that variability in distress throughout an exposure task is associated with improved treatment response (Culver et al., 2012; Kircanski et al., 2012).

One challenge for this area of work is that exposure can be used to target different types of distress, which may exhibit different patterns of change and/or relate differentially to treatment response and outcomes. This may be particularly relevant for understanding treatment response in OCD, a heterogeneous disorder whose topographical symptoms vary widely across individuals (Abramowitz et al., 2010). Previous data-driven classifications of topographical symptom presentations ("symptom dimensions") have yielded inconsistent findings of the effects of symptom dimensions on treatment response (e.g., Matsunaga et al., 2010; Storch et al., 2008). Moving away from the symptom dimensions approach, recent research has investigated the core motivations that underlie a range of OCD symptoms. The Core Dimensions Model of OCD (Summerfeldt et al., 2014) posits that OCD symptoms are motivated primarily by either "harm avoidance" or "incompleteness." Symptoms that are motivated primarily by harm avoidance are those that correspond to a fear of something bad happening to oneself or others (e.g., getting sick, getting hurt, hurting someone else), and symptoms that are motivated primarily by incompleteness are those that correspond to an inner sense of imperfection or "not just right" feeling (Pietrefesa & Coles, 2008; Summerfeldt, 2004; Taylor et al., 2014). Patients may present with either one or both core motivations. Core motivations are differentially related to OCD symptom dimensions (Cervin et al., 2020; Coles et al., 2003; Ecker & Gönner, 2008; Schreck et al., 2020) and other clinical features (e.g., comorbidity; Cervin et al., 2020). Specifically, incompleteness has been associated with checking and ordering symptom dimensions (Coles et al., 2003; Ecker & Gönner, 2008; Schreck et al., 2020), sensory phenomena (Ferrão et al., 2012), and greater OCD symptom severity (Sibrava et al., 2016). Moreover, some evidence suggests that patients who present with incompleteness may exhibit poorer ERP treatment response (Cervin & Perrin, 2021; Foa et al., 1999), although the reason for this finding remains unclear.

Differences in treatment response between patients with harm avoidance and incompleteness core motivations may relate to differences in the type and pattern of distress experienced by these patients during exposure. While classical conceptions of OCD have categorized the disorder with other fear-based disorders (see American Psychiatric Association, 2000) and focused primarily on treating fear associated with harm avoidance core motivations (Pietrefesa & Coles, 2008), recent evidence suggests that incompleteness may represent an emotional process that is distinct from fear (Cervin, 2019; Cervin et al., 2021). Incompleteness may be better categorized with other Research Domain Criteria (RDoC) constructs such as frustrative non-reward (see Cuthbert, 2014), and eliciting distress related to incompleteness may be more difficult clinically than eliciting fear related to harm avoidance (Summerfeldt, 2004). Lower distress elicited during incompleteness exposure tasks may provide one explanation for poorer treatment response among patients with incompleteness core motivations of OCD symptoms. Moreover, distress related to incompleteness may also follow a different pattern of change during exposure compared to fear related to harm avoidance. Exposure tasks are often designed to violate expectancy or disconfirm beliefs about feared outcomes (Craske et al., 2008, 2014), yet incompleteness symptoms are not typically accompanied by specific fear cognitions. For patients with incompleteness core motivations of OCD symptoms, the "feared" or distressing outcome is the feeling itself, and exposures may focus on learning to tolerate distress rather than targeting specific fear content. Patients completing incompleteness exposure tasks may experience expectancy violation in that they learn that they are able to tolerate the sense of incompleteness without performing compulsive behaviors. However, these patients may not exhibit the same amount of distress decrease within one exposure task if distress tolerance is built over multiple exposure tasks (i.e., between rather than within trials; e.g., Gillihan et al., 2012). Consequently, if patients who present with incompleteness core motivations take more time (either within or between trials) to exhibit distress decrease, clinicians may determine that these patients require a longer treatment course. If patients who present with incompleteness core motivations do not ever exhibit distress decrease comparable to that of patients with harm avoidance core motivations, clinicians may perceive this lack of distress decrease as an indicator of treatment non-response. More research is needed to examine distress during harm avoidance and incompleteness exposure tasks to better understand differences in exposure process and treatment response between these groups.

One method that has been used to examine distress during exposure is the Subjective Units of Distress Scale (SUDS; Wolpe, 1990; see also Benjamin et al., 2010), usually rated on a 0 to 10 or 0 to 100 scale at multiple intervals throughout an exposure task. The collection of SUDS ratings is recommended in various CBT treatment manuals, particularly for youth (e.g., Kendall & Hedtke, 2006), and can provide useful data to inform clinical decision making. SUDS is also more feasible to administer than other distress metrics such as physiological markers in routine clinical practice. SUDS ratings have been used in previous studies of distress during exposure (e.g., Hoeboer et al., 2021; Kircanski et al., 2012; Sripada & Rauch, 2015). For instance, Kircanski et al. (2012) found that within-exposure fear variability measured by SUDS ratings predicted improved outcomes in participants with contamination fears. Similarly, Hoeboer et al. (2021) found that SUDS rating change within an exposure task preceded symptom improvement for patients with post-traumatic stress disorder. Although SUDS ratings have clear limitations (e.g., relying on patient-report, unstandardized data collection procedures when collecting ratings at different time intervals based on clinical utility), they are practical in real-world clinical settings and can provide clinically useful information about a patient's subjective experience of distress during an exposure task that can inform our understanding of exposure process and treatment response.

In summary, more research is needed to understand differential treatment response to ERP for OCD, particularly among patients with harm avoidance and incompleteness core motivations of OCD symptoms. Current theory on exposure process highlights the importance of some level of distress for exposure effectiveness and subsequent treatment response. Distress change during exposure may also represent an intermediate treatment outcome that informs exposure process and relates to treatment response. Differences in distress level and/or distress change during exposure may provide one possible explanation for differences in treatment response between patients with harm avoidance and incompleteness core motivations. The collection of patient-reported SUDS ratings during exposure can offer insight into distress during exposure therapy conducted during routine clinical care with minimal patient or clinician burden. No studies thus far have examined

differences in exposure processes during harm avoidance versus incompleteness exposure tasks.

The current study examined patient-reported distress during harm avoidance and incompleteness exposure tasks completed within a partial hospitalization program for youth with severe OCD. First, we aimed to compare start, peak, and end SUDS ratings during harm avoidance versus incompleteness exposure tasks. We hypothesized that start, peak, and end SUDS ratings would be higher during harm avoidance compared to incompleteness exposure tasks. Second, to assess distress change over exposure, we aimed to classify and examine shapes of distress trajectories exhibited during harm avoidance and incompleteness tasks. We hypothesized that incompleteness exposure tasks would more often exhibit "flat" distress trajectories compared to harm avoidance exposure tasks, as is consistent with existing theory and research on the nature and treatment of incompleteness OCD symptoms.

2. Method

2.1. Participants

Inclusion and exclusion criteria. Participants included youth between the ages of 5 and 18 who were diagnosed with OCD, admitted to a partial hospitalization treatment program between January 2015 and March 2020, and consented to participation in research. Participants who were diagnosed with other comorbid diagnoses alongside OCD were included in the study. Participants for whom sufficient data were not collected for study analyses (i.e., those who had not provided at least two SUDS ratings during at least one exposure task due to non-adherence to clinical procedures) were excluded from the study.

A total of 419 patients were admitted to the partial hospitalization program from January 2015 to March 2020 and consented to participation in research. Of these, 299 patients were diagnosed with OCD. Nineteen of these 299 patients (6.4%) did not have sufficient data to be included in the study.

The final sample included 280 youth (53% female, 90% White) between the ages of 5 and 18 ($M = 12.47$, $SD = 3.13$). The average number of comorbid diagnoses in the sample was 2.77 ($SD = 1.31$), and comorbid diagnoses included anxiety disorders (e.g., generalized anxiety disorder, social anxiety disorder, specific phobia, panic disorder; $n = 113$; 41.24%), attention deficit hyperactivity disorder ($n = 109$; 39.78%), depressive disorders ($n = 95$; 34.67%), autism spectrum disorder ($n = 44$; 16.05%), and tic disorders ($n = 32$; 11.68%), among others. Participants' average Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) score at treatment admission was 28.23 ($SD = 5.22$), indicating severe OCD symptoms. Almost all participants were treated with serotonin reuptake inhibitor (SRI) medication (92.86%) during treatment admission. Some participants were treated with stimulant (38.38%) and/or benzodiazepine (19.85%) medication during treatment admission. Participants' average length of treatment admission in the partial hospitalization program was 44.49 days ($SD = 27.95$; minimum = 4 days, maximum = 285 days).

2.2. Measures

Demographics. Demographic information (i.e., age, gender, race) was collected from participants upon admission to the partial hospitalization program as a part of routine clinical intake procedures.

OCD symptom severity. The Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) was administered to participants to assess OCD symptom severity upon admission to the partial hospitalization program. The CY-BOCS is a frequently used clinician-rated measure of OCD symptoms in children and adolescents. The CY-BOCS includes a symptom checklist and a severity scale. Only the severity scale was examined in the current study. The CY-BOCS severity scale includes two subscales: obsessions severity and compulsions severity. Each subscale includes 5 items, and each item is rated on a 0 to 4 scale on which 0 indicates no symptom severity and 4 indicates extreme symptom severity. Total CY-BOCS severity scores range from 0 to 40. The CY-BOCS severity scale has demonstrated good internal consistency and test-retest reliability (Rapp et al., 2016; Storch et al., 2004).

Concurrent psychiatric medication. Information about participants' psychiatric medication treatment during the partial hospitalization program was collected from participants' electronic medical records as part of an Institutional Review Board-approved chart review protocol. Specifically, we assessed whether participants were being treated with SRI, stimulant, and/or benzodiazepine medication at some point during their treatment admission. Data relating to medication use during specific exposure tasks was not available given the naturalistic treatment setting in which this study was conducted.

Length of treatment admission. Participants' length of admission in the partial hospitalization program was measured as the total number of calendar days that the participant was admitted to the treatment program, from the date of their intake evaluation to the date of their discharge from the program.

Harm avoidance versus incompleteness exposure tasks. Before starting an exposure task, clinicians and patients recorded a description of the exposure task and the core motivation that the exposure task aimed to target. Exposures were classified as "harm avoidance" or "incompleteness" by two study raters (clinical research assistants; authors on this manuscript) who were blind to the SUDS ratings reported during the exposure. Exposures that aimed to target fears of contamination, sickness, or harm to oneself or others were classified by study raters as "harm avoidance." Exposures that aimed to target feelings of incompleteness, imperfection, or "not just right" feelings were classified by study raters as "incompleteness." Exposures that aimed to target other fears (e.g., for the treatment of other comorbid diagnoses) were excluded from the current study. A subset of exposure tasks ($n = 168$; 10%) were double-coded, and inter-coder reliability between study raters was excellent (Cohen's kappa = .928, $p < .001$). See Table 1 for example harm avoidance and incompleteness exposure tasks included in the study.

Patient-reported distress during exposure. The Subjective Units of Distress Scale (SUDS; Wolpe, 1990; see also Benjamin et al., 2010) is a measure of patient-reported distress that is commonly used in CBT with youth patients (e.g., Kendall & Hedtke, 2006). Clinicians collect SUDS ratings by asking a patient to rate their distress on a given scale. In the present study, clinicians collected patient-reported SUDS ratings on a 0 to 10 scale to assess patient distress at multiple intervals throughout an exposure task. A "start" SUDS rating was defined as the first SUDS rating reported by a participant during an exposure task. A "peak" SUDS rating was defined as the highest SUDS rating that a participant reported during an exposure task. An "end" SUDS rating was defined as the last SUDS rating reported by a participant during an exposure task. SUDS ratings were not collected at set frequency and time intervals for all participants; rather, SUDS ratings were collected at varying frequencies and varying time intervals depending on clinical factors. For example, clinicians often ask patients for SUDS ratings to determine whether they should make an exposure easier or harder, to assess whether a change in an exposure did in fact make the exposure easier or harder, and to assess whether a patient has experienced distress decrease during an exposure task. Clinicians may also adjust the frequency with which they collect SUDS ratings depending on individual patient variables (e.g., age, willingness to report distress level) and the nature of an exposure task (e.

g., if asking for SUDS is not feasible or functions as distraction during a certain exposure task).

Shape of distress trajectories. To examine distress change over exposure, exposures were classified into categories based on the shape of the curve created by graphing SUDS ratings over the course of exposure. Categories were developed through pilot examination of a subset of exposures in order to identify the range of possible shapes and develop consensus for each. Shapes of distress trajectories included the following mutually exclusive and exhaustive categories: increasing (SUDS ratings increased throughout the exposure), decreasing (SUDS ratings decreased throughout the exposure), quadratic (SUDS ratings increased by at least 2 points and then decreased by at least 2 points throughout the exposure; i.e., classical "habituation" curve), high variability (SUDS ratings increased and decreased by at least 2 points multiple times throughout the exposure), or flat (no change or only 1-point change in SUDS ratings throughout the exposure). Each exposure was coded independently by two study raters (clinical research assistants; authors on this manuscript) using these definitions. Study raters were blind to type of exposure task (harm avoidance versus incompleteness). Inter-coder reliability was good (Cohen's kappa = .796, $p < .001$).

2.3. Procedure

All procedures were conducted within an IRB-approved protocol.

Recruitment. Upon admission to the partial hospitalization program, patients and caregivers were presented with the option to participate in research. Caregivers completed informed consent to allow for their child's participation. Patients who were younger than 18 years old completed informed assent to agree to participate, and patients who were 18 years old completed informed consent to agree to participate. Participation in research or lack thereof did not change procedures of clinical care. Participation in research did not entail additional patient, caregiver, or clinician burden, but rather only entailed the use of clinical data for research purposes.

Treatment. The partial hospitalization treatment program followed a team model using both clinical psychologists and Bachelor's-level clinicians and included group and individual exposure-based CBT at a children's psychiatric hospital, medication management from a staff psychiatrist, and home- or community-based exposure therapy treatment sessions. Licensed clinical psychologists leading the treatment teams were trained in the same manner as those delivering exposure-based CBT in previous clinical trials (Freeman et al., 2009; Pediatric OCD Treatment Study Team, 2004). These clinical psychologists developed personalized exposure hierarchies for each patient and supervised Bachelor's-level clinicians who conducted the exposures with patients. Psychoeducation was tailored to individual patients' clinical presentations. When introducing exposure to patients, psychologists and Bachelor's-level clinicians described that exposure may lead to habituation (within or between trials) or improvements in distress tolerance over time (e.g., "It might get easier over time, or you might realize that you can handle it better than you thought you could.") as not to suggest that habituation within one exposure trial is necessary for exposure success or treatment response. Given the team model, each patient was treated by and completed exposures with multiple Bachelor's-level clinicians. Exposure tasks were conducted in a manner consistent with published treatment manuals (Freeman and Garcia, 2008; March & Mulle, 1998), and Bachelor's-level clinicians and patients were generally encouraged to select exposures that were moderately difficult (i.e., challenging but do-able). Other factors related to exposure selection (e.g., duration of exposure task, number of exposure tasks) varied due to the naturalistic clinical setting in which study data were collected. Clinicians' prompting for SUDS ratings during exposure tasks was tailored to individual patients' clinical presentations such that clinicians could ask, for example, "How scared do you feel right now?", "How uncomfortable do you feel right now?", "How hard is this [task] right now?", or "How much is this [task] bothering you right now?" depending on the language that was most relatable for a given patient. Patients attended treatment for 4–6 h per day every weekday, and the approximate dose of exposure treatment within the treatment program was 2–3 h per day. Length of intensive program admission was determined by symptom severity and pace of treatment response. Clinicians collected and recorded patient-reported SUDS ratings during exposure tasks.

Data collection. Data were collected from participants' electronic medical records as a part of an IRB-approved chart review. Exposure data collected during treatment at the hospital were included. Exposure data from home visits were collected inconsistently and therefore excluded. A sampling procedure was used to reduce the excessive volume of exposure data and the over-representation of data from participants with longer lengths of treatment. Three exposure worksheets were selected for each participant included in the study. One exposure worksheet was selected from "early" in a participant's treatment (i.e., within the first third of a participant's length of admission), one worksheet was selected from the "middle" of a participant's treatment (i.e., within the second third of a participant's length of admission), and one worksheet was selected from "late" in a participant's treatment (i.e., within the final third of a participant's length of admission). This purposive sampling was employed given that exposure tasks completed early in treatment may be of a lower difficulty level than exposure tasks completed later in treatment and given that patterns of distress activation and change may shift over time (e.g., it is possible that distress decrease may occur more quickly during exposures completed later in treatment when patients have already accrued some learning). Given that this study aimed to examine distress change over time, exposure tasks during which participants only reported 1 SUDS rating were excluded and replaced with an exposure from the same period of treatment. Given the methodological challenges of assessing between-task changes in SUDS ratings (i.e., due to changing the nature of exposure tasks across the course of treatment; Benito & Walther, 2015), this study only examined within-task changes in SUDS ratings.

Data analysis. Given our aim to examine differences at the exposure level rather than the participant level, given that one participant could have completed both exposure task types, and given evidence that hierarchical linear modeling and similar approaches may produce biased estimates if the data include few level 1 units per level 2 unit (in our case, only three exposure tasks per participant; Browne & Draper, 2006; Singer & Willett, 2003), we initially conducted data analyses across all observations without nesting exposure tasks within participants. However, we then confirmed our results by conducting the same analyses using hierarchical linear modeling to ensure no significant effect of participant-level variability on outcomes.

Exposure-level analyses were conducted in (SPSS) Version 26 (IBM Corp, 2019). First, we conducted descriptive analyses to assess differences in demographic and clinical variables of interest between participants who completed harm avoidance versus incompleteness exposure tasks and between participants who exhibited different distress trajectories, respectively. We conducted Chi Square tests of independence to assess relationships between harm avoidance/incompleteness task type and participant gender and psychiatric medication status (i.e., being treated with SRI, stimulant, or benzodiazepine medication), respectively. We conducted independent samples t tests to assess relationships between harm avoidance/incompleteness task type and participant age

and OCD symptom severity at admission, respectively. We conducted a non-parametric independent samples Mann-Whitney test to assess the relationship between harm avoidance/incompleteness task type and length of treatment admission given that length of treatment admission was non-normally distributed. We conducted Chi Square tests of independence to assess relationships between distress trajectory and participant gender and psychiatric medication status, respectively. We conducted one-way analysis of variance (ANOVA) tests to assess relationships between distress trajectory and age and OCD symptom severity at admission, respectively. We conducted a non-parametric Kruskal-Wallis test to assess the relationship between distress trajectory and length of treatment admission. When a relationship was found between a demographic or clinical variable and exposure task type or distress trajectory, we conducted post-hoc testing to assess third variable explanations for study findings. After assessing differences on demographic and clinical variables of interest between exposure task type and shape of distress trajectory, respectively, we conducted inferential analyses in accordance with our aims. We conducted a Kolmogorov-Smirnov test of normality to assess whether start, peak, and end SUDS ratings were normally distributed. Given that start, peak, and end SUDS ratings were not normally distributed, we conducted a non-parametric independent samples Mann-Whitney test to examine differences in start, peak, and end SUDS ratings between harm avoidance versus incompleteness exposure tasks. We employed a Bonferroni correction to adjust for multiple testing (adjusted p value = .05/3 = 0.016). Effect size r was calculated for the non-parametric independent samples Mann-Whitney tests by dividing the standardized test statistic by the square root of the sample size (i.e., number of exposure tasks examined). Finally, we conducted a Chi Square test of independence to examine the relationship between type of exposure task (harm avoidance versus incompleteness) and shape of distress trajectory. We conducted planned contrasts to further examine this relationship and employed a Bonferroni correction to adjust for multiple testing (adjusted p value = .05/10 = 0.005). Effect sizes for the Chi Square test of independence and planned contrasts were estimated using the phi coefficient (φ). Effect sizes for all inferential analyses were interpreted using guidelines set forth by Cohen (1988).

To assess whether our findings were explained by participant-level variability, we reconducted the same analyses controlling for participant-level effects. We conducted hierarchical linear modeling in R and RStudio (2022.07.1, Build 554) using the lmer function from the lme4 package (Bates et al., 2015) to fit models of the effect of exposure type (harm avoidance versus incompleteness) on start, peak, and end SUDS ratings, nesting exposure tasks within participants. In addition, we assessed how much variability in start, peak, and end SUDS ratings was explained by participant-level variability by calculating intraclass correlation coefficients for each of these outcome variables. One-way intraclass correlation coefficients were calculated using the multilevel.icc function from the misty package (Yanagida, 2022) and interpreted using guidelines set forth by Bliese (1998). To control for participant-level effects in our analysis of distress trajectories, we conducted a multinomial logistic regression in SPSS, including exposure type (harm avoidance or incompleteness) as the independent variable, participant as the covariate, and shape of distress trajectory as the dependent variable.

3. Results

Descriptive results. In total, 831 exposures were examined across the 280 participants. Almost all participants (n = 273; 97.50%) had sufficient data to include three exposures per participant. Five participants (1.79%) only had two exposures each, and two participants (0.71%) only had one exposure each. The number of SUDS ratings collected during any given exposure ranged from 2 to 54 (M = 10.71, SD = 6.95). Start, peak, and end SUDS ratings each ranged from 0 to 10. The median start SUDS rating was 5 (M = 4.95, SD = 2.32), the median peak SUDS rating was 7 (M = 6.98, SD = 2.09), and the median end SUDS rating was 4 (M = 4.07, SD = 2.64). Start ($D(831) = 0.112$, $p < .001$), peak ($D(831) = 0.126$, $p < .001$), and end ($D(831) = 0.101$, $p < .001$) SUDS ratings were not normally distributed. Of the 831 exposures examined, 580 targeted harm avoidance core motivations and 251 targeted incompleteness core motivations.

For most participants (n = 207; 73.93%), the three exposure tasks sampled each targeted the same core motivation (i.e., harm avoidance or incompleteness); however, for a minority of participants (n = 73; 26.07%), the three exposures tasks sampled included some targeting harm avoidance core motivations and some targeting incompleteness core motivations. For most participants (n = 230; 82.14%), the three exposure tasks sampled exhibited varied shapes of distress trajectories such that shape of distress trajectory did not appear to be a function solely of individual participant characteristics. Neither exposure task type nor shape of distress trajectory was associated with participant gender, age, OCD symptom severity at admission, or length of treatment admission ($p > .05$). Exposure task type was associated with psychiatric medication status such that participants who completed incompleteness exposure tasks were more likely than participants completing harm avoidance exposure tasks to be treated with benzodiazepine medication during their treatment admission ($\chi^2(1) = 8.85$, p = .003, φ = 0.105, indicating a small effect). There were no other relationships between psychiatric medication status and exposure task type, nor were there any relationships between psychiatric medication status and shape of distress trajectory ($p > .05$). See Tables 2 and 3 for descriptive statistics of participant demographic and clinical variables of interest by exposure task type and shape of distress trajectory, respectively.

Aim 1: Differences in start, peak, and end SUDS ratings. On average, participants reported lower distress at the start of incompleteness (M = 4.63, SD = 2.34) compared to harm avoidance (M = 5.09, SD = 2.29) exposure tasks (U = 64071.00, $z = -2.771$, p = .006, r = 0.096, indicating a small effect), at the "peak" of incompleteness (M = 6.67, SD = 2.17) compared to harm avoidance (M = 7.11, SD = 2.04) exposure tasks (U = 63753.00, $z = -2.875$, p = .004, r = 0.100, indicating a small effect), and at the end of incompleteness (M = 3.70, SD = 2.57)

Table 1
Examples of harm avoidance and incompleteness exposure tasks.

Exposure task description recorded by clinician and patient	Exposure task type
Touching the ground and then eating a snack	Harm avoidance
Thinking about dying from Mad Cow disease	Harm avoidance
Holding a pair of scissors	Harm avoidance
Sitting with intrusive sexual thoughts without ritualizing	Harm avoidance
Looking at bad words on a piece of paper	Harm avoidance
Making a choice (worry about perfectionism)	Incompleteness
Tolerating the 'not just right' feeling	Incompleteness
Not blowing away eraser shavings after erasing	Incompleteness
Sitting with something on one leg and not the other	Incompleteness
Wearing socks with shoes (does not feel right)	Incompleteness

Table 2
Participant demographic and clinical variables by exposure task type.

	Harm avoidance (n = 580)	Incompleteness (n = 251)
Gender	53.45% female	52.19% female
Age	M = 12.52 years	M = 12.44 years
CY-BOCS at admission	M = 28.16	M = 28.35
Treated with SRI	92.76%	93.63%
Treated with stimulant	37.21%	42.19%
Treated with benzodiazepine*	17.02%	26.16%
Length of admission	M = 45.47 days	M = 42.53 days

Note: Percentages represent proportion within the exposure type.
* Significant difference in proportions comparing harm avoidance and incompleteness exposure tasks.

Table 3
Participant demographic and clinical variables by distress trajectory.

	Increasing (n = 72)	Decreasing (n = 173)	Quadratic (n = 173)	High variability (n = 337)	Flat (n = 76)
Gender	51.39% female	56.07% female	53.76% female	51.63% female	52.63% female
Age	M = 12.64 years	M = 13.02 years	M = 12.39 years	M = 12.15 years	M = 12.95 years
CY-BOCS at admission	M = 29.05	M = 27.52	M = 28.28	M = 28.02	M = 29.98
Treated with SRI	97.22%	90.75%	94.80%	91.69%	96.05%
Treated with stimulant	28.99%	41.67%	38.79%	39.63%	36.49%
Treated with benzodiazepine	24.64%	20.24%	17.37%	17.93%	27.03%
Length of admission	M = 47.26 days	M = 45.53 days	M = 44.76 days	M = 42.65 days	M = 48.09

Note: Percentages represent proportion within the distress trajectory category.

Table 4
Number of exposure tasks by core motivation and shape of SUDS distress trajectory.

Shape of distress trajectory	Harm avoidance (%)	Incompleteness (%)
Increasing	55 (9.5%)	17 (6.8%)
Decreasing	115 (19.8%)	58 (23.1%)
Quadratic	118 (20.3%)	55 (21.9%)
High variability	252 (43.4%)	85 (33.9%)
Flat*	40 (6.9%)	36 (14.3%)
Total	580 (100%)	251 (100%)

* Significant difference in proportions comparing harm avoidance and incompleteness exposure tasks.

compared to harm avoidance (M = 4.23, SD = 2.65) exposure tasks (U = 63996.00, z = −2.785, p = .005, r = 0.097, indicating a small effect). The same pattern of differences was found for start (b = −0.52, SE = 0.19, t = −2.795, p = .002), peak (b = −0.40, SE = 0.17, t = −2.367, p = .009), and end (b = −0.54, SE = 0.21, t = −2.505, p = .006) SUDS ratings when exposure tasks were within participants, suggesting no significant effect of participant-level variability on outcomes. The intraclass correlation coefficients (ICC) calculated for start (ICC = 0.22), peak (ICC = 0.25), and end (ICC = 0.23) SUDS ratings similarly indicated a weak effect of participant-level variability on these dependent variables.

Aim 2: Differences in distress trajectories. A Chi Square test of independence indicated a significant effect of type of exposure task (harm avoidance versus incompleteness) on shape of distress trajectory ($\chi^2(4)$ = 17.19, p = .002, φ = 0.144, indicating a small effect), such that incompleteness exposure tasks were more likely than harm avoidance exposure tasks to exhibit a "flat" distress trajectory ($\chi^2(1)$ = 11.69, p < .001, φ = 0.115, indicating a small effect). There were no other statistically significant effects of type of exposure task on distress trajectory. The same effect of type of exposure task was found on shape of distress trajectory when controlling for participant-level variability ($\chi^2(4)$ = 17.15, p = .002, φ = 0.144, indicating a small effect). See Table 4 for descriptive statistics of shapes of distress trajectories by exposure task type and Fig. 1 through 5 for examples of each distress trajectory shape.

Post-hoc testing. Given evidence of a relationship between benzodiazepine medication status and incompleteness exposure task type, we conducted post-hoc tests to assess if this variable explained study findings. Participants receiving benzodiazepine medication (M = 4.92, SD = 2.23) did not differ from those not receiving benzodiazepine medication (M = 4.98, SD = 2.33) in their report of SUDS ratings at the start of exposure tasks (U = 50526.00, z = −0.38, p = .704). Similarly, participants receiving benzodiazepine medication (M = 6.97, SD = 2.04) did not differ from those not receiving benzodiazepine medication (M = 6.96, SD = 2.11) in their report of SUDS ratings at the "peak" of exposure tasks (U = 51330.00, z = −0.07, p = .943). Participants receiving benzodiazepine medication (M = 4.07, SD = 2.66) also did not differ from those not receiving benzodiazepine medication (M = 4.03, SD = 2.63) in their report of SUDS ratings at the end of exposure tasks (U = 51248.00, z = −0.10, p = .918). There was no relationship between benzodiazepine medication status and distress trajectory ($\chi^2(4)$ = 4.83, p = .305).

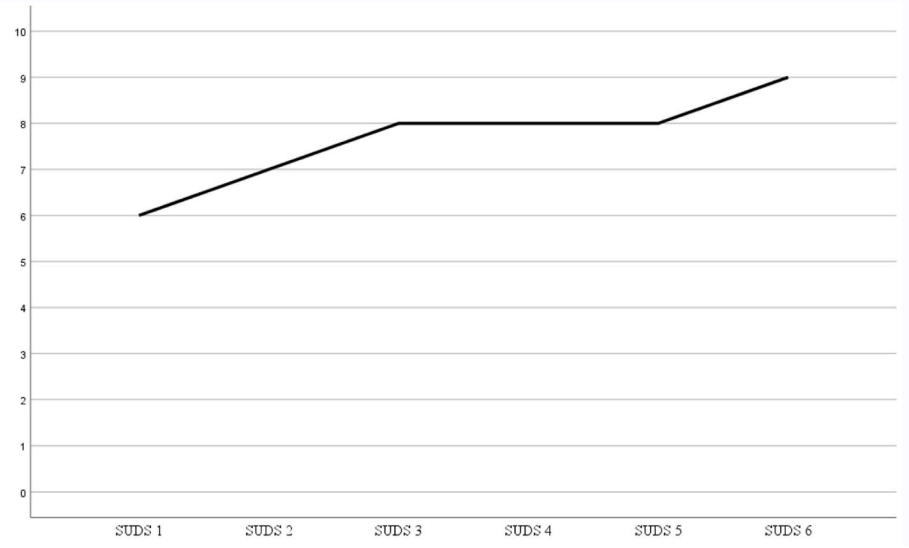

Fig. 1. Example "increasing" distress trajectory during an exposure task.

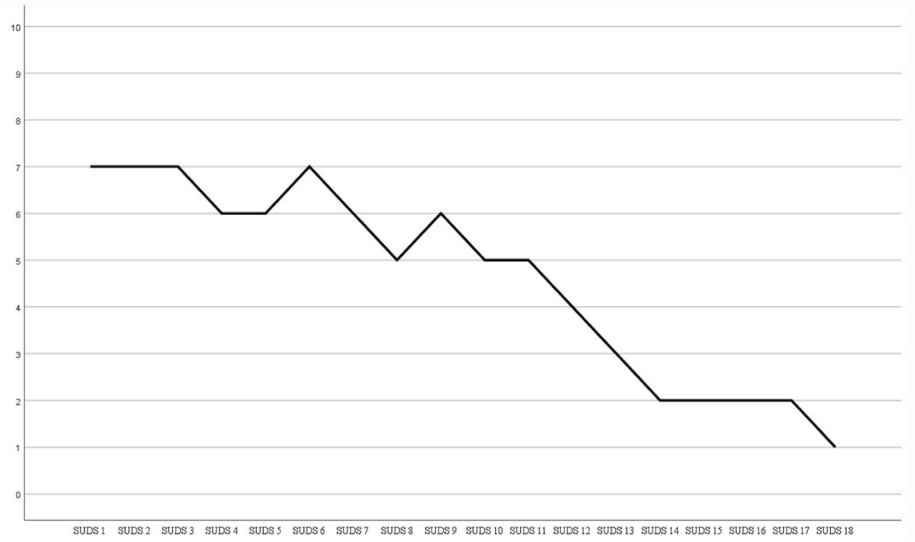

Fig. 2. Example "decreasing" distress trajectory during an exposure task.

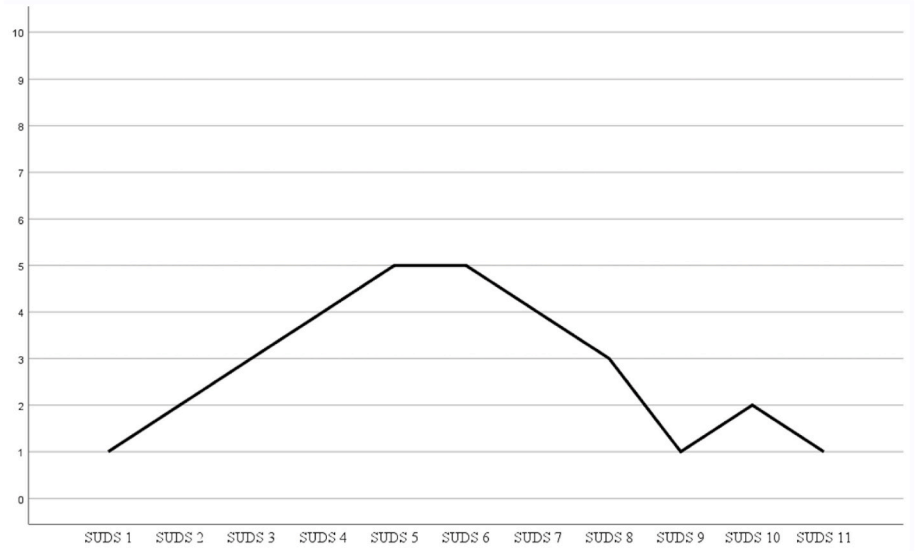

Fig. 3. Example "quadratic" distress trajectory during an exposure task.

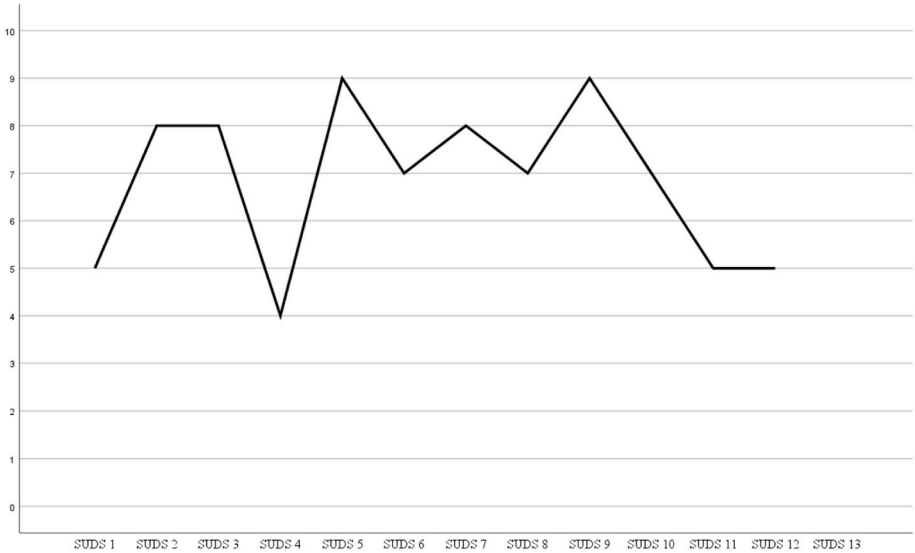

Fig. 4. Example "high variability" distress trajectory during an exposure task.

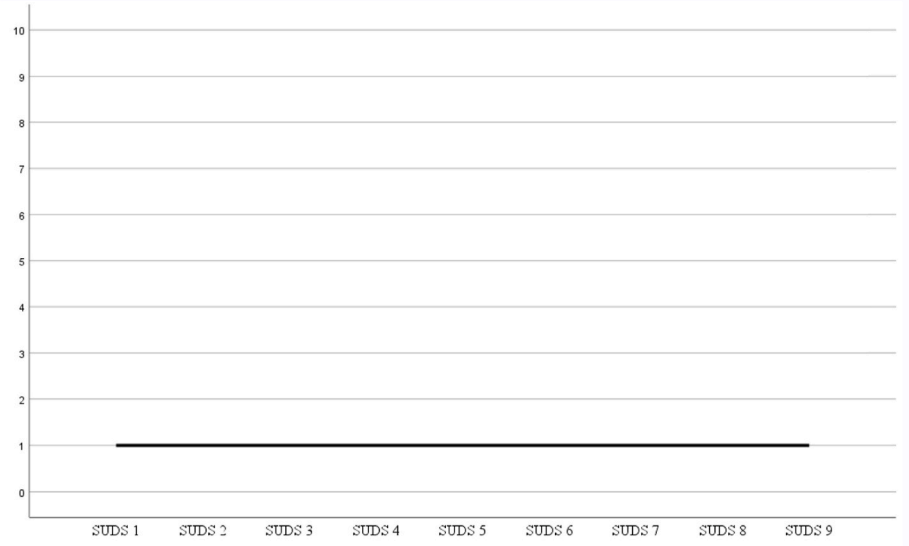

Fig. 5. Example "flat" distress trajectory during an exposure task.

4. Discussion

These findings provide preliminary evidence of differences in patient-reported distress during harm avoidance compared to incompleteness exposure tasks for youth with OCD. Descriptive results examining exposure tasks across exposure type indicate that distress generally started at a medium intensity level, increased moderately during an exposure task, and decreased moderately by the end of the task. Thus, examining only start, peak, and end SUDS ratings yields the appearance of a classical "habituation" curve wherein distress is elicited and then decreases over the course of an exposure task. However, a more nuanced examination of shapes of trajectories exhibited by distress ratings collected at multiple intervals over the course of exposure tasks offers more detailed insight into the course of distress during exposure. We found that the largest number of exposure tasks exhibited a "high variability" distress trajectory in which distress increased and decreased multiple times throughout an exposure task. This is consistent with clinical recommendations highlighting the benefit of distress variability guided by Inhibitory Learning Theory (Craske et al., 2014) and aligns with patterns of distress change during exposure described in clinical trials for pediatric OCD (Benito et al., 2018). Importantly, future work is needed to examine optimal exposure processes that influence distress variability. For example, high variability in distress may be due to changes in the difficulty of an exposure task (i.e., a clinician making an exposure easier or harder) or natural variations in distress that occur during exposure even when the exposure task difficulty does not change. Many exposure tasks also exhibited a "decreasing" trajectory in which distress decreased over the course of the exposure task, and many exposures exhibited a "quadratic" trajectory mirroring a classical habituation curve. Few exposures exhibited a "flat" trajectory in which distress did not change during exposure, and few exposures exhibited an "increasing" trajectory in which distress only increased during exposure. The lower rate of "flat" distress trajectories may be explained by clinicians purposefully increasing exposure difficulty to elicit distress increase. Alternatively, the lower rate of "increasing" distress trajectories may be explained by clinicians purposefully decreasing the difficulty of an exposure task to allow for distress decrease during exposure. Overall, these descriptive results demonstrate wide variability in patient-reported distress during exposure tasks conducted in a partial hospitalization program for youth with severe OCD.

As hypothesized, participants reported lower distress at the start, peak, and end of incompleteness compared to harm avoidance exposure tasks. Incompleteness exposure tasks were also significantly more likely than harm avoidance exposure tasks to exhibit a "flat," unchanging distress trajectory. We found the same pattern of results when exposure tasks were examined as unique observations as when exposure tasks were nested within participants. While these effects were small and the overall proportion of exposure tasks exhibiting the "flat" distress trajectory was low, these findings provide preliminary evidence of differences in emotional processes during harm avoidance versus incompleteness exposure tasks and complement previous research that suggests that incompleteness represents an emotional process that is distinct from fear (Cervin, 2019; Cervin et al., 2021). In particular, the finding that incompleteness exposure tasks are more likely to exhibit a "flat" distress trajectory offers a new perspective on existing evidence of differences in treatment response between patients with harm avoidance and incompleteness core motivations of OCD symptoms (Cervin & Perrin, 2021; Foa et al., 1999). If patients exhibit less change in distress during incompleteness exposure tasks, patients who present primarily with incompleteness core motivations of OCD symptoms may respond more poorly to exposure-based treatment because they are not experiencing within-trial habituation and/or fear variability that are theorized to be important for learning during exposure (Craske et al., 2014; Foa et al., 2006; Foa & Kozak, 1986; e.g., Benito et al., 2018; Culver et al., 2012; Foa et al., 1983; Kircanski et al., 2012).

Still, while it is possible that these findings are explained by true differences in the emotional or learning processes that underlie harm avoidance versus incompleteness in OCD, it is also possible that other variables explain these apparent differences (i.e., third variable cause). It is possible that patients with harm avoidance versus incompleteness core motivations of OCD symptoms differ in some way that affects the way they experience or report distress during exposure. For example, patients with harm avoidance core motivations may present with greater anxiety symptoms (Cervin et al., 2020) and/or higher anxiety sensitivity (Calamari et al., 2008) than patients with incompleteness core motivations, which may lead to higher distress during exposure, and which we did not measure in the current study. Patients with different clinical presentations (e.g., harm avoidance/incompleteness, comorbid psychiatric disorders, other clinical features) may also be treated with different psychiatric medications which may affect distress during exposure. In this sample, we found a relationship between exposure task type and psychiatric medication status such that participants completing incompleteness exposure tasks were more likely to be treated with benzodiazepine medication during their treatment admission (although we found no difference for SRI or stimulant medication). This finding may appear to explain lower distress reported during incompleteness

exposure tasks; however, we conducted post-hoc testing and found no direct effect of benzodiazepine medication status on distress level or distress trajectory during exposure tasks. Therefore, we do not have evidence to suggest that the relationship between incompleteness exposure task type and benzodiazepine medication status explains study findings, although future studies should further examine the effects of psychiatric medications (including those that were not included in this study, such as mood stabilizing and antipsychotic medication) on distress during exposure tasks and the implications for emotional processing or inhibitory learning (e.g., Norberg et al., 2008).

Aside from potential differences in clinical characteristics among patients with harm avoidance versus incompleteness core motivations of OCD symptoms, there are also other third variables that may explain apparent differences in distress during exposure between these groups. For instance, it is likely that patients who tend to report lower distress during exposure appear to exhibit less change in distress (i.e., higher peak SUDS rating allows greater potential for decrease), and SUDS rating change may not be an accurate indication of the amount of habituation or learning during exposure for patients who only ever report low distress. It is also possible that clinicians use different therapeutic approaches for harm avoidance versus incompleteness OCD symptoms. Some literature describes that incompleteness is less frequently studied (Pietrefesa et al., 2008) and/or more difficult to treat clinically (Summerfeldt, 2004) than harm avoidance OCD symptoms. Research also suggests that clinicians tend to deliver exposure in a more cautious, sub-optimal manner when they fear adverse reactions from patients (Deacon et al., 2013; Farrell et al., 2013). Thus, it is possible that clinicians may deliver a less potent dose of exposure (e.g., selecting easier rather than harder exposure tasks, encouraging greater use of safety behaviors) to patients with incompleteness OCD symptoms if clinicians are not as familiar with or hold misconceptions about this clinical presentation. Overall, while our findings suggest that participant-level variability does not fully explain differences in distress during harm avoidance and incompleteness exposure tasks, more research is needed to further examine this. Specifically, more research is needed to examine factors that affect patients' distress and clinicians' behaviors during exposure tasks to identify potential explanations for differences in patient-reported distress during harm avoidance versus incompleteness exposure tasks.

Nonetheless, these findings highlight the potential value of assessing core motivations of OCD symptoms prior to beginning treatment to inform a clinician's expectations for patient distress level and change during exposure. Moreover, these findings suggest that the use of SUDS ratings as an indicator of progress during exposure may be less clinically useful during incompleteness exposure tasks, as these tend to exhibit less change in distress over time (i.e., more often "flat" distress trajectories). Clinicians may not wish to rely solely on within-trial SUDS rating change to indicate that habituation or learning has occurred during incompleteness exposure tasks but may instead aim to compare averages and patterns of SUDS ratings across repeated exposure trials. Still, more research is needed to examine whether there exist differences in between-trials distress change for patients completing harm avoidance versus incompleteness exposure tasks. Clinicians may also aim to assess improvement in a patient's ability to function while distressed as another indicator of treatment progress.

This study has some limitations worth noting. First, the sample of participants included in this study were youth who had severe and/or refractory OCD symptoms requiring a partial hospital level of care. These findings may not replicate in samples of adult patients given evidence that adolescents in particular exhibit deficits in fear extinction learning (see Baker et al., 2014). Findings similarly may not replicate in samples of patients receiving standard outpatient care. Nevertheless, studies of youth with severe and/or refractory symptoms are uncommon but critically important given the need to improve treatment outcomes for these patients (Martino et al., 2020). Additionally, the sample of participants included in this study was predominately White, which is consistent with the population of patients admitted to the partial hospitalization program from which the sample was drawn and with the population of patients receiving intensive services nationally (Alegria, Vallas, & Pumariega, 2010; Gudiño et al., 2009). Even so, this clearly limits the generalizability of results to non-White samples. Research on the prevalence of OCD among different racial and ethnic groups (e.g., Heyman et al., 2001; Himle et al., 2008; Kessler et al., 2005) suggests similar prevalence rates across groups, but non-white groups are consistently underrepresented in OCD research (Wetterneck et al., 2012; Williams et al., 2012). More efforts are needed to ensure that research and clinical services are accessible to all racial and ethnic groups and to ensure that clinical research samples are representative of the clinical populations in need of treatment. Likewise, participants included in this study were only those who consented to participation in research and had sufficient data collected during clinical care to be included in study analyses, and it is possible that these participants differ in some way from those who did not consent to research participation and those who did not have sufficient data collected during clinical care. Still, only a small proportion of patients (n = 19; 6.4%) were excluded from the study for this reason.

This study also has several measurement limitations due to the clinical nature of the data collected. This study relies on a self-report measure, which differs from measures of distress commonly used in laboratory research (e.g., physiological markers). There may be individual differences in self-report, such as the tendency for some people to report higher or lower distress than others in the same context, possibly due to variability in levels of insight, comfort with self-disclosure, or treatment expectancies (e.g., erroneous belief that one must report a decrease in SUDS to experience symptom improvement). Still, this method is highly practical in real-world clinical settings as it incurs no patient or clinician burden above and beyond that of routine clinical care. Another measurement limitation of the current study is that SUDS ratings were not collected with the same frequency or at the same time intervals for all participants. In addition, collecting SUDS ratings alone to measure distress during exposure does not elicit information about the reason why distress increased or decreased. It may be common for clinicians to decrease the difficulty of exposure tasks when patients report high distress or to increase difficulty when patients report low distress (Benito & Walther, 2015). It is also possible that patients who experienced high distress engaged in some form of avoidance or ritualizing during the exposure that then functioned to decrease distress. In both cases, a decrease in distress rating would seem to indicate that a patient had experienced habituation or learning when in fact the task became easier. Similarly, habituation or learning may have occurred despite a lack of decrease in distress ratings, particularly when the clinician regularly increases the difficulty of the original task. This study is also limited in that it did not examine patterns of distress change between trials, as it is likely that the nature and difficulty of exposure tasks change over the course of treatment (Benito & Walther, 2015). While some studies have found within-trial distress decrease to be a meaningful indicator of therapeutic process and/or treatment response (Beckham et al., 1990; Benito et al., 2018; Foa et al., 1983; van Minnen & Hagenaars, 2002), others have not found an effect of within-trial distress decrease on outcomes (Baker et al., 2010; Kamphuis & Telch, 2000; Kozak et al., 1988; Lang & Craske, 2000; Peterman et al., 2019; Pitman et al., 1996; Sripada & Rauch, 2015) but have found some evidence for the role of between-trial distress decrease in outcomes (Baker et al., 2010; Craske et al., 2008; Rauch et al., 2004). Future studies should assess both within- and between-trial distress change during exposure for harm avoidance and incompleteness core motivations of OCD symptoms to yield a more comprehensive understanding of the emotional and learning processes that underlie treatment response for these patients. Finally, this study was designed to examine differences related to harm avoidance or incompleteness core motivations and did not consider other core motivations. For example, recent research highlights the importance of disgust in OCD symptoms (Cervin et al.,

2021; Georgiadis et al., 2020; McKay, 2006; Olatunji et al., 2011) as an emotional process that is distinct from both harm avoidance and incompleteness (Cervin et al., 2019; Cervin et al., 2020; Cervin & Perrin, 2021). Studies of disgust also suggest differential patterns of distress change during exposure (Olatunji & Armstrong, 2009; Olatunji et al., 2009), and future work should examine this in the context of treatment for OCD.

Despite these limitations, this study provides preliminary evidence of differences in distress during harm avoidance and incompleteness exposure tasks conducted during routine clinical care for youth with severe OCD. Future research should continue to examine emotional processes during exposure and how core motivations of OCD symptoms may affect exposure process, distress level and change, and treatment outcomes. Specifically, future studies should assess distress at planned intervals during exposure tasks and examine the ways in which clinician and family behaviors (e.g., family accommodation, performing compulsions) may affect distress during exposure and subsequent treatment response (see Benito et al., 2021). Future research should also examine distress during exposure tasks using physiological markers and compare such physiological markers to self-report SUDS ratings to determine the validity of SUDS as a measure of distress during harm avoidance and incompleteness exposures. In this vein, future research should examine the ways in which clinicians use information about distress and core motivations to inform treatment planning and exposure delivery. Lastly, future research should examine disgust as a third core motivation of OCD symptoms that represents a distinct emotional process and may exhibit a different pattern of distress during exposure conducted in routine clinical care. Through this work, we can gain a better understanding of the therapeutic processes that underlie exposure in order to tailor treatment based on an individual's presenting symptoms and improve treatment response among subsets of youth with different core motivations of OCD.

Declaration of interest

The authors declare no conflict of interest.

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Author statement

Lauren Milgram conceived of the study design, entered the data to be used for the study, conducted the data analyses, and wrote the manuscript. Kate Sheehan and Grace Cain coded the study data. Matthew M. Carper aided in the conception of the study design and provided statistical counsel for data analyses. Erin E. O'Connor, Jennifer B. Freeman, Abbe Garcia, Brady Case, and Kristen Benito provided input on the study design and provided feedback on the manuscript. All authors approved the final version of the manuscript.

Data availability

Data will be made available on request.

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