Moderators and Processes of Change in Traditional Exposure and Response Prevention (ERP)

Versus Acceptance and Commitment Therapy-Informed ERP for

Obsessive-Compulsive Disorder

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Abstract

The present study evaluated moderators and processes of change in a randomized controlled trial comparing exposure and response prevention (ERP) delivered from a traditional framework versus ERP from an acceptance and commitment therapy framework (ACT+ERP) for obsessive-compulsive disorder (OCD). This paper presents baseline, weekly session, posttreatment, and follow-up data from the study. We examined (a) moderation effects of anxiety, depression, psychological inflexibility, and interpretation of intrusions and (b) the role of psychological inflexibility and interpretation of intrusions respectively as processes of change. Participants with less dysfunctional appraisals at pretreatment performed consistently better in ERP relative to ACT+ERP. In process analyses, psychological inflexibility and interpretation of intrusions positively influenced OCD severity over time in both conditions but OCD symptom severity also positively influenced psychological inflexibility and interpretation of intrusions in both conditions. Furthermore, whereas OCD symptom severity strongly and positively predicted dysfunctional appraisals over the course of treatment in ERP, symptom severity had a weaker positive effect on dysfunctional appraisals in ACT+ERP. Clinical and theoretical implications as well as study limitations are discussed.

Keywords: obsessive-compulsive disorder, acceptance and commitment therapy, exposure and response prevention, moderation, processes of change

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Obsessive-compulsive disorder (OCD) is a psychological condition characterized by unwanted and intrusive thoughts and images that evoke distress (obsessions) and repetitive and ritualistic behaviors (compulsions), which are performed to reduce perceived threat and/or associated distress (American Psychiatric Association, 2013). Research supports cognitive-behavioral therapy (CBT) as a first-line intervention for OCD with meta-analyses demonstrating large pre- to posttreatment effects (e.g., McKay et al., 2015; Olatunji, Davis, Powers, & Smits, 2013). CBT techniques found to be most efficacious include exposure (repeated confrontation with feared thoughts, situations, or objects) and response prevention (resisting compulsive rituals and other avoidance behaviors)—jointly referred to as "ERP" (Rosa-Alcázar, Sánchez-Meca, Gómez-Conesa, & Marín-Martínez, 2008).

Despite its demonstrated efficacy, not all patients respond to ERP and many endorse residual OCD symptoms and functional impairment after an adequate trial (e.g., Abramowitz, 2006). Accordingly, investigators have examined ways to increase the efficacy and tolerability of ERP to improve OCD treatment response. One possibility, for example, is to conduct ERP from an acceptance and commitment therapy (ACT) framework. Although similar to traditional ERP in many ways, an ACT approach might augment ERP by changing the stated function of interactions with feared stimuli (e.g., Tolin, 2009; Twohig, 2009). That is, whereas the explicit goal of exposure trials in ERP is to correct mistaken appraisals or interpretations of obsessions (e.g., Foa & Kozak, 2004), the stated goal of confronting feared stimuli in ACT is to practice pursuing a valued life in lieu of attempting to control unwanted internal experiences (Twohig,

2009; Twohig, Abramowitz, et al., 2015). Although research on ACT for OCD is limited, findings suggest ACT on its own may be an efficacious alternative to existing empirically supported treatments (Bluett, Homan, Morrison, Levin, & Twohig, 2014; Rohani et al., 2018). Recently, however, we found no differences in outcome when comparing traditional ERP to ERP conducted from an ACT perspective (ACT+ERP; Twohig et al., 2018). This suggests that although on average, ACT+ERP does not confer advantages over traditional ERP, clinicians can be flexible with respect to how they conduct ERP with their clients, giving them more options based on client needs and preferences. An important question, however, is whether certain variables moderate the effects of treatment and might predict who is likely to respond preferentially to a traditional versus an ACT-based approach to ERP. Accordingly, the present study addressed this issue.

OCD is frequently accompanied by another (comorbid) disorder. In the National Comorbidity Survey Replication, for example, Ruscio, Stein, Chiu, and Kessler (2010) found 76% of individuals with OCD also met criteria for another lifetime DSM-IV anxiety disorder and 41% had a lifetime comorbid diagnosis of major depressive disorder. Some evidence indicates psychiatric comorbidity predicts poorer treatment response (Olatunji et al., 2013; Rosa-Alcázar et al., 2008). Comorbid depression or anxiety could attenuate OCD treatment response for many reasons, such as decreased energy or motivation to engage in treatment (e.g., homework noncompliance) or symptom overlap influencing posttreatment assessment. Thus, it is worth examining if comorbidity moderates response to treatment between conditions. That is, do participants with psychiatric comorbidity achieve better outcomes in ERP relative to ACT+ERP? Currently, empirical support for a moderating effect of concurrent

depression and anxiety on different treatments for OCD is limited. Hence, additional research on the effect of these co-occurring disorders on response to available treatments is warranted.

Psychological inflexibility is another potential moderator of treatment response though extant findings are mixed for anxiety disorders (Craske et al., 2014; Wolitzky-Taylor, Arch, Rosenfield, & Craske, 2012). Psychological inflexibility refers to rigid responding to internal experiences that interferes with the ability to persist or change behavior based on personally meaningful values (S. C. Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Performance in treatment could depend on level of baseline psychological inflexibility. Patients with OCD who have higher psychological inflexibility at baseline may benefit more from ACT+ERP because it directly targets this skill set whereas patients with lower psychological inflexibility (or higher psychological flexibility) may benefit more from ERP as there may not be incremental benefit from learning ACT concepts. Because determining robust treatment moderators can aid treatment matching and lead to stronger outcomes, it is important to examine how psychological inflexibility influences treatment response in OCD.

Even less research has been conducted on the moderating effect of interpretations of intrusions—a key contributor to the development and maintenance of OCD—on treatment response (Knopp, Knowles, Bee, Lovell, & Bower, 2013). Although OCD symptom severity can be used as a proxy variable for maladaptive appraisals of intrusions, results regarding the impact of symptom severity on treatment outcomes have been mixed: four studies reported a statistically significant relationship between greater baseline OCD symptom severity and worse treatment outcome and seven reported no association with outcome (see review by Knopp et al., 2013). Inconsistent findings could be due to the broadness of the construct of OCD symptom severity.

Therefore, using a more precise variable such as maladaptive appraisals may provide more reliable findings on moderation effects.

In addition to investigating *for whom* treatment works using moderation analyses, it is also critical to examine *how* treatment works. Previous research on processes of change in OCD highlights the role of maladaptive appraisals regarding the importance and/or meaning of obsessional stimuli (Fisher & Wells, 2005; Wilhelm, Berman, Keshaviah, Schwartz, & Steketee, 2015). The Obsessive-Compulsive Cognitions Working Group (OCCWG, 1997, 2001, 2005) identified three primary appraisal domains central to OCD: perceived need to control thoughts, importance given to thoughts, and inflated responsibility associated with intrusive thoughts. Endorsement of such "obsessive beliefs" has not only predicted CBT outcomes (Adams, Riemann, Wetterneck, & Cisler, 2012) but also partially mediated OCD symptom improvement during CBT (Diedrich et al., 2016). Although these studies lend empirical support to conceptual models positing interpretations of obsessional thoughts to be a critical process of change in OCD treatment, findings are also limited by certain aspects of study design. For example, the treatment delivered in Diedrich and colleagues' (2016) study involved multiple components (i.e., group occupational therapy, music therapy, sports therapy, individual psychoeducation and ERP sessions), making it difficult to precisely attribute cognitive change to ERP-related treatment components. Moreover, participants in this study were receiving inpatient treatment, the duration of which varied widely across patients (M_{days} = 65.41; SD = 24.15). Thus, the degree to which changes in appraisals of intrusive thoughts explains the effect of ERP on OCD warrants additional research attention.

The principal process of change posited in ACT for OCD is psychological flexibility (S. C. Hayes et al., 2006). Psychological flexibility is the converse of psychological inflexibility; it

describes the ability to be open and willing to experience psychological events as they occur in the present moment while intentionally selecting behaviors consistent with values (S. C. Hayes et al., 2006). Because patients with OCD tend to use unhelpful behaviors such as resisting or otherwise avoiding aversive internal experiences to the detriment of a meaningful life (i.e., psychological inflexibility), ACT aims to increase willingness to experience and more adaptively respond to obsessions and associated distress (i.e., psychological flexibility). Psychological flexibility is a desirable change target because although obsessional experiences (e.g., unwanted thoughts, anxiety) are inherently out of patients' control, patients can always choose how to respond to such private experiences. Indeed, lack of psychological flexibility has been linked to OCD symptom severity (Bluett et al., 2014; Jacoby, Abramowitz, Buchholz, Reuman, & Blakey, 2018) and increases in psychological flexibility during ACT are associated with improvements in mental health outcomes (S. C. Hayes et al., 2006).

Studies have shown changes in ACT processes influence subsequent changes in outcome (e.g., S. A. Hayes, Orsillo, & Roemer, 2010; Hesser, Westin, Hayes, & Andersson, 2009; Twohig, Whittal, Cox, & Gunter, 2010). Yet, only one study to date has examined psychological flexibility as a process of change in ACT for OCD using a sufficiently powered sample. Specifically, Twohig, Plumb Vilardaga, Levin, and Hayes (2015) found changes in psychological flexibility predicted changes in OCD more strongly than changes in OCD severity predicted changes in psychological flexibility during ACT. However, these findings are limited by two methodological issues. First, this study used an outdated measure of psychological flexibility, which has since been revised to improve its psychometric properties (Bond et al., 2011). Second, neither the ACT nor the control condition included ERP techniques. Thus, the degree to which psychological flexibility represents a treatment process specific to ACT—versus

a process inherent in *any* efficacious OCD treatment—is unknown. Because ERP-based CBT is currently the intervention for OCD with the most empirical support, it is worth investigating psychological flexibility as a possible process of change underlying ERP for OCD.

A randomized clinical trial by Twohig et al. (2018)—from which present data were drawn—comparing traditional ERP and ACT+ERP failed to detect a main effect of condition. However, participants in both conditions evidenced large reductions in OCD symptoms from pretreatment to posttreatment (with no significant change from posttreatment to six-month follow-up; Twohig et al., 2018). In addition, 68% and 70% of participants in the ERP and ACT+ERP conditions respectively evidenced clinically significant and reliable change (Twohig et al., 2018), indicating both treatments were comparable and highly effective. The current study presents secondary analyses probing for potential ERP and ACT+ERP moderators and change processes. Accordingly, we aimed to answer the following questions: (a) Does comorbid anxiety moderate the relationship between condition (ERP versus ACT+ERP) and treatment outcome? (b) Does comorbid depression moderate the relationship between condition and treatment outcome? (c) Do dysfunctional appraisals of intrusions moderate the relationship between condition and treatment outcome? (d) Does psychological inflexibility moderate the relationship between condition and treatment outcome? We did not have specific predictions regarding moderating influences of comorbid anxiety, comorbid depression, maladaptive appraisals of intrusions, or psychological inflexibility given limited and/or inconsistent extant data.

Because traditional models of ERP emphasize dysfunctional appraisals of intrusions whereas the ACT+ERP framework highlights psychological inflexibility, we also conducted exploratory analyses testing for an interaction between treatment condition and putative processes of change. That is, (e) do improvements in dysfunctional appraisals differentially

predict subsequent changes in OCD symptom severity between conditions? (f) Do improvements in psychological inflexibility differentially predict subsequent changes in OCD symptom severity between conditions? We predicted maladaptive appraisals would be the more relevant process of change in the ERP condition and psychological inflexibility would be more relevant in the ACT+ERP condition.

Method

Data were collected from a multisite randomized controlled trial comparing the efficacy and acceptability of ERP and ACT+ERP (Twohig et al., 2018). All study procedures were approved by the Institutional Review Board at each study site. Only information pertinent to the current study is presented in the present report; additional information about study design and primary outcomes are described in greater detail elsewhere (Twohig et al., 2018).

Participants

Fifty-eight adults with a primary diagnosis of current DSM-IV OCD participated in this study. Twenty-eight participants were randomly assigned to the ERP condition and 30 participants were randomized to the ACT+ERP condition. To be considered eligible, participants must have met criteria for a primary diagnosis of DSM-IV-TR OCD (at least 12-month duration), been at least 18 years old, been fluent in English, been willing to attend all therapy and assessment visits, and been willing to have therapy sessions recorded. Participants currently taking psychiatric medications were considered eligible if their medication was stable for at least 30 days prior to the pretreatment assessment. Exclusion criteria were a previous CBT trial for OCD and current symptoms of alcohol abuse/dependence, substance abuse/dependence, mania, psychosis, or suicidal ideation. Twenty-two participants were excluded following the intake

session: 12 did not have OCD as a primary diagnosis, two were diagnosed with substance abuse/dependence, seven declined to participate, and one for other reasons.

In the total sample, participants were mostly female ($n = 38$; 65.5%) and had a mean age of 27.3 ($SD = 8.3$) years old. The two treatment groups did not differ significantly along demographic variables (age, sex, race, employment, highest education level, religion, income level, or comorbidity rate; all ps > .05). With regard to comorbid anxiety and depression, 14 participants (5 in ERP, 9 in ACT+ERP) met criteria for another current anxiety disorder and 20 (7 in ERP, 13 in ACT+ERP) had comorbid depression. Groups were not significantly different with respect to comorbid anxiety or depression (ps > .25).

Procedure

Assessment. Participants were recruited from the surrounding areas at each study site via flyers, internet and local newspaper advertisements, and clinic referrals. Interested individuals contacted the local site study coordinator to schedule a phone screen, during which time initial eligibility was assessed. Individuals who passed the phone screen were invited to an in-person visit at which participants provided written informed consent. This pretreatment assessment ($N = 80$) involved conducting a diagnostic interview with an assessor blind to study condition and completing a self-report battery containing the measures described later. These measures were also administered at each treatment session, posttreatment, and follow-up; data from sessions and assessments were analyzed in the present study.

Treatment. Treatment in both conditions involved 16 twice-weekly, two-hour individual therapy sessions delivered according to manualized treatment protocols. The two conditions were matched on number and duration of exposure sessions but differed with regard to how exposure tasks were framed and implemented. Specifically, in the ERP condition, the rationale

emphasized how exposure corrects mistaken beliefs regarding the (a) meaning and importance of obsessional stimuli and (b) need to perform compulsive rituals. In contrast, the ACT+ERP rationale underscored the advantages of responding flexibly to (a) obsessions and (b) associated anxiety/urges to ritualize. Readers interested in additional information regarding the structure and delivery of ERP and ACT+ERP are referred to the main outcome paper, which offers a more detailed description of treatment procedures (Twohig et al., 2018).

Measures

Mini International Neuropsychiatric Interview 5.0 (MINI 5.0; Sheehan & Lecrubier, 1992-2005). The MINI 5.0 is a semi-structured interview that was used to assess current DSM-IV diagnoses: major depressive episode, dysthymia, (hypo)manic episode, anxiety disorders (i.e., panic disorder, agoraphobia, social phobia, posttraumatic stress disorder, and generalized anxiety disorder), eating disorders (i.e., anorexia nervosa and bulimia nervosa), alcohol abuse/dependence, substance abuse/dependence, psychosis, and antisocial personality disorder. Assessors blind to study condition administered the MINI 5.0 at the pretreatment assessment to determine initial eligibility criteria. It was also used to denote comorbid (secondary) depression or anxiety disorder in the current study. Comorbid anxiety disorder was defined as meeting criteria for any current DSM-IV-TR anxiety disorder. Comorbid depression was defined as meeting criteria for a current major depressive episode.

Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz et al., 2010). The DOCS is a 20-item self-report measure of OCD severity across four symptom dimensions: contamination, responsibility for harm/mistakes, symmetry/ordering, and unacceptable thoughts. For each dimension, five items (rated 0 to 4; anchors change with each item) assess: time occupied by obsessions and rituals, avoidance, distress, functional interference, and difficulty

disregarding obsessions/refraining from rituals. Total scores range from 0 to 80 with higher scores indicating greater OCD symptom severity. The DOCS has demonstrated sound psychometric properties and convergent validity in previous research (Abramowitz et al., 2010). The DOCS was administered at each assessment and therapy session. Internal consistency for the DOCS was good to excellent in our sample (Cronbach's αs = .85 to .96).

Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011). The AAQ-II is a seven-item self-report measure of psychological flexibility/experiential avoidance. Respondents rated their agreement with each statement using a 1 (*never true*) to 7 (*always true*) scale. Total scores range from 7 to 49, with higher scores indicating more psychological inflexibility. The AAQ-II has demonstrated a single factor structure as well as convergent, discriminant, and incremental validity in previous work (Bond et al., 2011). The AAQ-II was administered at each assessment and therapy session. Internal consistency for the AAQ-II was good to excellent in the current study (Cronbach's αs = .85 to .92).

Interpretation of Intrusions Inventory-31 (III-31; OCCWG, 2003). The III-31 is a 31-item self-report measure of immediate appraisals and interpretations of unwanted, intrusive thoughts, images, or impulses (i.e., obsessions). Participants first identify two recently experienced obsessions and then rate recency, frequency, and distress associated with the two identified obsessions. Next, 31 items assess the degree to which participants agree with each possible appraisal/interpretation using a 0 (*I did not believe this idea at all*) to 100 (*I was completely convinced this idea was true*) scale. Items are summed together and then divided by 10 to yield a total score, which has a possible range of 0-310. The III-31 has demonstrated a single factor structure excellent internal consistency, and good convergent and criterion validity in past work (OCCWG, 2005). The III-31 was administered at each assessment and therapy

session. Internal consistency for the III-31 was excellent in the current study (Cronbach's αs = .94 to .98).

Statistical Analyses

Statistical analyses were conducted with R in RStudio using the following packages: tidyverse (Wickham, 2017), lme4 (Bates, Maechler, Bolker, & Walker, 2015), texreg (Leifeld, 2013), and margins (Leeper, 2018). Normality of residuals in multilevel analyses was examined using residuals versus fitted plots, which indicated homoscedastic linear models with normally distributed errors (Faraway, 2014).

Moderation. Moderation effects of comorbid conditions and process of change variables—psychological inflexibility (AAQ-II) and interpretations of intrusions (III-31)—at baseline on DOCS scores at baseline, posttreatment, and follow-up (measured in weeks; three assessment points total) were tested using multilevel modeling with maximum likelihood estimation by fitting a series of nested models. First, a null random intercept model was specified. Second, a fixed linear time effect was added. Third, we tested if a quadratic time effect produced a better model fit. Fourth, we added a three-way interaction term for time (based on the better-fitting time model), condition, and baseline moderator. Finally, we tested for quadratic moderation effects by adding a three-way interaction term containing the quadratic moderator variable, creating a time (or time^2) × condition × moderator^2 fixed effect. The same steps were repeated for other moderators of interest. If there was no significant difference in model fit based on the χ^2-difference statistic, the more parsimonious (i.e., fewer predictors) model was selected as the best-fitting model.

Processes of change. Linear multilevel (i.e., mixed effects) lagged models were used to test the temporal relationship between process (i.e., AAQ-II, III-31) and outcome (i.e., DOCS)

over the course of the study from the first to the final therapy session (16 assessment points total); other data were not included as intervention was not occurring during those times. In the models, intercepts were allowed to vary by participant. Four series of models were tested: lagged AAQ-II (i.e., time t-1) predicting DOCS at the subsequent session (i.e., time t), lagged DOCS predicting AAQ-II, lagged III-31 predicting DOCS, and lagged DOCS predicting III-31.

For each series of models, we compared model fit for the lagged variable as the sole predictor (Model 1), interaction between the lagged variable and condition (Model 2), interaction between the lagged variable and session (Model 3), and a three-way interaction among the lagged variable, condition, and session (Model 4). Average marginal effects for predictors in each model were estimated to provide a measure of the overall influence of predictors on the dependent variables, accounting for interaction effects.

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Results

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Moderation

Comorbid anxiety. The quadratic time model fit significantly better than the linear time effects model ($\chi^2_{\text{difference}}(1) = 44.95$, $p < .001$). The model that included the interaction term for presence of comorbid anxiety disorders did not fit significantly better than the quadratic model ($\chi^2_{\text{difference}}(9) = 12.275$, $p = .198$). Coefficients for the quadratic model are reported in Table 1. Results show a comorbid anxiety diagnosis at baseline did not differentially affect treatment response between conditions.

Based on this finding, we examined if baseline comorbid anxiety influenced outcomes regardless of condition by omitting the condition variable from our model, leaving a two-way interaction between presence of anxiety comorbidity and time. We compared this model to our quadratic time only model. The two-way interaction model did not significantly improve model

fit ($\chi^2_{\text{difference}}(3) = 1.077$, $p = .783$), indicating baseline comorbid anxiety did not differentially predict outcomes in our sample collapsed between conditions.

Comorbid depression. The quadratic time model fit significantly better than the linear time model ($\chi^2_{\text{difference}}(1) = 45.865$, $p < .001$). There was no significant difference in model fit between the quadratic time-only model and the interaction model for comorbid depressive disorders ($\chi^2_{\text{difference}}(9) = 14.103$, $p = .119$). Coefficients for the quadratic model are reported in Table 1 and show a comorbid depressive diagnosis at baseline did not differentially affect treatment response between conditions.

We conducted post-hoc follow-up analyses to test whether baseline comorbid depression influenced outcomes regardless of condition by comparing the quadratic time-only model to a model with a two-way interaction between presence of comorbid depression and time. The two-way interaction model did not significantly improve model fit ($\chi^2_{\text{difference}}(3) = 0.795$, $p = .851$), indicating baseline comorbid depression did not differentially predict outcomes in our sample regardless of condition.

Psychological inflexibility. The model with a quadratic time effect fit significantly better than the linear model ($\chi^2_{\text{difference}}(1) = 44.227$, $p < .001$). Thus, a quadratic time term was entered in the three-way interaction model. Neither the three-way linear ($\chi^2_{\text{difference}}(9) = 10.863$, $p = .285$) nor quadratic ($\chi^2_{\text{difference}}(15) = 16.937$, $p = . 323$) interaction model produced a significantly better fit than the quadratic time-only model, indicating the quadratic time-only model was most parsimonious. Coefficients from the best-fitting model are presented in Table 1. They show baseline levels of psychological inflexibility did not differentially affect treatment response depending on condition.

Given the model with a three-way interaction of time, condition, and baseline psychological inflexibility did not significantly improve fit, we examined if baseline psychological inflexibility affected outcomes over time regardless of condition by comparing two models each with a two-way interaction of condition and baseline psychological inflexibility (linear and quadratic terms respectively) to the quadratic time-only model. The two-way interaction models did not significantly improve fit ($\chi^2_{\text{difference}}(3) = 2.949$, $p = .400$; $\chi^2_{\text{difference}}(6) = 10.736$, $p = .097$), indicating baseline level of psychological inflexibility did not predict OCD symptom severity over time.

Interpretation of intrusions. Based on the better-fitting quadratic time only model ($\chi^2_{\text{difference}}(1) = 45.431$, $p < .001$), similar interaction models were fitted for the III-31 that included an interaction of time^2, condition, and baseline III-31 score (linear and quadratic, respectively). The linear moderator model fit significantly better than the quadratic time model ($\chi^2_{\text{difference}}(9) = 19.567$, $p = .021$) but not better than the quadratic moderator model ($\chi^2_{\text{difference}}(6) = 11.400$, $p = .077$). These results suggest baseline III-31 scores differentially affected treatment response between conditions. As shown in Figure 1 (leftmost panel), participants with the lowest baseline III-31 scores in the ACT+ERP condition had higher variability in DOCS scores compared to the ERP condition whereas for the same subgroup of participants, DOCS scores in the ERP condition consistently decreased from posttreatment to follow-up.

Processes of Change

Model fit. For all dependent variables tested, the best-fitting model included the three-way interaction based on χ^2-difference tests (see Table 2).

DOCS and AAQ-II. There was an overall positive association between AAQ-II at the previous session (time *t-1*) and DOCS at the subsequent session (time *t*), with higher inflexibility

at the previous session predicting higher symptom severity at the subsequent session (see Table 2) over time. The strength of this association depended on condition and session, as illustrated in Figure 2, Panel A. The strength of the relationship between AAQ-II at time t-1 and DOCS at the next session (time t) increased toward the end of treatment in the ERP condition whereas the strength of the relationship did not change as much in the ACT+ERP condition. However, the steeper slope in the farthest right subpanel (Sessions 12-16) demonstrates AAQ-II predicted DOCS more strongly toward the end of treatment in the ACT+ERP condition compared to the ERP condition. The overall standardized average marginal effect of previous session AAQ-II on DOCS was 0.30 (see Table 3 for more information).

A similar pattern was observed for DOCS at the previous session (time t-1) and AAQ-II at the subsequent session (time t). Generally, higher symptom severity was linked to higher inflexibility at the subsequent session and this relationship became stronger over the course of treatment in the ERP condition but remained relatively more constant in the ACT+ERP condition (see Figure 2, Panel B). The overall standardized average marginal effect of DOCS at time t-1 on AAQ at time t was 0.41 (see Table 3 for more information).

This pattern of findings indicates the temporal relationship between psychological inflexibility and OCD severity was bidirectional and positive. That is, greater psychological inflexibility preceded greater OCD severity and greater OCD severity preceded greater psychological inflexibility over the course of therapy. As illustrated in Figure 1, psychological inflexibility at the previous session predicted OCD severity at the subsequent session more strongly over time in ACT+ERP than in ERP (steeper dashed line than solid line in top panel), whereas OCD severity at the previous session predicted inflexibility at the subsequent session more strongly over time in ERP compared to ACT+ERP (steeper solid line than dashed line in

bottom panel). However, overall, psychological inflexibility appeared to play comparable roles in both conditions in that psychological inflexibility both influenced later assessment of OCD severity and was influenced by previous assessment of OCD symptom severity in ERP and ACT+ERP.

DOCS and III-31. The relationship between DOCS and III-31 was similar to that between DOCS and AAQ-II: each variable at time t-1 was positively associated with the other at time t. In the ERP condition, the relationships between DOCS at time t-1 and III-31 at time t as well as between III-31 at time t-1 and DOCS at time t strengthened over the course of treatment whereas the magnitude of those same relationships remained relatively constant over time in ACT+ERP (see Figure 3; solid lines become steeper over time compared to dashed lines whose gradients are relatively constant over time). In addition, the difference between conditions was more pronounced in the model with DOCS at time t-1 as the predictor and III-31 at time t as the outcome than the model with lagged III-31 predicting subsequent DOCS. This suggests OCD symptom severity at the previous session predicted dysfunctional appraisals at the subsequent session much more reliably toward the end of treatment in ERP but not ACT+ERP (see Figure 3, Panel B). The standardized average marginal effect of lagged III-31 on DOCS was 0.35 and that of lagged DOCS on III-31 was 0.37 (see Table 3).

These results indicate an overall stronger bidirectional relationship between dysfunctional appraisals of intrusions and symptom severity in ERP than in ACT+ERP. In other words, interpretations of intrusions at the previous session predicted more symptom severity at the subsequent session to a greater degree in ERP compared to ACT+ERP. Furthermore, symptom severity at the previous session more strongly predicted maladaptive appraisals at the subsequent session in ERP relative to ACT+ERP. It also appeared the two constructs became increasingly

correlated as ERP progressed whereas the magnitude of the association between interpretations of intrusions and severity remained relatively constant over the course of ACT+ERP. Thus, dysfunctional interpretations of intrusions seemed to be more relevant to outcome in ERP than in ACT+ERP such that OCD severity was more likely to influence later maladaptive appraisals of intrusions and be influenced by previous maladaptive appraisals of intrusions in ERP compared to ACT+ERP.

Discussion

The current study tested the moderation effects of comorbid anxiety and depression at baseline. We also examined the roles of psychological inflexibility and dysfunctional interpretations of intrusions as moderators and processes of change in ERP and ACT+ERP. Neither comorbid anxiety nor comorbid depression at baseline differentially affected treatment response between conditions. Our findings were contrary to a previous study on individuals with mixed anxiety disorders that found presence of comorbid mood disorders predicted better outcomes in ACT compared to CBT (Wolitzky-Taylor et al., 2012). In that study, Wolitzky-Taylor et al. (2012) attributed their finding to the broader focus of ACT on responses to distress in general as opposed to the focus of CBT on the specific presenting anxiety concern. However, similar to the skill of psychological flexibility, skills learned in ERP (e.g., tolerance for obsessional thoughts) can be easily applied to other concerns so it is possible both ACT and ERP skills are equivalently generalizable. Thus, it could be the way in which therapy is conducted— rather than the type of therapy per se—determines the extent to which clients successfully apply skills learned to comorbid concerns. For example, generalizability of skills could depend on how clinicians explain the rationale for exposures. A clinician who frames tolerance of uncertainty as a global skill (e.g., linking its use to interpersonally ambiguous situations) might facilitate more

skill generalization than one who frames tolerance of uncertainty as a coping strategy specific to obsessions.

Neither comorbid anxiety nor depression at baseline was associated with treatment outcome over time, indicating participants with and without concurrent depression and/or anxiety disorders responded similarly to the interventions tested in the current study. This finding is contrary to evidence suggesting psychiatric comorbidity is associated with worse response to treatment (Olatunji et al., 2013; Rosa-Alcázar et al., 2008). Results could be due to ability of participants to generalize skills learned in both conditions to comorbid concerns or natural concomitant decreases in anxiety and depression as OCD symptoms improved. The significant decrease in depression scores from pre- to posttreatment in both conditions (Twohig et al., 2018) is consistent with these interpretations.

Psychological inflexibility at baseline did not significantly predict differential treatment response between conditions or in our overall sample (when conditions were collapsed). Our findings indicate participants reported similar outcomes regardless of not only therapy received but also baseline level of psychological inflexibility. The lack of a consistent pattern for the moderating effect of psychological inflexibility suggests there may be unobserved variables (e.g., prior experience with mindfulness) affecting the relationship between condition and treatment outcome. Further, that psychological inflexibility did not affect outcomes in general suggests ERP and ACT+ERP were similarly effective across the range of psychological inflexibility scores. Another possibility for mixed findings in the literature is psychological inflexibility is imprecisely assessed by different instruments and across samples (Ong, Pierce, Woods, Twohig, & Levin, 2018; Tyndall et al., 2018; Wolgast, 2014) such that operationalizations of psychological inflexibility reported in different studies are not equivalent. The multifaceted

definition of psychological inflexibility naturally makes it a difficult construct to evaluate via self-report. In particular, given its contextual sensitivity, even the use of a well-validated but general measure of psychological inflexibility like the AAQ-II may be suboptimal. Administering context-specific versions of the AAQ in future studies (e.g., Acceptance and Action Questionnaire for Obsessions and Compulsions [AAQ-OC]; Jacoby et al., 2018) may facilitate more precise measurement of psychological inflexibility as it pertains to the concern of interest. At the same time, it is possible our study was underpowered to detect true moderation effects given our relatively small sample size. Thus, null results should be replicated with larger samples before robust conclusions can be drawn.

Maladaptive appraisals of intrusions at baseline predicted differential treatment response over time between conditions (see leftmost panel in Figure 1). Among participants with the lowest baseline scores of dysfunctional interpretations of intrusions, OCD severity showed greater variability over the course of treatment in the ACT+ERP group whereas OCD severity reliably decreased in the ERP group. That is, participants in the ERP condition performed consistently well regardless of baseline III-31 scores whereas those in the ACT+ERP condition only maintained treatment gains from posttreatment to follow-up if their baseline III-31 scores were at least moderately high. The observed pattern suggests techniques used in ERP exposures worked better than cognitive defusion techniques emphasized in ACT+ERP exposures for less dysfunctional appraisals (i.e., lower III-31 scores). Still, it appears strategies used in ERP and ACT+ERP are similarly helpful for more dysfunctional or more "powerful" interpretations of intrusions. This finding provides some support for treatment matching based on baseline III-31 scores. Besides baseline III-31 scores, we did not identify significant moderators of outcomes among the variables examined. Thus, based on our circumscribed list of potential moderators, we

did not find circumstances under which ACT+ERP was more effective than ERP. Inclusion of other moderators in future research might elucidate client profiles that would benefit more from ACT+ERP than ERP or vice versa.

With respect to psychological inflexibility as a potential process of change, we found a reciprocal relationship between psychological inflexibility and OCD severity over time for both conditions such that greater inflexibility at the previous session predicted greater OCD severity at the subsequent session and greater OCD severity at the previous session predicted greater psychological inflexibility at the subsequent session regardless of condition over the course of therapy. In the ACT+ERP condition, psychological inflexibility at the previous session predicted OCD severity at the subsequent session to a slightly greater extent than vice versa whereas in the ERP condition, OCD severity at the previous session predicted psychological inflexibility at the subsequent session to a slightly greater extent than vice versa. That is, in ACT+ERP, practicing psychological flexibility at the previous session tended to predict less symptom severity at the subsequent session over the course of therapy more so than the other way around (see dashed lines in Figure 2). This observation is consistent with a previous study on ACT for OCD that found psychological inflexibility predicted decreases in OCD severity more strongly than OCD severity predicted inflexibility (Twohig, Plumb Vilardaga, et al., 2015). Moreover, these findings are congruent with the theory underlying ACT, which posits changes in response to inner experiences (practicing flexibility) precede changes in the inner experiences themselves (obsessions; S. C. Hayes et al., 2006).

Conversely, for ERP participants, lower symptom severity at the previous session tended to be associated with greater subsequent psychological flexibility more so than the other way around (compare solid lines in bottom panel to top panel in Figure 2). This could be because

unlike in the ACT+ERP condition, ERP participants were not explicitly guided to practice psychological flexibility in response to OCD symptoms. Still, it appeared ERP participants were able to practice psychological flexibility at a later session when self-reported OCD severity was lower (bottom panel in Figure 2). It is possible emphasis on tolerance of uncertainty (i.e., sitting with rather than resolving uncertainty) and response prevention (i.e., eliminating rituals rather than anxiety or intrusions) had the inadvertent effect of teaching psychological flexibility in the ERP condition as participants were trained to practice new ways of responding to distress, increasing flexibility with respect to their behavioral repertoire. Given the positive bidirectional relationship observed in both conditions, it seems modifying responses to private events is generally easier in the context of lower symptom severity and supports graduated practice of psychological flexibility skills (i.e., practicing willingness with gradually increasing levels of distress). Furthermore, psychological flexibility appears to function as both a process of change and consequence of symptom improvement in both ACT+ERP and ERP.

As for the relationship between interpretations of intrusions and symptom severity, we found dysfunctional interpretations of intrusions at the previous session predicted OCD severity at the subsequent session to a greater extent in the ERP condition than in the ACT+ERP condition over the course of therapy. This indicates interpretations of intrusions may be a more relevant process of change to ERP than ACT+ERP, which is expected given the use of exposure to facilitate cognitive modification in ERP but not ACT+ERP. At the same time, interpretations of intrusions at the previous session were still associated with subsequent symptom severity in the ACT+ERP condition—just to a lesser extent. One possible explanation for the weaker link between interpretations of intrusions and subsequent OCD symptoms in the ACT+ERP condition is participants were able to regard intrusions and their significance or meaning from a defused

stance (i.e., as thoughts to be noticed rather than to be believed as truth). Defused responses to interpretations of intrusions could be represented by a weakened association between interpretations of intrusions and subsequent OCD severity because defusing undermines the literality of thoughts such that their perceived impact on behavior decreases even if their frequency does not change. Consequently, defusing allows individuals to experience certain thoughts about their intrusions without acting on them (e.g., without engaging in compulsions) such that OCD severity (e.g., compulsions) does not necessarily increase in the presence or maladaptive appraisals of intrusions. This pattern was observed in the ACT+ERP condition but not the ERP condition (see Figure 3), which is consistent with such an interpretation.

Greater symptom severity at the previous session also more strongly predicted dysfunctional interpretations of intrusions at the subsequent session in ERP than in ACT+ERP over the course of therapy. This relationship was weaker in ACT+ERP such that even when OCD symptoms were more severe, they were not as likely to be associated with greater maladaptive interpretations of intrusions. Thus, it appears participants in the ACT+ERP condition were able to respond to intrusions adaptively even when symptoms were more intense. This finding has particular clinical significance because it indicates in ACT+ERP, even if OCD severity increases (e.g., obsessions become more frequent), dysfunctional appraisals do not automatically follow. Again, this temporal pattern coheres with the conceptualization of inner experiences and behavior from an ACT perspective in which thoughts and feelings are not perceived to have causal power over behavior. Moreover, our findings support the viability of targeting function of or responses to inner experiences rather than the form or frequency of those experiences as they show evaluations of OCD symptoms (function) are not always correlated with their severity (form and/or frequency).

Contrary to the pattern of findings regarding psychological inflexibility, the correlations between dysfunctional interpretations and symptom severity were weaker in the ACT+ERP condition compared to the ERP condition. In other words, dysfunctional interpretations were more independent of symptom severity than was psychological inflexibility in ACT+ERP. This could be because (a) defusing from thoughts is a specific skill that can be more easily trained whereas psychological flexibility more broadly encompasses willingness to be open to difficult inner experiences while engaging in valued behaviors and so is harder to master or (b) because the focus of treatment on OCD rendered participants more proficient at applying flexibility in the form of defusion to interpretations of intrusions specifically. Alternatively, as mentioned above, the AAQ-II might not have been a sufficiently sensitive measure of psychological inflexibility in the context of OCD (Tyndall et al., 2018; Wolgast, 2014). Again, using a context-specific measure of psychological inflexibility for OCD (e.g., AAQ-OC; Jacoby et al., 2018) may provide a clearer picture of the role of psychological inflexibility in treatment for OCD.

Conclusion

Overall, our findings do not support comorbid anxiety, comorbid depression, or psychological inflexibility as clinically meaningful moderators of treatment outcome in ACT+ERP versus ERP. However, less dysfunctional interpretations of intrusions tended to be associated with better performance in ERP on average relative to ACT+ERP from posttreatment to follow-up. These results provide equivalent empirical support for ERP and ACT+ERP except when patients report less maladaptive interpretations of intrusions—in which case, ERP may be preferred. Otherwise, when considering between using ERP or ACT+ERP with patients with OCD, clinicians can decide based on other factors like professional expertise and/or client preference.

Our findings also underscore the difficulty of finding consistent and robust treatment moderators for OCD (Steketee, Siev, Yovel, Lit, & Wilhelm, 2018). In fact, research suggests composite moderators that take multiple variables into account may be more useful than isolated variables at predicting dropout (Niles, Wolitzky-Taylor, Arch, & Craske, 2017). These collective findings underscore the complexity of examining moderation effects and the need for more nuanced investigation of how the interplay among different variables influence response to interventions. Researchers should also investigate other potential moderators to obtain a more complete picture of how baseline presentation affects outcomes.

Psychological inflexibility and dysfunctional interpretations of intrusions both appeared to be clinically relevant processes of change in ERP and ACT+ERP for OCD. The temporal relationship between psychological inflexibility and OCD severity was comparable between conditions although psychological inflexibility tended to predict subsequent OCD severity more so in ACT+ERP whereas OCD severity tended to be linked to greater subsequent inflexibility more so in ERP.

Between-condition differences were more evident in the relationship between dysfunctional appraisals of intrusions and OCD symptoms. Whereas OCD severity strongly predicted later maladaptive interpretations of intrusions and was strongly predicted by maladaptive interpretations of intrusions at the previous session in ERP, the bidirectional relationship between symptom severity and dysfunctional appraisals was more tenuous in ACT+ERP. The latter finding suggests in ACT+ERP, (a) interpretations of intrusions were less affected by antecedent OCD symptoms and (b) interpretations of intrusions were less likely to predict later OCD severity. This pattern of associations is largely consistent with the theories underlying ERP and ACT, providing some evidence that the two therapies—though similarly

effective—effect change through different means. In practice, the different processes of change suggest the skills on which to focus in exposures from a traditional ERP perspective versus an ACT framework are different (e.g., adaptive appraisals of intrusions versus cognitive defusion). To be theoretically consistent, clinicians should pay attention to how they are delivering ERP and maintain consistency within their selected framework to increase the likelihood of replicating results from the current clinical trial.

Limitations

We had a limited set of measures of processes of change to test our hypotheses and given criticisms regarding the discriminant validity of the AAQ-II (Tyndall et al., 2018; Wolgast, 2014), including multiple measures to eliminate measurement error as a confounding effect would have increased reliability of our findings. In addition, the primary outcome variable in this study was symptom severity even though the definition of psychological health can extend beyond psychopathology (Kashdan & Rottenberg, 2010). It might be worth examining if the same moderation and process of changes patterns are observed for other outcomes such as quality of life. Furthermore, our study might have been underpowered to detect significant effects given the relatively small sample size ($N = 58$) and number of predictors in our multilevel models. Thus, it is possible null findings were due to low power rather than absence of true effects. Interrater reliability was also not established for MINI diagnoses in the current study. However, assessors received thorough training in clinical interviewing broadly and administering the MINI specifically. The PI at each site oversaw didactic and role-play training for each assessor who also completed mock MINI ratings of recorded training interview tapes. In addition, MINI assessors were recorded for supervision purposes (tapes were deleted once diagnostic accuracy and participant safety/appropriateness for study participation were

confirmed). Finally, all measures used were self-report; gathering information on other dimensions of wellbeing (e.g., behavioral data) would have provided convergent validity for current findings.

Conflict of Interest

Declarations of interest: None.

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Table 1

Results from Multilevel Models Testing Moderation Effects of Baseline Variables on DOCS Scores Over Time

	Comorbid Anxiety	Comorbid Depression	AAQ-II	III-31
Intercept	32.62 (1.60)***	32.80 (1.63)***	32.00 (1.54)***	16.88 (5.21)**
Time	-2.35 (0.26)***	-2.42 (0.27)***	-2.25 (0.26)***	-1.09 (0.89)
Time^2	0.06 (0.01)***	0.06 (0.01)***	0.05 (0.01)***	0.02 (0.02)
Condition				9.84 (8.08)
Baseline III-31				0.13 (0.04)***
Time × Condition				-0.16 (1.39)
Time × Baseline III-31				-0.01 (0.01)
Condition × Baseline III-31				-0.11 (0.06)*
Time^2 × Condition				0.01 (0.04)
Time^2 × Baseline III-31				0.00 (0.00)
Time × Condition × Baseline III-31				0.01 (0.01)
Time^2 × Condition × Baseline III-31				-0.00 (0.00)
AIC	1046.44	999.74	1120.96	1203.89
BIC	1061.04	1014.12	1135.92	1245.94
Log likelihood	-518.22	-494.87	-555.48	-587.94
Number of observations	137	131	147	149

* $p < .05$. *** $p < .001$.

Note. AIC = Akaike information criterion; AAQ-II = Acceptance and Action Questionnaire—II; BIC = Bayesian information criterion; DOCS = Dimensional Obsessive-Compulsive Scale; III-31 = Interpretation of Intrusions Inventory.

Table 2
Fit Indices for Multilevel Lagged Models Testing Processes of Change

	AIC	BIC	Log likelihood	χ^2	χ^2 difference	*df* difference	*p*
Lagged AAQ-II —> DOCS							
Model 1	1027.3	1045.62	-509.65	1019.3			
Model 2	1028.7	1056.18	-508.35	1016.7	2.60	2	.272
Model 3	914.38	941.87	-451.19	902.38	114.31	0	<.001
Model 4	**907.91**	**953.72**	**-443.96**	**887.91**	**14.47**	**4**	**.006**
Lagged DOCS —> AAQ-II							
Model 1	952.92	971.25	-472.46	944.92			
Model 2	942.95	970.44	-465.48	930.95	13.97	2	<.001
Model 3	879.52	907	-433.76	867.52	63.44	0	<.001
Model 4	**876.8**	**922.61**	**-428.4**	**856.8**	**10.72**	**4**	**.030**
Lagged III-31 —> DOCS							
Model 1	953.38	971.68	-472.69	945.38			
Model 2	939.14	966.59	-463.57	927.14	18.24	2	<.001
Model 3	882	909.45	-435	870	57.14	0	<.001
Model 4	**844.08**	**889.83**	**-412.04**	**824.08**	**45.93**	**4**	**<.001**
Lagged DOCS —> III-31							
Model 1	929.41	947.72	-460.71	921.41			
Model 2	908.92	936.38	-448.46	896.92	24.49	2	<.001
Model 3	778.01	805.47	-383.01	766.01	130.91	0	<.001
Model 4	**761.98**	**807.74**	**-370.99**	**741.98**	**24.03**	**4**	**<.001**

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; AAQ-II = Acceptance and Action Questionnaire—II; DOCS = Dimensional Obsessive-Compulsive Scale; III-31 = Interpretation of Intrusions Inventory-31. Model 1 only included the lagged predictor, Model 2 included a lagged variable × condition interaction, Model 3 included a lagged variable × session interaction, and Model 4 included a three-way interaction of lagged variable × condition × session.

Table 3
Average Marginal Effects of Predictors on Outcomes

	Estimate	Lower CI	Upper CI	*p*
DOCS				
Lagged AAQ-II	0.30	0.23	0.36	<.001
Session	-0.05	-0.05	-0.04	<.001
Condition[a]	-0.18	-0.58	0.22	0.377
AAQ-II				
Lagged DOCS	0.41	0.34	0.49	<.001
Session	-0.03	-0.04	-0.03	<.001
Condition[a]	0.26	-0.14	0.65	0.204
DOCS				
Lagged III-31	0.35	0.27	0.42	<.001
Session	-0.04	-0.05	-0.03	<.001
Condition[a]	-0.06	-0.48	0.36	0.779
III-31				
Lagged DOCS	0.37	0.30	0.44	<.001
Session	-0.05	-0.06	-0.04	<.001
Condition[a]	-0.14	-0.59	0.30	0.529

[a] Reference group is exposure and response prevention (ERP). That is, values in this column reflect the average marginal effect of being assigned to the acceptance and commitment therapy condition relative to the ERP condition.
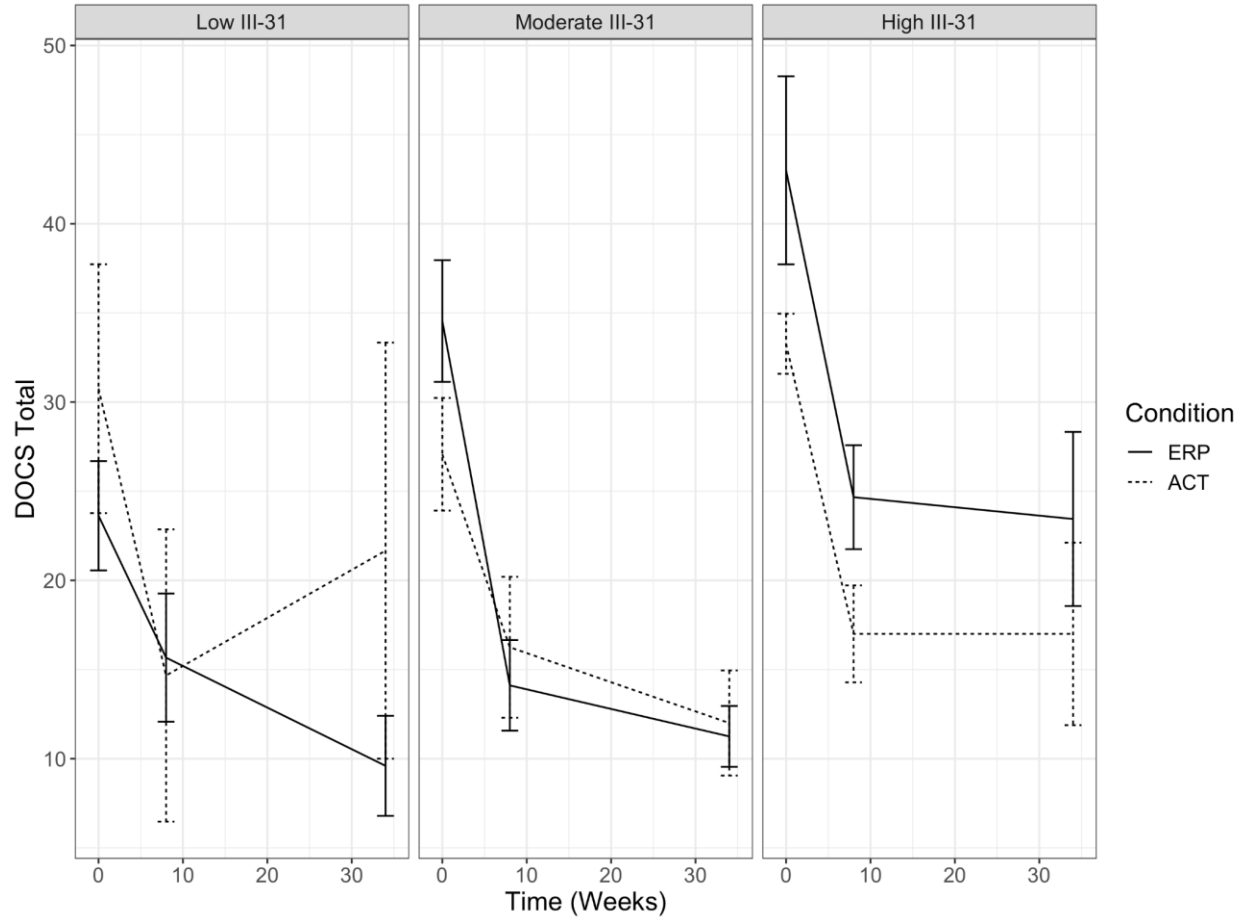
Figure 1. Change in Dimensional Obsessive-Compulsive Scale (DOCS) total scores over time by baseline Interpretation of Intrusions Inventory-31 (III-31) scores.
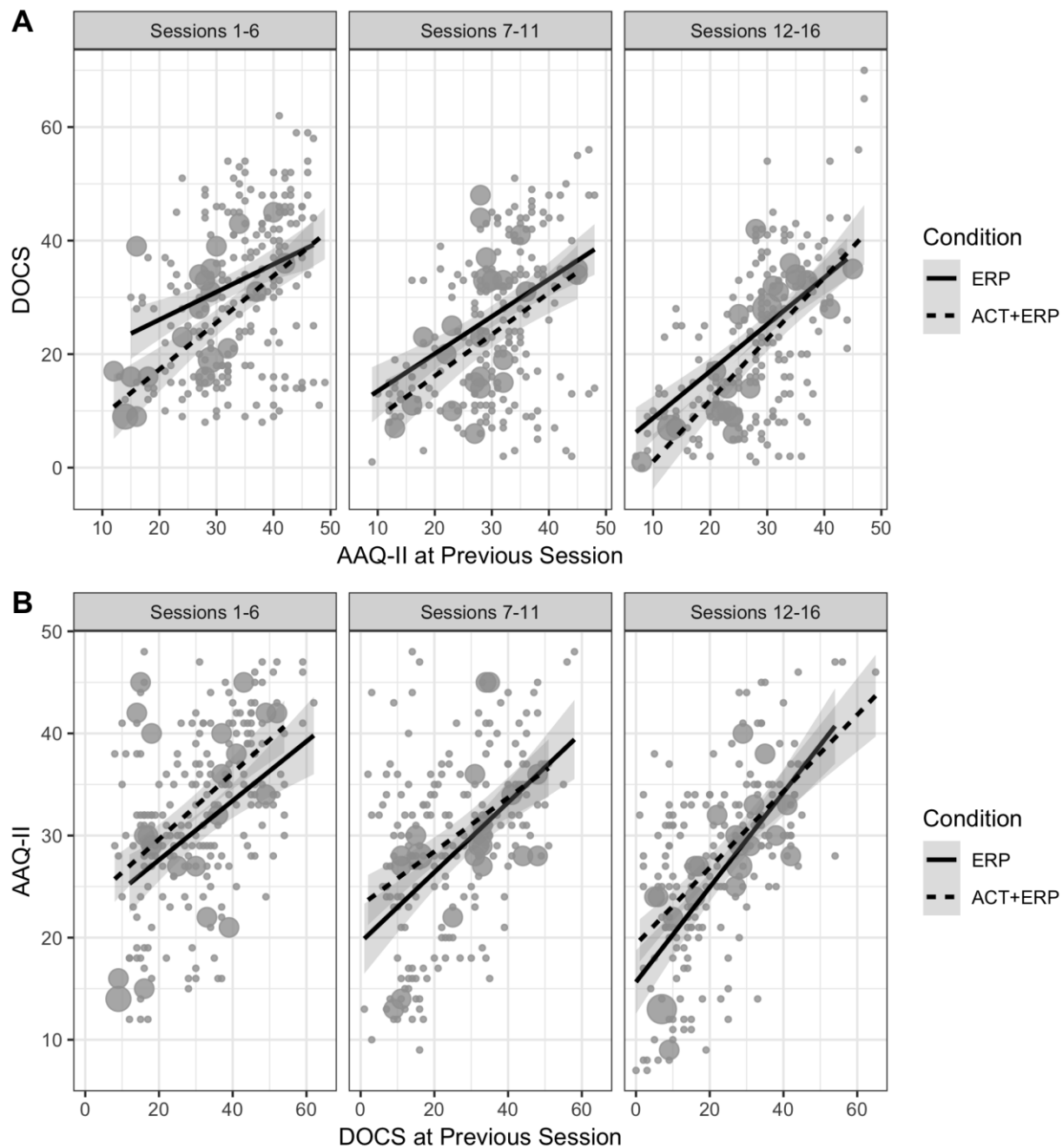
Figure 2. Scatterplots of the relationship between Acceptance and Action Questionnaire—II (AAQ-II) and Dimensional Obsessive-Compulsive Scale (DOCS) scores over time. Panel A depicts the association between lagged AAQ-II and current DOCS over the course of 16 sessions of therapy by condition. Panel B depicts the association between lagged DOCS and current AAQ-II over the course of 16 sessions of therapy by condition. The size of the circles reflects participant density.
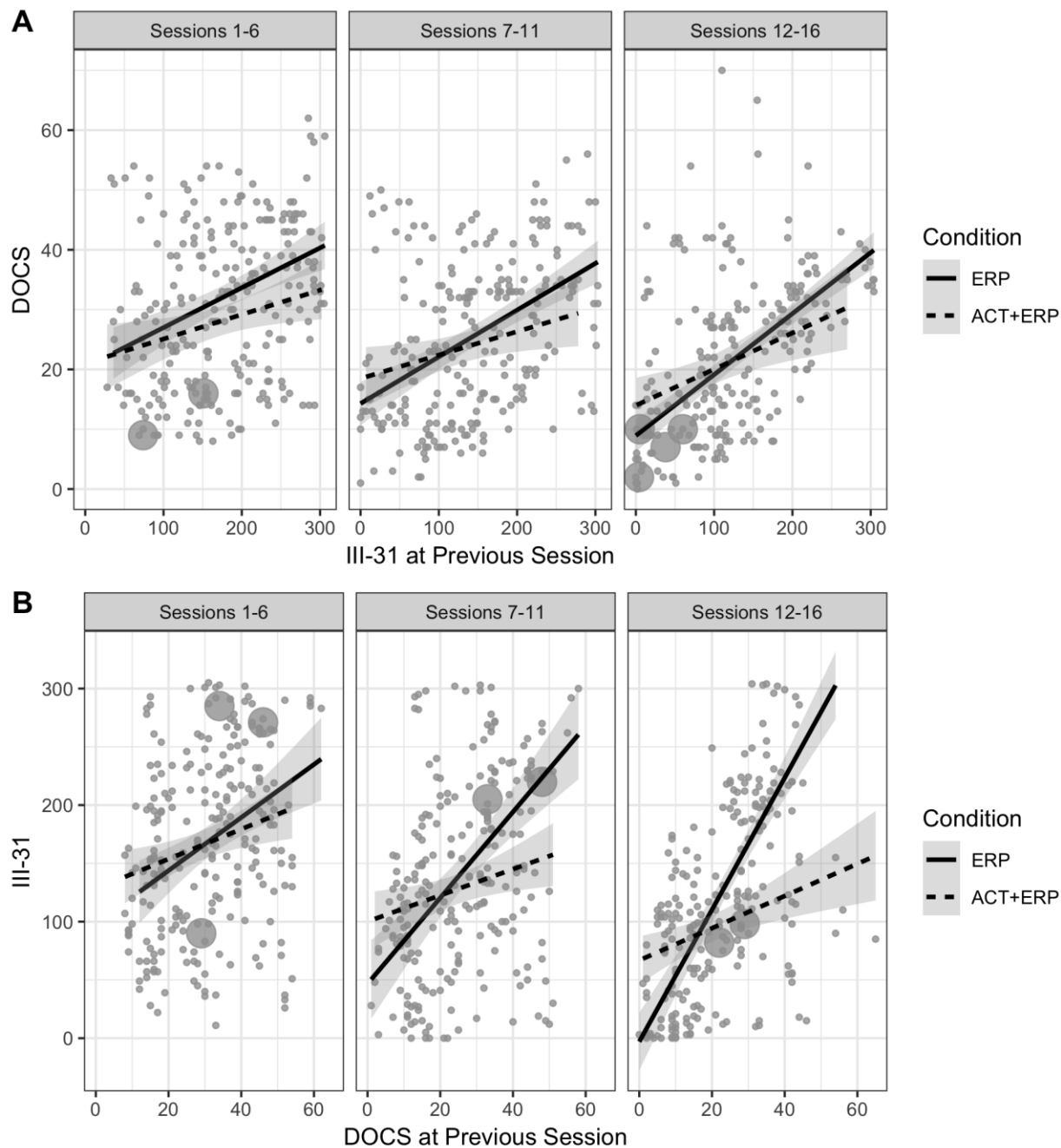
Figure 3. Scatterplots of the relationship between Interpretation of Intrusions Inventory-31 (III-31) and Dimensional Obsessive-Compulsive Scale (DOCS) scores over time. Panel A depicts the association between lagged III-31 and current DOCS over the course of 16 sessions of therapy by condition. Panel B depicts the association between lagged DOCS and current III-31 over the course of 16 sessions of therapy by condition. The size of the circles reflects participant density.