Psychotherapy Research

ISSN: 1050-3307 (Print) 1468-4381 (Online) Journal homepage: www.tandfonline.com/journals/tpsr20

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To cite this article: Stephen A. Semcho, Matthew W. Southward, Nicole E. Stumpp, Michelle M. Smith, Martina Fruhbauerova & Shannon Sauer-Zavala (2024) Within-person changes in aversive reactivity predict session-to-session reductions in anxiety and depression in the unified protocol, Psychotherapy Research, 34:6, 760-773, DOI: 10.1080/10503307.2023.2254467

To link to this article: https://doi.org/10.1080/10503307.2023.2254467

Psychotherapy Research, 2024
Vol. 34, No. 6, 760–773, https://doi.org/10.1080/10503307.2023.2254467

RESEARCH ARTICLE

Within-person changes in aversive reactivity predict session-to-session reductions in anxiety and depression in the unified protocol

STEPHEN A. SEMCHO, MATTHEW W. SOUTHWARD, NICOLE E. STUMPP, MICHELLE M. SMITH, MARTINA FRUHBAUEROVA, & SHANNON SAUER-ZAVALA

Department of Psychology, University of Kentucky

(Received 5 June 2023; revised 22 August 2023; accepted 23 August 2023)

ABSTRACT

The Unified Protocol (UP) theoretically leads to reductions in emotional disorder symptoms by reducing aversive reactions to emotions. However, aversive reactions can take many forms (e.g., non-acceptance, behavioral avoidance). We examined if (1) multiple aspects of aversive reactivity predicted session-to-session changes in anxiety and depression in the UP, (2) these aspects reflected a single latent construct, and (3) changes in this latent construct predicted changes in anxiety and depression. Participants ($N = 70$, $M_{age} = 33.74$, 67.1% female, 74.3% white) completed six sessions of UP modules and measures of aversive reactivity, anxiety, and depression before each session. We used hierarchical linear modeling and random-intercept cross-lagged panel models to test aspects of aversive reactivity and a latent factor of aversive reactivity, respectively, as predictors of session-to-session changes in anxiety and depression. Within-person improvements in four of five aspects of aversive reactivity predicted decreases in anxiety, and improvements in two aspects predicted decreases in depression. However, within-person improvements in latent aversive reactivity predicted decreases in anxiety at five sessions and in depression across all sessions. These results add to the growing literature highlighting the role of aversive reactivity as a potential transdiagnostic process involved in improvements in emotional disorder symptoms during treatment.

Keywords: within-person; transdiagnostic; mechanisms; aversive reactivity; anxiety; depression

Clinical Significance Statement

These findings lend support to the notion that reducing aversive reactivity to negative emotions on an individual level in treatment with the UP is related to symptom improvement. Clinicians could consider monitoring patients' level of aversive reactivity as an early indicator of treatment response to determine whether patients are "on track" to experience symptom relief. Additionally, clinicians may be able to utilize one global measure of aversive reactivity, rather than measures of multiple mechanistic processes, when conducting baseline treatment assessments and when using routine outcome monitoring to track patient progress.

Emotional disorders include psychiatric conditions such as anxiety and depressive disorders, as well as borderline personality disorder, insomnia, and eating disorders, among others (Bullis et al., 2019). These conditions are characterized by frequent and intense negative emotions that prompt aversive, emotionally avoidant reactions (Barlow et al., 2014). Specifically, aversive reactivity has been described as a functional mechanism that connects the experience of negative emotions to the avoidant coping behaviors that represent emotional disorder symptoms (e.g., hypersomnia in depression, compulsions in obsessive-compulsive disorder, binging and purging in bulimia nervosa; Bullis et al., 2019).

Aversive reactivity is an umbrella term for a number of constructs that have been implicated in the development and maintenance of emotional disorders (Semcho et al., 2023). For instance, anxiety

*Correspondence concerning this article should be addressed to: Stephen A. Semcho. Email: semcho@uky.edu
This article has been corrected with minor changes. These changes do not impact the academic content of the article.

sensitivity refers to the fear of physiological sensations associated with emotional experiences (Reiss et al., 1986) and has largely been studied in the context of panic disorder (McNally, 2002; Reiss, 1991), though emerging data suggest this construct confers risk transdiagnostically (Saulnier et al., 2018; Short et al., 2022). Indeed, anxiety sensitivity demonstrates correlations of $r = .40–.60$ with anxiety disorder symptoms and $r = .46$ with depressive disorder symptoms (Naragon-Gainey, 2010). Intolerance of uncertainty, a form of cognitive inflexibility in which ambiguity is deemed aversive, is commonly associated with generalized anxiety disorder and obsessive-compulsive disorder (Naragon-Gainey & Watson, 2018). Other forms of aversive reactivity such as experiential avoidance and distress intolerance have been studied transdiagnostically and are relevant to a wide swath of psychopathology, including both anxiety and depression (Akbari et al., 2022; McHugh et al., 2009; Naragon-Gainey & Watson, 2018; Spinhoven et al., 2014; Spinhoven et al., 2017). Lastly, mindfulness (which functions in opposition to aversive reactivity) has demonstrated negative associations with anxiety and depression (Carpenter et al., 2019), underscoring its role as a transdiagnostic construct.

Treatments for emotional disorders are thought to lead to symptom change by reducing patients' aversive reactivity to their negative emotions. For instance, the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders (UP; Barlow et al., 2018) includes five core modules designed to target common expressions of aversive reactivity. The Understanding Emotions module provides psychoeducation about the adaptive nature of emotions and encourages patients to identify the short and long-term consequences of emotionally avoidant coping. Next, the Confronting Physical Sensations module is designed to teach patients that they can tolerate uncomfortable physical sensations that arise as part of strong emotions. The Countering Emotional Behaviors module helps patients identify their urges to engage in avoidant behaviors and to practice alternative, approach-oriented actions instead. The Mindful Emotion Awareness module teaches patients to nonjudgmentally observe the unfolding of their emotional experiences in the present moment, whereas the Cognitive Flexibility module encourages patients to recognize and reevaluate overly negative thoughts arising from or about strong negative emotions. Preliminary evidence suggests that, when the UP modules are presented in isolation, they engage their corresponding form of aversive reactivity (i.e., Mindful Emotion Awareness is associated with increased levels of nonjudgmental, present-focused attention; Cassiello-Robbins et al., 2020; Sauer-Zavala et al., 2021).

There is accumulating evidence that improvements in aversive reactivity predict reductions in anxiety and depression symptoms during treatment with the UP. For example, early improvements in mindfulness, cognitive flexibility, behavioral avoidance, and interoceptive tolerance were related to decreased anxiety at post-treatment (Sauer-Zavala et al., 2021). Reductions in reactions to negative emotions (including fear of emotions and anxiety sensitivity) were significantly related to symptom change in the UP, above and beyond trait negative emotionality (Sauer-Zavala et al., 2012). Furthermore, improvements in emotion dysregulation, intolerance of uncertainty, and experiential avoidance predicted reductions in anxiety and depression at post-treatment (Khakpoor et al., 2019), and reductions in anxiety sensitivity from pre- to post-treatment were associated with lower anxiety at post-treatment and 6-month follow-up (Boswell et al., 2013). Additionally, over the course of six sessions of treatment with the UP, improvements in cognitive flexibility on a within-person level were correlated with reductions in both anxiety and depression symptoms (Southward & Sauer-Zavala, 2022). Lastly, increases in mindfulness were significantly related to reductions in anxiety and depression symptoms (Barnhofer et al., 2009; Hofmann et al., 2010).

Although engagement of several forms of aversive reactivity is associated with lower psychopathology at post-treatment, measures of these constructs have not been administered frequently enough to establish temporal precedence or to determine the relative contribution of each unique form of aversive reactive in enacting symptom improvement. Additionally, the functional model of emotional disorders posits a reciprocal bidirectional relation wherein reductions in symptoms should theoretically engage a feedback loop that reduces future aversive reactivity, further reducing the putative cycle of negative emotions and aversive reactivity (Bullis et al., 2019). However, this bidirectional process has also not yet been examined with the aforementioned frequency or intensity to establish session-to-session changes, warranting further exploration.

Rather than view each form of aversive reactivity as a discrete construct, it is possible that improvements in non-acceptance of emotions, anxiety sensitivity, behavioral avoidance, mindfulness, and cognitive flexibility reflect changes in an underlying aversive reactivity factor. In fact, there is recent empirical evidence to support this notion. For instance, various combinations of experiential avoidance, distress tolerance, emotion dysregulation, anxiety sensitivity, worry, rumination, and perfectionism have been shown to load single latent factor (Conway et al., 2021; Naragon-Gainey & Watson, 2018; Spinhoven

et al., 2017). The total score of experiential avoidance as measured by the Multidimensional Experiential Avoidance Questionnaire (MEAQ; Gámez et al., 2011) is another notable example of a potential explanation of a latent factor of aversive reactivity. The authors of these factor analytic studies have used different labels to describe their latent constructs (i.e., distress tolerance, psychological vulnerability, and neuroticism). However, given the growing theoretical (Barlow et al., 2014; Bullis et al., 2019) and empirical (Sauer-Zavala et al., 2021) literature describing aversive reactivity as the putative mechanism targeted by the UP, we continue to use this term to describe the tendency to view strong emotions negatively. Moreover, although these findings suggest patterns of single underlying latent factors, especially involving experiential avoidance, it remains unclear if the five aspects of aversive reactivity targeted in the UP represent variations of an underlying latent factor of general aversive reactivity.

Finally, nearly all the research to date on the structure of aversive reactivity and its impacts in treatment have been conducted at the between-person level. Between-person variability represents relatively stable individual differences, whereas within-person variability represents relations between constructs over time for any given person. Thus, disaggregating within-person variability allows for more direct tests of processes of change in treatment without potential confounding from relatively stable individual differences. For instance, in a study of dialectical behavior therapy skills training for emotional disorders, people who generally used more skills reported lower anxiety (between-person variability) than people who use fewer skills; however, when individuals used more skills than their personal average (within-person variability) they demonstrated more effective outcomes (Southward et al., 2022). Given that between-person differences do not necessarily generalize to within-person changes (Fisher et al., 2018), it is important to confirm previous between-person results regarding the structure of aversive reactivity and its associations with symptom change and extend these results to within-person processes.

Current Study

The current study is a secondary analysis of a sequential multiple assignment randomized trial (SMART) of the UP in which participants received the five core skill modules in a standard or personalized order and were randomly assigned to discontinue treatment after six or 12 sessions (Sauer-Zavala et al., 2022). In the original trial, eligible participants were randomly assigned to one of three conditions: (1) Standard, (2) Capitalization, or (3) Compensation. Participants in the Standard condition received UP skill modules in the order published in the manual. The Capitalization condition presented modules in an order of relative patient strengths, whereas the Compensation condition prioritized modules in the order of relative patient skill deficits. After six sessions of treatment, participants underwent a secondary randomization process to either discontinue therapy after six sessions or to continue for the full twelve sessions.

The primary goal of the current study was to test if between- and within-person changes in aspects of aversive reactivity that reflect the five core UP modules predict session-to-session changes in anxiety and depressive symptoms. Secondly, we aimed to investigate whether these aspects of aversive reactivity could be modeled as a single latent factor and, if so, whether within-person changes in this latent aversive reactivity factor also predicted session-to-session changes in anxiety and depression. We hypothesized that (1) within-person changes in each aspect of aversive reactivity would predict session-to-session changes in anxiety and depression, (2) aspects of aversive reactivity would load onto a single latent factor of general aversive reactivity, and (3) that within-person changes in the latent general aversive reactivity factor would also predict session-to-session changes in anxiety and depression. We also performed exploratory analyses to assess the bidirectional impact of within-person changes in anxiety and depression symptoms on both the individual and latent aspects of aversive reactivity.

Method

Participants

To be included in the study, participants were required to be at least 18 years old at the start of treatment and meet criteria for at least one of the following DSM-5 (APA, 2013) diagnoses: panic disorder (PD), generalized anxiety disorder (GAD), social anxiety disorder (SAD), obsessive-compulsive disorder (OCD), posttraumatic stress disorder (PTSD), major depressive disorder (MDD), or persistent depressive disorder (PDD). The most common primary diagnoses were GAD ($n = 33$; 47.1%), followed by MDD ($n = 19$; 27.1%), and SAD ($n = 16$; 22.9%). The same number of participants met criteria for an anxiety disorder without a depressive disorder ($n = 31$; 44.3%) as met criteria for at least one anxiety disorder and depressive disorder ($n = 31$; 44.3%),

with 8 participants (11.4%) only meeting criteria for a depressive disorder and not an anxiety disorder. Of note, the majority of participants (n = 51; 72.9%) met criteria for more than one diagnosis. Participants with symptoms or diagnoses that required acute care or hospitalization were excluded. Specifically, exclusion criteria were: lifetime mania, imminent suicide risk, current substance use disorder requiring greater than outpatient levels of care, or lifetime psychosis. Participants who had received at least five sessions of CBT within the past five years were also excluded.

A total of 70 participants met inclusion criteria for the study. Participants ranged in age from 19 to 63 (M = 33.74, SD = 12.64) and predominantly identified as female (n = 47; 67.1%) and Caucasian (n = 52; 74.3%). A plurality were single/never married (n = 24; 34.3%), although 23 participants (32.9%) were currently married. Most participants identified as heterosexual or straight (n = 52; 74.3%) and reported a median income $50,000 to $74,999. Similar proportions of participants had completed some college (n = 15; 24.3%), attained a bachelor's degree (n = 24; 34.3%), or held a degree higher than a bachelor's (n = 18; 25.7%).

Measures

Diagnostic interview. The Diagnostic Interview for Anxiety, Mood, and Obsessive-Compulsive and Related Neuropsychiatric Disorders (DIAMOND; Tolin et al., 2018) is a semi-structured diagnostic interview for DSM-5 disorders. Assessors use the DIAMOND to assign categorical DSM-5 diagnoses as well as dimensional ratings of subjective distress and/or degree of functional impairment of each individual diagnosis using a seven-point (1–7) clinical severity rating (CSR) scale where ratings of 3 or higher represent clinical threshold cutoffs. The DIAMOND was administered at baseline to assess if participant eligibility and determine if study inclusion/exclusion criteria were satisfied as well as to establish pre-treatment clinical severity. The DIAMOND was also administered after 5 sessions of treatment, prior to the second-stage randomization, and additionally at the end of the 12-week treatment window, regardless of duration condition. Graduate student assessors who were certified in the DIAMOND administered all diagnostic assessments. In the current study, assessors demonstrated excellent reliability on categorical ratings of primary diagnoses (Krippendorff's αs: .91–1.00; median = 1.00)[1] and dimensional severity ratings (CSRs) of each disorder (Krippendorff's αs: .83–1.00; median = .92).

Aversive reactivity mechanisms. Beliefs about Emotions Scale. The Beliefs about Emotions Scale (BES; Rimes & Chalder, 2010) is a 12-item self-report questionnaire that assesses an individual's beliefs about the unacceptability of experiencing and expressing emotions (e.g., "It is a sign of weakness if I have miserable thoughts") and corresponds to the UP Understanding Emotions Module (Sauer-Zavala et al., 2017). Each item is rated from 0 (*totally disagree*) to 6 (*totally agree*) and summed to create a total score, with higher scores indicating stronger beliefs in the unacceptability of negative emotions. In the current sample, BES items demonstrated good internal consistency at baseline (ω = .88).

Anxiety Sensitivity Index. The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) is a 16-item self-report survey that assesses an individual's beliefs about the possible negative consequences of anxiety, such as additional anxiety or fear, illness, embarrassment, and loss of control (e.g., "It scares me when I feel shaky") and corresponds to the UP Confronting Physical Sensations Module (Sauer-Zavala et al., 2017). All items are rated on a five-point scale from 0 (*very little*) to 4 (*very much*) and summed to create a total score. In the current sample, ASI items demonstrated good internal consistency at baseline (ω = .85).

Multidimensional Experiential Avoidance Questionnaire—Behavioral Avoidance. The Multidimensional Experiential Avoidance Questionnaire—Behavioral Avoidance Subscale (MEAQ-BA; Gámez et al., 2011) is a 13-item self-report measures designed to assess avoidance of discomfort and distress (e.g., "I rarely do something if there is a chance that it will upset me") and corresponds to the UP Countering Emotional Behaviors Module (Sauer-Zavala et al., 2017). All items are rated on a six-point scale from 1 (*strongly disagree*) to 6 (*strongly agree*) and summed to create a total score. In the current sample, MEAQ-BA items demonstrated excellent internal consistency at baseline (ω = .90).

Southampton Mindfulness Questionnaire. The Southampton Mindfulness Questionnaire (SMQ; Chadwick et al., 2008) is a 16-item self-report measure that assesses mindful awareness of internal thoughts, emotions, and sensations (e.g., "When I experience distressing thoughts and images, I just try to experience the thoughts or images without judging them") and corresponds to the UP Mindful Emotion Awareness Module (Sauer-Zavala et al., 2017). All items are rated on a seven-point scale from 0 (*strongly disagree*) to 6 (*strongly agree*), yielding a total sum score. In the current sample, SMQ items demonstrated good internal consistency at baseline (ω = .89).

Unified Protocol—Cognitive Skills Questionnaire. The Unified Protocol—Cognitive Skills Questionnaire (UP-CSQ; Sauer-Zavala et al., 2017) is a seven-item self-report questionnaire that assesses cognitive flexibility, or the ability to identify and re-appraise interpretations of emotional situations (e.g., "I evaluated my thinking when I experienced a distressing emotion") and corresponds to the UP Cognitive Flexibility Module (Sauer-Zavala et al., 2017). The items are rated on a five-point scale from 1 (*never*) to 5 (*always or when needed*). In the current sample, UP-CSQ items demonstrated good internal consistency at baseline ($\omega = .86$).

Emotional disorder symptoms. Overall Anxiety Severity and Impairment Scale. The Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al., 2006) is a five-item self-report questionnaire designed to assess severity and impairment due to anxiety over the prior week (e.g., "In the past week, how often did you avoid situations, places, objects, or activities because of anxiety or fear?"). In the current sample, OASIS items demonstrated good internal consistency at baseline ($\omega = .86$).

Overall Depression Severity and Impairment Scale. The Overall Depression Severity and Impairment Scale (ODSIS; Bentley et al., 2014) is a five-item self-report questionnaire designed to assess severity and impairment due to depression over the prior week (e.g., "In the past week, how often did you have difficulty engaging in or being interested in activities you normally enjoy because of depression?"). In the current sample, ODSIS items demonstrated excellent internal consistency at baseline ($\omega = .93$).

Study Procedures

Treatment-seeking adults were recruited from the state of Kentucky. The study was advertised on multiple local Reddit communities and via the Center for Clinical and Translational Science at the University of Kentucky. Phone screens were conducted with 165 interested adults, and 93 individuals were assessed for eligibility during which they were administered a structured clinical interview. Likely eligible participants provided informed consent and completed a baseline diagnostic assessment to confirm eligibility. Two graduate student assessors certified in the Diagnostic Interview for DSM-5 Anxiety, Mood, Obsessive-Compulsive and Related Disorders (Tolin et al., 2018) and masked to participants' randomization conditions conducted all diagnostic assessments. A total of 70 eligible participants ultimately engaged in the study and were randomized to receive core UP modules in either the standard published order ($n = 26$; 37.1%; Barlow et al., 2018) or a personalized order prioritizing modules that capitalized on patients' skill strengths ($n = 23$; 32.9%) or compensated for patients' skill deficits ($n = 21$; 30%). Each UP module, except Countering Emotional Behaviors, was delivered across two 50–60 min weekly sessions. The Countering Emotional Behaviors module was delivered across four sessions. Study therapists (one licensed clinical psychologist, one postdoctoral fellow, and two advanced graduate students) were certified in the UP demonstrated good adherence to the treatment protocol (Sauer-Zavala et al., 2022). Finally, participants were re-randomized between sessions 5 and 6 to either discontinue treatment after session 6 ($n = 35$; 50.0%) or continue treatment until session 12 ($n = 35$; 50.0%). For a more detailed explanation of study procedures, see Sauer-Zavala et al. (2022).

Participants completed measures of aversive reactivity, anxiety, and depression no more than 24 h before each weekly therapy session. The self-report measures were distributed and managed by Research Electronic Data Capture (REDCap) tools hosted at The University of Kentucky. REDCap is a secure, web-based software platform designed to support data capture for research studies. All study procedures were approved by the local university Institutional Review Board.

Data Analytic Method

We first examined descriptive statistics, correlations, and changes over time among demographics, anxiety and depression symptoms, and aspects of aversive reactivity (i.e., negative beliefs about emotions, mindfulness, cognitive flexibility, behavioral avoidance, anxiety sensitivity). To assess whether symptoms and aspects of aversive reactivity changed in the context of the first six sessions, we used hierarchical linear modeling (HLM) with *proc mixed* in SAS Version 9.4. We regressed each variable on session/week number[2] in separate models, entering therapist and sequencing condition as covariates, and including random intercepts and slopes. We focused on the effects of the first six sessions for our primary analyses because (a) only half of participants continued to receive treatment after this point and (b) the majority of change in depression and anxiety has been shown to occur over the first six sessions (Niileksela et al., 2021; Southward & Sauer-Zavala, 2022).

To test our first hypothesis, that within-person changes in each of the five aspects of aversive reactivity would predict session-to-session changes in anxiety and depression, we first disaggregated participants' skill use into between- and within-person variability. Between-person aversive reactivity was determined by (a) calculating each participant's mean score on each measure of aversive reactivity across sessions/weeks 1–7, (b) calculating a grand mean of the sample from all participants, and (c) subtracting the grand mean from each participant's mean for each aspect of aversive reactivity. Within-person aversive reactivity was determined by subtracting each participant's mean score on each measure of aversive reactivity across sessions/weeks 1–7 from their raw aversive reactivity score at a given session for each aspect of aversive reactivity. We then regressed the target symptom (e.g., anxiety) at session *n* on (a) between- and within-person aversive reactivity measured at session *n*, (b) the target symptom at session *n*–1, (c) session number, (d) a sequencing condition indicator variable, and (e) a therapist indicator variable using *proc mixed*.[3] We repeated this process, replacing anxiety with depression, to predict changes in depressive symptoms in separate models. We applied restricted maximum likelihood estimation with random intercepts, an autoregressive lag-1 residual covariance structure, and the Kenward-Roger method to calculate degrees of freedom. Finally, we used the Glimmix_R2 macro (Jaeger et al., 2017) in SAS to estimate R^2 effect sizes for each model. We also examined the reciprocal effects of within-person changes in anxiety and depression symptoms to predict session-to-session changes in each of the five aspects of aversive reactivity. We had 80% power to detect medium-sized between-person effects ($R^2 \geq .10$; Faul et al., 2009) and small-sized within-person effects ($R^2 \geq .01$; Lafit et al., 2021).

To test our second hypothesis, we conducted a multilevel exploratory factor analysis in Mplus Version 7.0 (Muthén & Muthén, 1998-2012) using maximum likelihood estimation with robust standard errors to explore the between- and within-person factor structure of total scores representing each of the five aspects of aversive reactivity targeted by the UP. We evaluated the fit of this model using the chi-squared statistic, root-mean-squared error of approximation (RMSEA), comparative fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root-mean-squared residual (SRMR) estimated at each level of the model. Following Hu and Bentler (1999), the following fit indices indicated excellent model fit: a non-significant chi-squared statistic, RMSEA < .06, CFI and TLI > .95, and SRMR < .08. Models with RMSEA < .10 and CFI and TLI > .90 were interpreted to have acceptable model fit.

Finally, to test our third hypothesis, we fit two random intercept cross-lagged panel models (RI-CLPM; Mulder & Hamaker, 2021) to test the effects of within-person changes in the latent variable of aversive reactivity on anxiety and depressive symptoms using the *lavaan* package Version 0.6-8 (Rosseel, 2012) in R (Version 4.2.1; R Core Team, 2022). We allowed total scores from all five indicators of aversive reactivity to load onto a general aversive reactivity factor at each session to predict total observed scores of anxiety or depression. In line with our HLMs above, we examined the within-person cross-lagged effect of general aversive reactivity at session *n* on anxiety (or depression) at session *n*, controlling for anxiety (or depression) at session *n*–1. We also examined the reciprocal cross-lagged effects of within-person anxiety (or depression) on residualized change in general aversive reactivity.

We used hierarchical linear modeling (HLM) to test our first hypothesis and RI-CLPM in to test our third hypothesis given the specific goals of each hypothesis and to contribute to a more comprehensive understanding of the strengths and limitations of each approach (Falkenström et al., 2022). HLM allows for model specifications that are particularly appropriate to modeling longitudinal effects (e.g., lag-1 autoregressive covariance structures, the inclusion of between- and within-person covariates). HLM also tends to require relatively less data to achieve model convergence than RI-CLPM, especially in the presence of multiple covariates. Further, by applying both HLM and RI-CLPM to these data, these results can function as a second empirical replication of Falkenström et al.'s (2022) results. By testing both lag-1 and contemporaneous effects, we hope to help future researchers specify the timescale at which these theorized processes occur (Fisher & Bosley, 2020; Lazarus & Fisher, 2021), since these are currently unknown.

Results

Changes in Aspects of Aversive Reactivity and Symptoms Across Treatment

Negative beliefs about emotions (BES), $B = -1.32$, $SE = .27$, $p < .01$, 95% CI [−1.87, −.77], $d = .57$; anxiety sensitivity (ASI), $B = -1.53$, $SE = .19$, $p < .01$, 95% CI [−1.90, −1.16], $d = .97$; and behavioral avoidance (MEAQ-BA), $B = -.90$, $SE = .19$, $p < .01$, 95% CI [−1.29, −.51], $d = .55$, significantly decreased across the first seven sessions, whereas

mindfulness (SMQ), $B = 2.18$, $SE = .37$, $p < .01$, 95% CI [1.43, 2.93], $d = -.66$, and cognitive flexibility (UP-CSQ), $B = .65$, $SE = .11$, $p < .01$, 95% CI [.42, .87], $d = -.47$, significantly increased across these sessions. Both anxiety (OASIS), $B = -.30$, $SE = .07$, $p < .01$, 95% CI [−.43, −.17], $d = .53$, and depression (ODSIS), $B = -.42$, $SE = .08$, $p < .01$, 95% CI [−.59, −.26], $d = .65$, significantly decreased across the first seven sessions/weeks (see Table I for means and standard deviations at each session).

Changes in Aspects of Aversive Reactivity Predicting Symptom Change

Within-person improvements in anxiety sensitivity, $B = .08$, $SE = .03$, $p = .02$, 95% CI [.02, .15], $R^2 = .02$; behavioral avoidance, $B = .08$, $SE = .03$, $p = .01$, 95% CI [.02, .15], $R^2 = .03$; mindfulness, $B = -.06$, $SE = .02$, $p < .01$, 95% CI [−.09, −.03], $R^2 = .05$; and cognitive flexibility, $B = -.12$, $SE = .05$, $p = .01$, 95% CI [−.21, −.03], $R^2 = .03$, significantly predicted session-to-session reductions in anxiety (Tables S2–S5). Additionally, within-person improvements in anxiety sensitivity, $B = .08$, $SE = .04$, $p = .03$, 95% CI [< .01, .16], $R^2 = .02$; and mindfulness, $B = -.06$, $SE = .02$, $p < .01$, 95% CI [−.09, −.02], $R^2 = .06$, significantly predicted session-to-session reductions in depression (Tables S7 and S9). Within-person changes in behavioral avoidance, $B = .07$, $SE = .04$, $p = .06$, 95% CI [−.002, .14], $R^2 = .03$; and cognitive flexibility, $B = -.10$, $SE = .05$, $p = .05$, 95% CI [−.20, .001], $R^2 = .03$, did not significantly predict session-to-session changes in depression (Tables S8 and S10). Within-person changes in negative beliefs about emotions did not predict changes in anxiety or depression, $ps > .15$, $R^2 < .01$(Tables S1, and S6).[4]

The results were mixed when examining the reciprocal effects of symptoms on session-to-session changes in aversive reactivity. Within-person improvements in anxiety significantly predicted session-to-session improvements in anxiety sensitivity, $B = .22$, $SE = .10$, $p = .03$, 95% CI [.03, .41], $R^2 = .02$; mindfulness, $B = -.42$, $SE = .18$, $p = .02$, 95% CI [−.77, −.07], $R^2 = .03$; and cognitive flexibility, $B = -.21$, $SE = .07$, $p < .01$, 95% CI [−.35, −.06], $R^2 = .04$; but not negative beliefs about emotions or behavioral avoidance, $ps > .15$, $R^2 < .01$. Within-person improvements in depression significantly predicted session-to-session improvements in behavioral avoidance, $B = .24$, $SE = .10$, $p = .02$, 95% CI [.04, .44], $R^2 = .02$, mindfulness, $B = -.47$, $SE = .17$, $p < .01$, 95% CI [−.81, −.13], $R^2 = .03$, and cognitive flexibility, $B = -.17$, $SE = .07$, $p = .02$, 95% CI [−.31, −.03], $R^2 = .03$; but not negative beliefs about emotions or anxiety sensitivity, $ps > .05$, $R^2 < .01$.[5]

The Structure of Aversive Reactivity

Only the 1-between/1-within factor structure converged and provided acceptable-to-excellent fit to the five aspects of aversive reactivity, $\chi^2(10) = 28.86$, $p < .01$; RMSEA = .062, 90% CI [.036, .088]; CFI = .986; TLI = .971; SRMR between = .076, within = .026. All aspects of aversive reactivity, except between-person UP-CSQ scores, $\lambda = -.16$, $SE = .14$, $p = .26$, demonstrated sizable and significant loadings on factors at both within- ($\lambda s > |.50|$, $ps < .05$) and between-person levels ($\lambda s \geq |.45|$, $ps < .05$; Table II).

Changes in General Aversive Reactivity Predicting Symptom Change

Given the above evidence supporting a general factor of aversive reactivity, we examined the relations between this general factor and session-to-session

Table I. Means and standard deviations of aspects of aversive reactivity and symptoms by session

Measure	Session 1 ($n = 68$) M *(SD)*	Session 2 ($n = 63$) M *(SD)*	Session 3 ($n = 61$) M *(SD)*	Session 4 ($n = 60$) M *(SD)*	Session 5 ($n = 59$) M *(SD)*	Session 6 ($n = 59$) M *(SD)*	Session/Week 7 ($n = 55$) M *(SD)*
OASIS	8.52 (3.53)	8.02 (3.34)	7.93 (3.65)	7.77 (3.40)	7.03 (3.07)	7.08 (3.57)	6.55 (3.54)
ODSIS	7.49 (4.78)	6.63 (4.56)	6.41 (4.66)	6.00 (4.04)	5.85 (4.59)	5.03 (4.51)	4.91 (4.09)
BES	44.22 (11.74)	42.14 (11.92)	40.48 (13.37)	38.80 (12.31)	37.22 (13.29)	36.00 (13.34)	36.36 (14.14)
ASI	25.71 (11.72)	23.13 (10.85)	21.82 (11.41)	19.22 (10.13)	17.20 (9.77)	15.54 (9.63)	16.56 (10.07)
MEAQ-BA	40.56 (11.05)	39.60 (11.52)	39.10 (11.37)	36.77 (12.26)	35.93 (11.36)	35.32 (10.26)	34.76 (10.15)
SMQ	39.63 (14.37)	39.49 (13.90)	40.05 (14.83)	42.45 (13.58)	46.03 (12.79)	49.68 (14.53)	52.78 (15.57)
UP-CSQ	22.65 (5.13)	23.03 (5.10)	23.33 (4.89)	24.72 (5.49)	25.81 (4.43)	26.25 (5.07)	25.51 (4.91)

Note. OASIS = Overall Anxiety Severity and Impairment Scale; ODSIS = Overall Depression Severity and Impairment Scale; BES = Beliefs about Emotions Scale; ASI = Anxiety Sensitivity Index; MEAQ-BA = Multidimensional Experiential Avoidance Questionnaire—Behavioral Avoidance subscale; SMQ = Southampton Mindfulness Questionnaire; UP-CSQ = Unified Protocol—Cognitive Skills Questionnaire.

Table II. Factor loadings of aspects of aversive reactivity

	Factor	
Total Score	Within-Person λ (*SE*)	Between-Person λ (*SE*)
1. BES	.66* (.02)	.45* (.13)
2. ASI	.76* (.02)	.69* (.13)
3. MEAQ-BA	.53* (.03)	.54* (.11)
4. SMQ	−.75* (.02)	−.59* (.11)
5. UP-CSQ	−.52* (.02)	−.16 (.14)

Note. Loadings represent the fully standardized solution.
*$p < .05$

symptom change. After controlling for previous session symptoms, within-person reductions in general aversive reactivity predicted session-to-session decreases in anxiety at all sessions, *B*s = .20–.44, *p*s < .04, except sessions four, $B = .22$, $SE = .13$, $p = .10$, and seven, $B = .17$, $SE = .10$, $p = .08$ (see Figure 1 for a visual example). However, within-person reductions in general aversive reactivity significantly predicted session-to-session decreases in depression across all seven sessions, *B*s = .18–.20, *p*s < .03 (Figure 1).

By contrast, within-person changes in anxiety only significantly predicted changes in latent aversive reactivity at session four, $B = .24$, $SE = .12$, $p = .04$, and not at the remaining sessions, *B*s: −.14–.38, *p*s > .05. Similarly, within-person changes in depressive symptoms only significantly predicted changes in latent aversive reactivity at sessions three, $B = .20$, $SE = .09$, $p = .03$, and five, $B = .29$, $SE = .13$, $p = .02$, and not at the remaining sessions, *B*s: −.11 −.22, *p*s > .10.[6]

Discussion

The primary goals of the present study were to characterize changes in five aspects of aversive reactivity, test the bidirectional relations between these aspects and session-to-session reductions in anxiety and depression symptoms, and evaluate if these five aspects reflected a unitary latent construct. Each of the five aspects of aversive reactivity, in addition to depression and anxiety, improved over six sessions of the UP. Consistent with our first hypothesis, within-person improvements in four aspects of aversive reactivity (i.e., anxiety sensitivity, behavioral avoidance, mindfulness, and cognitive flexibility) predicted session-to-session reductions in anxiety and two (i.e., anxiety sensitivity and mindfulness) predicted session-to-session reductions in depression. When we modeled the five aspects of aversive reactivity as a single latent variable, within-person changes in latent aversive reactivity predicted session-to-session reductions in anxiety and depression, but changes in anxiety and depression did not consistently predict changes in aversive reactivity.

In line with the stated goal of the UP "to approach … emotions in a more accepting manner" (Barlow et al., 2017), the UP led to medium-to-large sized improvements in each of the five indicators of aversive reactivity. In particular, anxiety sensitivity demonstrated the largest standardized change from session 1 to session 7 ($d = .97$), followed by mindfulness ($d = .66$), non-acceptance of emotions ($d = .57$), behavioral avoidance ($d = .55$), and cognitive flexibility ($d = .47$). Together, these findings provide further evidence that the UP engages multiple aspects of its theorized functional mechanisms (Barlow et al., 2017). Further, the degree of change in aspects of aversive reactivity over 6 sessions in the current study was 50–70% as large as that obtained from 12 to 16 sessions of the UP (Sauer-Zavala et al., 2021), suggesting relatively linear improvements in aversive reactivity over the course of treatment.

The functional model of emotional disorders (Barlow et al., 2017) describes a fundamentally within-person process by which decreases in aversive reactions to negative emotional experiences lead to improvements in symptoms of anxiety and depression. We found mixed support for this model, as within-person improvements in four out of five putative aspects of aversive reactivity significantly predicted session-to-session reductions in anxiety. Only within-person improvements in anxiety sensitivity and mindfulness significantly predicted session-to-session reductions in depression over the first seven weeks. Within-person improvements in behavioral avoidance and cognitive flexibility did not significantly predict session-to-session changes in depression; however, the size of these effects were nearly identical to the significant effects of each construct on session-to-session changes in anxiety. Given that there was greater variability in anxiety than depression in this sample, we may have had less power to detect the slightly smaller effects of these constructs on depression than on anxiety.

Furthermore, when considering data from all 12 sessions/weeks, all five constructs significantly predicted session-to-session changes in depression, suggesting that the effects of these processes on depression may increase over time. Interestingly, however, within-person changes in beliefs about emotions did not significantly predict reductions in anxiety and only predicted reductions in depression when considering all 12 weeks. These findings suggest that changes in general beliefs about how

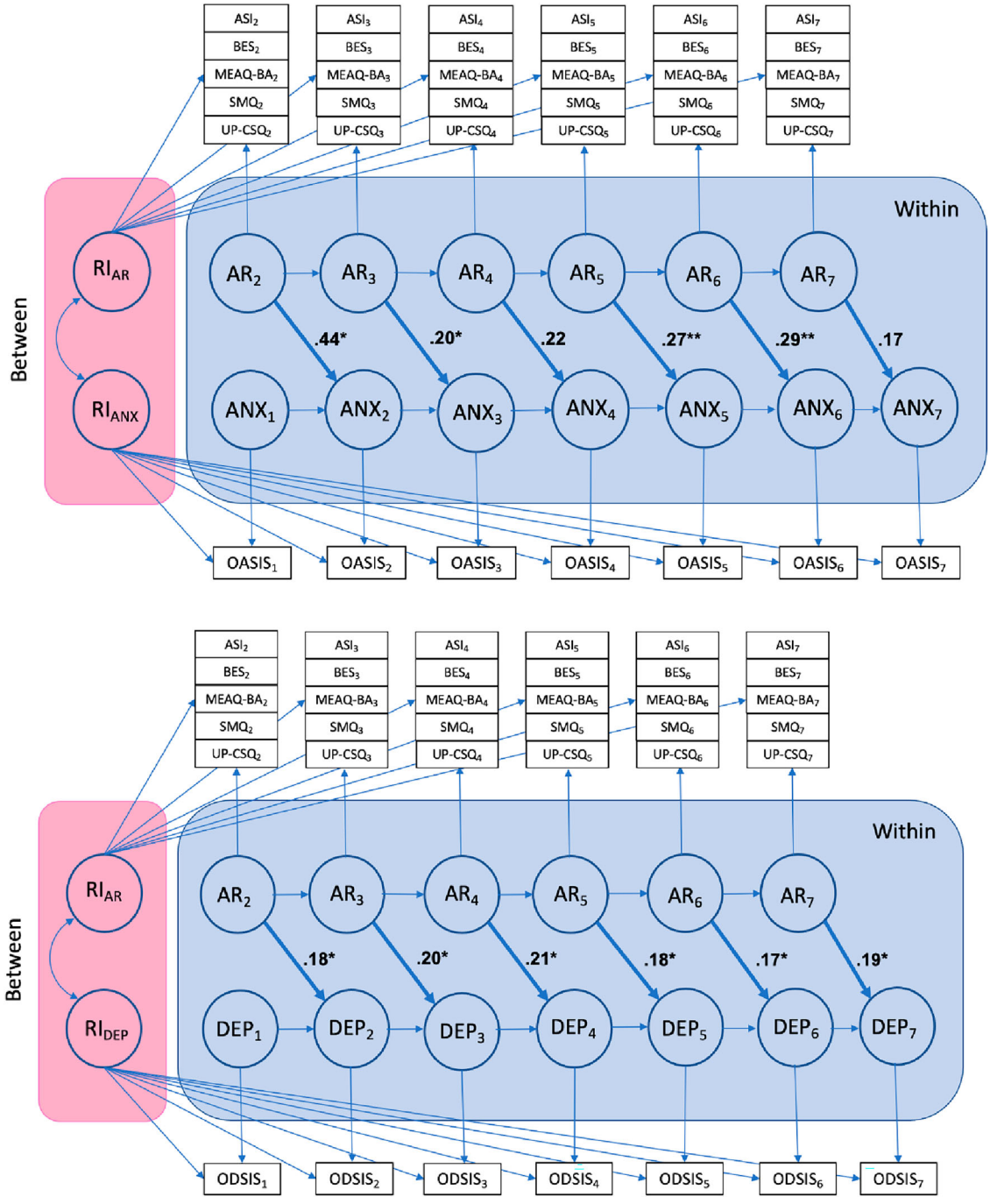

Figure 1. Latent aversive reactivity predicting session-to-session changes in anxiety and depression. Note. RI_{AR} = random intercept of aversive reactivity. RI_{ANX} = random intercept of anxiety. RI_{DEP} = random intercept of depression. AR = latent aversive reactivity, ASI = Anxiety Sensitivity Index, BES = Beliefs about Emotions scale, MEAQ-BA = MEAQ Behavioral Avoidance subscale, SMQ = Southampton Mindfulness Questionnaire, UP-CSQ = UP Cognitive Skills Questionnaire. OASIS = Overall Anxiety Severity and Impairment Scale. ODSIS = Overall Depression Severity and Impairment Scale. Bold values on the diagonal indicate standardized beta weights of latent aversive reactivity predicting anxiety and depression at the same session, controlling for previous session anxiety and depression. $^{*}p < .05$, $^{**}p < .01$

acceptable it is to experience and express emotions may be less relevant to immediate changes in anxiety and depression than other aspects of aversive reactivity; perhaps using skills in line with an approach-oriented stance toward emotions (e.g., facing physical sensations, engaging with the content of one's thoughts rather than pushing them away, avoiding behavioral avoidance) is more important than changing one's overall stance toward emotions (e.g., "it's okay to feel"). In other words,

it is possible that a person may demonstrate changes in their beliefs about emotions, but these changes in beliefs alone may not be sufficient to exhibit associations with symptom change unless they are coupled with active skill use. It may also be more difficult for participants to articulate or notice changes in their beliefs about emotions, compared to changes in their experiential avoidance or anxiety sensitivity, for example. Future researchers may test whether changes in these beliefs exert more delayed associations with symptom changes at follow-up time points.

To determine if these five indicators plausibly represented aspects of a single aversive reactivity construct, we conducted a multilevel exploratory factor analysis. In line with our second hypothesis, this model was a good fit to the data and all five indicators demonstrated significant and substantial loadings on a single latent aversive reactivity factor, with the exception the between-person component of cognitive flexibility. It is possible that cognitive flexibility did not load onto the between-person latent factor due to measurement concerns. For example, the UP-CSQ items tend to refer more to frequency and quality of cognitive flexibility skill use than to a subjective experience of aversive reactivity. Despite that, these findings replicate and extend previous research demonstrating conceptual and empirical overlap among these seemingly disparate aspects of aversive reactivity (Naragon-Gainey & Watson, 2018; Semcho et al., in preparation; Spinhoven et al., 2017). Together, these findings suggest that the five constructs targeted by UP modules generally reflect a similar underlying process. Future research would benefit from the inclusion of additional candidate aversive reactivity processes (e.g., intolerance of uncertainty, distress tolerance) to evaluate the degree to which treatments lead to global or specific changes in the processes they are designed to target. Such research would advance our understanding of the breadth of treatment effects and clarify the conceptual boundaries of putative mechanisms of treatment.

Finally, and in line with our third hypothesis, within-person improvements in the latent aversive reactivity construct predicted session-to-session reductions in anxiety at five out of seven sessions and in depression across all seven sessions, but only when using concurrent predictions and controlling for previous session aversive reactivity. When using lagged modeling, prior session latent aversive reactivity did not predict changes in anxiety or depression symptoms when controlling for prior session anxiety or depression. Our findings suggest that improvements in the core process of aversive reactivity may more reliably and consistently predict session-to-session reductions in anxiety and depression than any single observed aspect of aversive reactivity, providing further evidence to support the functional model of emotional disorders (Barlow et al., 2017). Taken together with the results of the individual aspects of aversive reactivity, these results highlight the utility of assessing multiple indicators of change processes. Whereas testing individual aspects of aversive reactivity can reveal symptom-specific relations, modeling them as a latent construct may reveal more generalizable principles of change. However, it is possible that changes in latent aversive reactivity are more concurrent with symptom change rather than preceding or predictive of symptoms change, given the discrepancy between our contemporaneous and lagged analyses. We encourage future researchers to continue applying multilevel structural equation modeling to a variety of putative mechanisms of treatment to more clearly discern the structure of change in treatment.

Bidirectional Effects

Although the functional model of emotional disorders posits a unidirectional effect of aversive reactivity predicting changes in anxiety and depression, it is also plausible that anxiety and depression exert bidirectional effects on aversive reactivity. We found mixed evidence for this bidirectional effect. Within-person reductions in anxiety significantly predicted session-to-session improvements in anxiety sensitivity, mindfulness, and cognitive flexibility, and within-person reductions in depression predicted session-to-session improvements in behavioral avoidance, mindfulness, and cognitive flexibility. However, when predicting the general aversive reactivity factor, within-person reductions in anxiety only led to significant improvements in this construct at session four, and within-person reductions in depression only led to significant improvements in latent aversive reactivity at sessions three and five. Thus, although there was some evidence that changes in symptoms predicted changes in aversive reactivity, this evidence was relatively less consistent than the evidence that changes in aversive reactivity predicted symptom change. This may highlight the importance of targeting transdiagnostic mechanisms, rather than symptoms, in the context of cognitive–behavioral treatment of anxiety and depression. These results indicate that improvements in aversive reactions to emotions are associated with symptom change, in line with the functional model of emotional disorders, although additional research is needed to clearly establish temporal precedence

and determine if improvement in aversive reactivity predicts symptom change, or vice versa.

Clinical Implications

Although more work is needed to establish whether aversive reactivity is a unique and independent mechanism of change during treatment with the UP, these findings lend support to the notion that engaging this process in treatment is related to symptom improvement. It is possible that therapists could track patients' level of aversive reactivity as an early indicator of treatment response to determine whether patients are "on track" to experience symptom relief (Southward & Sauer-Zavala, 2020). Moreover, given that many patients experience early change in aversive reactivity and symptoms, it is possible as few as six sessions may be needed for some individuals; improvement in aversive reactivity could be used to trigger discontinuation decisions (Sauer-Zavala et al., 2023). Additionally, with replication to more robustly determine whether unique aversive reactivity constructs display differential relations with anxiety and depression, therapists may be able to prioritize UP modules based on presenting concerns. Lastly, future researchers could explore measurement development given that the five separate constructs all demonstrated significant loadings onto a latent factor of aversive reactivity. It is possible that clinicians may be able to utilize one global measure of aversive reactivity when conducting baseline treatment assessments and when using routine outcome monitoring to track patient progress.

Limitations

The findings of this study should be considered in the context of its limitations. First, participants completed measures of symptoms and aversive reactivity at the same time points, limiting our ability to draw strong conclusions of temporal precedence. Although we included prior session measures of both constructs in our models to test residualized change and tested for bidirectional effects, future researchers should compare multiple time-lagged effects to test when changes in each set of constructs occurs. We also encourage future researchers to continue to analyze time-lagged models of latent aversive reactivity and symptom change to draw more firm conclusions about precedence and predictive power. Additionally, the present study did not have a control group, rendering it difficult to draw conclusions about the specificity of aversive reactivity as a mechanism of action in the UP. It is possible that participants may experience reductions and fluctuations in aversive reactivity mechanisms as a function of the passage of time, and not as a result of treatment with the UP. Future research should directly compare the UP to an active control condition to more clearly compare the effect of the UP on the aversive reactivity mechanisms and depression and anxiety symptoms.

We only selected five measures of aversive reactivity from the larger body of potential aversive reactivity constructs (Semcho et al., 2023), although the constructs we selected have been well-researched individually, especially in treatment outcome research and conceptually map on to the skill modules of the UP (Sauer-Zavala et al., 2017). Future researchers may extend these results by including measures of other constructs closely related to aversive reactivity (e.g., intolerance of uncertainty, distress intolerance, negative urgency) to determine the shared variance and unique effects on symptom outcomes. Lastly, we utilized total scale and subscale scores for the purposes of the factor analysis, rather than individual items, given our limited power to model relations among all relevant individual items. We encourage future researchers to use item-level analyses in a larger sample to conduct a more nuanced test of the factor structure of aversive reactivity.

Finally, aspects of our sample may have limited our power to detect significant effects, including the number of participants and the number of assessments collected. Our sample also included more patients endorsing anxiety symptoms and anxiety-related diagnoses than patients endorsing depression symptoms or diagnoses. This disparity in symptom distribution may have influenced our power to detect changes in models of aversive reactivity predicting changes in depression and changes in depression predicting aversive reactivity. Additionally, our sample was predominantly white and female, limiting the generalizability of our results. We encourage future researchers to replicate these results in larger, more diagnostically and demographically diverse samples with more frequent assessments to enhance the power and generalizability of the findings.

Conclusions

Despite these limitations, we found that within-person session-to-session improvements in all but one aspect of aversive reactivity predicted session-to-session reductions in anxiety in early sessions of the UP. Furthermore, the five mechanisms of aversive reactivity loaded onto one latent factor, which predicted session-to-session changes in both anxiety

and depression and were at times predicted by changes in anxiety and depression. These results are in line with the functional model of emotional disorders; however, we encourage future researchers to continue applying novel experimental treatment designs to elucidate the nature, specificity, function, and timing of aversive reactivity in treatment to optimize treatment outcomes for transdiagnostic emotional disorders (Southward & Sauer-Zavala, 2020).

Acknowledgements

The authors would like to thank Patrick Goh and Caitlyn Hood for conducting therapy sessions. The authors would also like to thank Destiney MacLean, Anna Garlock, and Alex Urs for their project assistance throughout the study. The authors received no funding from an external source.

Disclosure Statement

Shannon Sauer-Zavala receives royalties from Oxford University Press in her role as an author of the Unified Protocol. The other authors declare no conflicts of interest.

Notes

[1] Krippendorff's αs ≥ .80 indicate reliable variables; αs between .67 and .80 indicate tentative reliability (Krippendorff, 2004).

[2] Although half of participants were randomized to discontinue treatment after session 6, they continued to complete the same pre-session measures on a weekly basis until week 12. We thus included data from session/week 7 to capture effects of session 6 content for all participants.

[3] We included the non-target symptom as a covariate to better specify the effects of aversive reactivity on the target symptoms. We included session number to account for time in line with Wang and Maxwell's (2015) recommendations. We included the sequencing condition indicator variable, using the standard sequencing condition as the reference category, to account for effects of module sequences. We included a therapist indicator variable to account for therapist effects rather than a random effect of therapists because, with only four therapists, the models with random effects of therapists did not converge.

[4] To test if these results held when including all available sessions, we repeated the above analyses using data from all available sessions from all participants (Tables S11–S20). We found three notable differences: in contrast to results from the first 7 sessions, within-person improvements in negative beliefs about emotions, $B = .04$, $SE = .02$, $p = .04$, 95% CI [.001, .09], $R^2 = .01$; behavioral avoidance, $B = .07$, $SE = .03$, $p < .01$, 95% CI [.02, .12], $R^2 = .03$.; and cognitive flexibility, $B = -.13$, $SE = .04$, $p < .01$, 95% CI [−.20, −.05], $R^2 = .03$, significantly predicted session-to-session reductions in depression. The number of available sessions differs between our analyses of the first 6 sessions and all available sessions, but the total sample size does not, because participants completed all measures at every session.

[5] We repeated the above analyses using data from all available sessions. The results did not substantively change with two exceptions: within-person reductions in anxiety significantly predicted session-to-session reductions in behavioral avoidance, $B = .21$, $SE = .08$, $p = .01$, 95% CI [.05, .37], $R^2 = .07$, but within-person reductions in depression did not significantly predict session-to-session reductions in behavioral avoidance, $B = .13$, $SE = .08$, $p = .09$, 95% CI [−.02, .27], $R^2 = .04$.

[6] Because it was unclear at what lag different constructs exert different effects, we also performed analyses of these data using an RI-CLPM with aversive reactivity at session t–1 predicting anxiety/depression at session t, controlling for anxiety/depression at session t–1. Although in the expected direction, aversive reactivity was not a significant predictor of next-session changes in anxiety, $B = .02$, $p = .62$, or depression, $B = .10$, $p = .13$.

Supplemental data

Supplemental data for this article can be accessed online at https://doi.org/10.1080/10503307.2023.2254467.

ORCID

Stephen A. Semcho http://orcid.org/0000-0001-6831-6763
Matthew W. Southward http://orcid.org/0000-0002-5888-2769
Nicole E. Stumpp http://orcid.org/0000-0001-9871-6469
Martina Fruhbauerova http://orcid.org/0000-0001-6836-3236
Shannon Sauer-zavala http://orcid.org/0000-0002-7322-983X

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