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Does Change in Distress Matter? Mechanisms of Change in Prolonged Exposure for PTSD

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Abstract

Background and Objectives—Clinically, many individuals persist in prolonged exposure therapy (PE) for chronic PTSD despite continuing distress during recounting of the trauma memory (imaginal exposure). Theorists suggest that distress reduction is necessary for successful treatment outcome (e.g., Foa & Kozak, 1986), while others suggest otherwise (e.g., Craske et al., 2008). This study examined clinically reliable changes in distress, relations to broad clinical outcomes, and whether homework adherence affected this relationship.

Method—In 116 patients with PTSD, first to last imaginal exposure sessions' peak and average distress was examined, calculating reliable change in distress. Homework adherence and helpfulness were examined. At post-treatment, PTSD symptoms (re-experiencing, avoidance, hyperarousal), depression, and functioning were examined.

Results—Patients exhibited a lack of reliable change in distress (64.7%) more than a reliable change in distress (35.3%). Although no difference in post-treatment PTSD diagnostic status, individuals experiencing a reliable change in distress reported lower PTSD severity (re-experiencing, hyperarousal), depression, and better functioning. Further, perceived helpfulness of imaginal homework had an indirect effect on this relationship.

Limitations—This study did not utilize a distress tolerance self-report measure; however, examined self-reported distress during imaginal exposure.

Conclusions—Results are encouraging for clinicians treating PTSD with PE, arguing that lack of reliable change in distress to the trauma memory does not result in treatment failure. Patient

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“buy in” to homework, rather than amount completed, was related to the process of distress reduction. Results suggest that distress reduction in imaginal exposure is not a key mechanism underlying therapeutic change in PE.

Keywords

PTSD; Prolonged Exposure; Reliable Change, Distress, Homework; Treatment Outcome

1. Introduction

Recently, there has been considerable debate over the necessity of between-session habituation in individuals undergoing exposure therapy (Baker et al., 2010; Craske et al., 2008). Between-session habituation is often defined as the difference of peak responses to feared stimuli from first to last exposure session. Although there is a strong historical literature suggesting that between-session habituation is an indicator of successful treatment outcome (e.g., Grayson, Foa, & Stekete, 1982; Jaycox, Foa, & Moral, 1998; Kamphius & Telch, 2000; Kozak, Foa, & Stekete, 1988; Rauch, Foa, Furr, & Filip, 2004; Telch et al., 2004; van Minnen & Hageraars, 2002), there is a growing body of research showing successful treatment despite the lack of between-session habituation (e.g., Kozak et al., 1988; Lang & Craske, 2000; Rowe & Craske, 1988b; Tsao & Craske, 2000).

At the center of this debate is emotional processing theory (Foa & Kozak, 1986; Lang 1977, 1979; Rachman, 1980). As defined by Foa and Kozak (1986), emotional processing is the course by which new information is introduced into an existing fear structure in order to change emotional responding. In this theory, there are three indicators identifying that emotional processing has occurred: the fear structure must be activated, (as evidenced by physiological reactivity, behavioral avoidance, or by self-report distress); there is a decrease in fear during exposure sessions, that is, within-session habituation; and finally, there is a decrease in initial reactions to the feared stimuli across sessions, that is, between-session habituation. It should be noted that the term “habituation” is considered by some to be a misnomer and the observed reduction in distress over repeated exposures reflects a learning (extinction) rather than a non-learning (habituation) process. Regardless, the term habituation is used clinically and will be used subsequently throughout this paper. In exposure therapy, studies often show that these indicators result in better treatment outcome. Activation of fear has shown to be positively related to treatment outcome in some studies (e.g., Foa, Riggs, Massie, & Yarczower, 1995; Pitman, Orr, Altman, & Longpre, 1996), as well as within-session habituation (e.g., Borkovec & Sides, 1979; Foa & Kozak, 1986, 1997; Grayson et al., 1982; Kozak, Foa, & Stekete, 1998; Lang, Melamed, & Hart, 1970; Watson & Marks, 1971) and between-session habituation (e.g., Foa, Grayson, & Stekete, 1982; Jaycox et al., 1998; Kamphius & Telch, 2000; Kozak et al., 1998; van Minnen & Hageraars, 2002; Rauch et al., 2004; Telch et al., 2004).

In contrast, a growing body of research shows that fear reduction, either within or between sessions, is not imperative for better treatment outcome (e.g., Kozak et al., 1988; Lang & Craske, 2000; Rowe & Craske, 1988b; Tsao & Craske, 2000). One possible explanation is the concept of distress tolerance (Craske et al., 2008). The toleration of distress may be exhibited as the ability to move in a goal-directed activity while experiencing emotional distress and the ability to withstand experiential discomfort (e.g., Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Daughters et al., 2009). Specifically, this persistence, despite fear, may promote new secondary, inhibitory learning where original conditioned stimulus unconditioned stimulus expectancies have been disconfirmed (Craske et al., 2008). Therefore, regardless of the level of fear reduction during exposure itself, this new secondary learning underlies changes in symptom expression. The question, then, is not

whether fear reduction takes place during exposure or across sessions, but rather is fear reduction *necessary* for positive treatment outcome. Although little is known about the role of toleration of distress in exposure therapy for PTSD, recent studies have shown that lower distress tolerance is associated with higher PTSD symptom severity (Marshall-Berenz, Vujanovic & Zvolensky, 2011; Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011; Vujanovic, Hart, Potter, Berenz, Niles, & Bernstein, 2013).

To date, we are aware of only three studies that have directly examined the role of between-session habituation in exposure therapy for individuals with chronic posttraumatic stress disorder (PTSD). Using cluster analysis, Jaycox et al. (1998) reported that those with a pattern of higher fear activation and gradual habituation had better post-treatment end-state functioning, particularly on lower re-experiencing symptoms, than those who had a pattern of lack of between-session habituation. Similarly, van Minnen and Hageraars (2002) found that greater habituation between early therapy sessions, session 1 to session 2, was associated with better treatment outcome. Additionally, Rauch et al. (2004) found that between-session habituation of peak fear over the course of imaginal exposure predicted greater PTSD symptom reduction beyond the correlation between maximum anxiety during imaginal exposure and post-treatment PTSD symptoms. Thus, there is preliminary evidence for an association between-session habituation and better treatment outcome in exposure therapy for PTSD. To date, however, a majority of these studies have focused on peak distress during imaginal exposure rather than also examining average levels of distress over the entire exposure session. The van Minnen and Hageraars (2002) examined average distress but only at session 1 and session 2. Furthermore, no studies have examined whether or not the change in distress across sessions was reliable or a clinically meaningful change, most have failed to examine clusters of PTSD symptoms, and none have examined broader social, work, and family functioning.

Notably, previous research in this area has also generally failed to look at other confounding factors potentially influencing between-session fear reduction, namely between-session homework adherence. In fact, there is a dearth of studies that have looked at homework and its relationship to treatment outcome in PTSD. Homework adherence reflects the extent to which the client completes exposure tasks outside of treatment sessions (Kazantzis, Deane, & Ronan, 2000) potentially affecting the relationship between between-session habituation and better treatment outcome. An individual with strong homework adherence has had more exposure to the fear memory, possibly affecting how much habituation occurs between sessions and ultimately affecting treatment outcome (Huppert, Roth, Ledley, & Foa, 2006). In a meta-analysis conducted by Kazantzis, Deane, and Ronan (2010), homework adherence was shown to be a significant, yet small, predictor of treatment outcome across anxiety disorders ($r = .22$). Although this displays a consistent association between homework adherence and outcome, very little research has specifically examined the relationship among homework adherence, between-session fear reduction, and treatment outcome in individuals undergoing exposure therapy for PTSD. We are aware of only two studies in individuals with PTSD (Vaughan & Tarrier, 1992; van Minnen et al., 2002). In one, more self-directed exposure (i.e., imaginal exposure homework) was related to greater reduction of anxiety both after and between exposure sessions; however, they did not directly examine the effect of homework on treatment outcome. In the other (van Minnen et al., 2002), a limited measure of homework compliance was not associated with clinical improvement.

In many respects, imaginal exposure in the treatment of chronic PTSD is an excellent test case of the differential role of between-session habituation and the lack of between-session habituation on treatment outcome, as it utilizes a relatively consistent exposure task, imaginal exposure to the trauma memory, over the course of sessions and homework. Specifically, in the present study, we examined reduction of distress over the course of

imaginal exposure, which occurred from session 3 (first imaginal exposure session) to session 10 (last imaginal exposure session). The first and last imaginal exposure session was chosen as the whole trauma memory is recounted during these sessions; whereas in intervening sessions the focus shifts to what are called “hot spots” and the full memory is not usually recounted. Distress reduction was measured by subjective units of distress (SUDs, Wolpe & Lazarus, 1966), which measures self-reported distress levels on a scale from 0 to 100. SUDs ratings were taken approximately every 5 min during the imaginal exposure sessions, over 30 to 45 min exposure sessions. Between-session habituation was operationalized as a reliable reduction (Jacobson & Truax, 1991) in distress (SUDs) from the first to the last imaginal exposure session completed. We examined a change in both peak and mean SUDs ratings, in order to examine both maximum and average distress. Based on exposure therapy for PTSD being an effective treatment for PTSD and between-session habituation being hypothesized as critical mechanism in emotional processing theory, we hypothesized that a reliable change in distress would be more prevalent than not. We further hypothesized that those who had a reliable change in distress would be less likely to meet criteria at post-treatment for PTSD than those who did not. We hypothesized that individuals who exhibited a reliable change in distress would also be more likely to have better treatment outcome as measured by reduction in PTSD severity, PTSD symptom clusters (re-experiencing, avoidance, and hyperarousal), and other trauma-related outcomes (depression, functioning) than those who did not. Finally, we examined whether homework adherence, measured by both frequency and perceived helpfulness, had an indirect effect on the relationship between reliable change in distress from first to last imaginal exposure session and treatment outcome.

2. Method

2.1 Participants

In the present study, participants ($N = 116$) were part of a larger two site, randomized clinical trial who received prolonged exposure (PE). The larger trial examined the role of patient choice and compared PE to sertraline. Participants were adult female (75.9%, $n = 88$) and male (24.1%, $n = 28$) trauma survivors with a primary diagnosis of chronic PTSD. Participants were recruited via advertisements and referrals. To be eligible for the study, participants must have been between the ages of 18 and 65, fluent in English, and have a primary diagnosis of chronic PTSD. Exclusion criteria included primary diagnosis of schizophrenia, other psychotic disorder, bipolar disorder, or current alcohol or drug dependence.

Age ranged from 20 to 62 years old with a mean age of 36.60 years ($SD = 11.30$). Participants were 65.5% Caucasian, 34.5% were of other backgrounds. Sixty-four percent ($n = 74$) did not have a college degree. In terms of index trauma, 30.2% reported a sexual assault, 20.7% nonsexual assault, 19.0% childhood sexual assault, 7.8% childhood nonsexual assault, 13.8% motor vehicle accident/general accident, 2.6% combat or war, and 6.0% unexpected death or injury of a loved one.

2.2 Measures

2.2.1 PTSD Symptom Scale–Interview (PSS–I)—The PSS–I (Foa, Riggs, Dancu, & Rothbaums, 1993) is a clinician administered, 17-item scale that assesses PTSD symptoms. Each symptom is rated on a 0-3 Likert scale based on frequency and severity in the past two weeks. The PSS–I has good convergent validity, test-retest reliability, and inter-rater reliability (Foa, Cashman, Jaycox, & Perry, 1997; Foa & Tolin, 2000). In this study, approximately 10% of the cases were re-rated for diagnostic reliability. Overall, reliability was high with good reliability for overall PTSD severity scores ($ICC = .985$). The PSS–I was

assessed at both pre- and post-treatment, with a minimum two-week separation between the last treatment session and post-treatment interview so that assessment was not confounded by treatment.

2.2.2 Structured Clinical Interview for DSM-IV (SCID-IV)—The SCID-IV (First, Spitzer, Gibbon, & Williams, 1995) is a semi-structured interview that assesses major Axis I disorders and was used to determine initial study eligibility. This measure has high inter-rater reliability (Skre, Onstad, Torgersen, & Kringlen, 1991). In this study, 10% were rated for diagnostic reliability. Reliability was acceptable for major depression ($\kappa = .68$, $p_{pos} = .88$, $p_{neg} = .80$), anxiety disorders ($\kappa = 1.00$, $p_{pos} = 1.00$, $p_{neg} = 1.00$), substance abuse disorders ($p_{pos} = .00$, $p_{neg} = 1.00$), and other diagnoses ($p_{pos} = 0.00$, $p_{neg} = 1.00$).

2.2.3 Beck Depression Inventory (BDI)—The BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) is a 21-item measure that is used to assess severity of depression. Each item is scored on a scale from 0 to 3, from not severe to very severe. The BDI demonstrates good reliability and validity (Beck, Steer, & Garbin, 1988).

2.2.4 Anxiety Sensitivity Index (ASI)—The ASI (Reiss & McNally, 1986) is a self-report measure that contains 16 items that assess sensitivity to anxiety symptoms. Participants indicate on a 5-point Likert-type scale (0 = *very little* to 4 = *very much*) the degree they fear anxiety symptoms. This measure has good test-retest reliability (Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004) and high internal consistency (Reiss et al, 1986).

2.2.5 Sheehan Disability Scale (SDS)—The SDS (Sheehan, 1983) is a self-report measure contains three items assessing functioning: work, social life/leisure activities, and family life/home responsibilities. Participants indicate on a scale (0 = *not at all impaired* to 10 = *very severely impaired*). Total scores were calculated; with lower scores indicate higher levels of functioning.

2.2.6 Utility of Techniques Inventory (UTI)—The UTI (Foa, Hembree, & Dancu, 2002) is a retrospective self-report measure given at the beginning of each session measuring both frequency of completion and perceived helpfulness of homework assignments. To measure frequency of imaginal homework, the question asked was: “How many times did you listen to the imaginal exposure audiotope in the last week?” and for *in vivo* exposure, the question asked was: “How often did you do *in vivo* exposure exercises in the last week?” Frequency was rated on a scale of 0 (*not at all*), 2 (*less than 2 times*), 3 (*2-5 times*), 4 (*6-10 times*), or 5 (*more than 10 times*). Perceived helpfulness of imaginal and *in vivo* exposure was assessed via: “How helpful did you find the following in the last week?” from 1 (*not helpful at all*), 2 (*a little helpful*), 3 (*somewhat helpful*), 4 (*very helpful*), or 5 (*extremely helpful*). Mean scores across sessions were calculated for both frequency and perceived helpfulness.

2.2.7 Subjective Units of Distress (SUDs)—SUDs are self-ratings of distress ranging from 0 (*complete relaxation*) to 100 (*maximum distress*; Wolpe & Lazarus, 1966). Based on the PE protocol, the therapist works with the client to generate anchor examples at 0, 25, 50, 75, and 100 (e.g., 25: riding a roller coaster). These anchors are carefully chosen so as to not change over the course of therapy. SUDs were recorded every 5 min during the imaginal exposure. Peak SUDs, highest reported distress during first (Session 3) and last imaginal exposure session (Session 10), and mean SUDs, average reported distress during first (Session 3) and last imaginal exposure (Session 10), were calculated. SUDs are commonly used in the assessment of distress in reaction to fear-evoking stimuli in the treatment of anxiety disorders (e.g., van den Hout et al., 1987). SUDs ratings correspond well with other

indices of fear expression, including physiological indicators (Griez et al., 1990; Foa, Riggs, Massie, Yarczower, 1995).

2.3 Procedures

2.3.1 Assessment—After informed consent procedures, evaluators blind to eventual treatment condition conducted initial eligibility interviews (PSS-I, SCID-IV). These independent evaluators were trained to an 80% criterion on interview measures prior to conducting interviews and participated in routine reliability checks. Participants were assessed at pre- and post-treatment.

2.3.2 Treatment—Prolonged exposure was conducted based on a treatment manual (Foa, Hembree, & Dancu, 2002). Sessions were 90-120 min, occurring weekly for 10 weeks. Prolonged exposure consisted of psycho-education about common reactions to trauma, breathing retraining, *in vivo* exposure, imaginal exposure (starting at Session 3), processing of imaginal exposure, and assigned homework. Master's and doctoral level clinicians served as therapists. These therapists participated in initial multi-day workshop and received weekly supervision. Trained raters reviewed 10% of videotapes, assessing essential treatment components and protocol violations. For essential components, PE providers completed 90%. No protocol violations were observed. PE sessions were also rated for therapist competence (e.g., engaged in interactive exchange with client) on a 3-point scale (1 = *Inadequate*, 3 = *Adequate or Better*). Overall PE therapist competence was very good ($M = 2.73$, $SD = .32$).

Imaginal exposure to the trauma memory began in Session 3 and continued through Session 10. Participants closed their eyes, visualized the trauma, and recounted the trauma in the present tense aloud for approximately 30-45 min per session. Subjective ratings of distress (SUDs) were taken every 5 min by the therapist during the recounting. Homework was assigned at each treatment session, which consisted of listening to the tape of the imaginal exposure daily and *in vivo* exercises. At the beginning of each session, homework adherence was assessed using the UTI.

Of men and women who completed pre-treatment measures, 21 dropped out of treatment prior to the onset of imaginal exposure and an additional 7 did not complete at least two imaginal exposure sessions, which was necessary for calculating reliable change in distress (SUDs), and therefore were not used for analysis. These individuals ($n = 28$) did not differ from those who completed at least two sessions ($n = 88$) on either key demographic or baseline variables including PTSD severity.

2.4 Calculating Reliable Change in Distress

To calculate whether an individual had experienced a reliable reduction of distress during the course of imaginal exposure, both peak and mean SUDs from the first to the last sessions of imaginal exposure were examined. Peak SUDs was utilized as this is often utilized as a measure of between-session habituation (e.g., Kozak, Foa, & Steeke, 1998) and mean SUDs was utilized to capture general distress over the approximately 30-45 minutes of imaginal exposure. A reliable change index (Jacobson et al., 1991) was used to determine a standardized measure of clinically significant change in SUDs ratings, providing a statistically reliable cut off point between those who showed a reliable reduction in SUDs from the first to last imaginal exposure to those who did not. The last session of imaginal exposure was used to calculate reliable change for individuals who did not complete the full ten sessions of PE. For example, if an individual dropped out after Session 7, Session 3 and Session 7 were used to calculate reliable change.

Reliable change was calculated using the standard error of the difference (Jacobson & Truax, 1991) for SUDs. First, test-retest reliability (r_{xx}) was calculated between sessions three and five, five and seven, and seven and nine for peak and mean SUDs. An average was then calculated using these scores for peak ($r_{xx} = .53$) and mean SUDs ($r_{xx} = .61$). The standard deviation (SD) was calculated for peak ($SD_P = 16.90$) and mean ($SD_M = 18.64$) SUDs. The standard error of the measurement (SE) was computed according to the equation $SE_P = SD_P \sqrt{1 - r_{xx}}$ for peak ($SE_P = 11.54$) and $SE_M = SD_M \sqrt{1 - r_{xx}}$ for mean SUDs ($SE_M = 11.70$). The standard error of the difference (S_{diff}) then captures the spread of the difference of change scores that would be expected if no actual change had occurred (Jacobson & Truax, 1991). Therefore, S_{diff} was calculated using $S_{Pdiff} = 2(SE_P)^2$ for peak ($S_{Pdiff} = 16.32$) and $S_{Mdiff} = 2(SE_M)^2$ for mean SUDs ($S_{Mdiff} = 16.55$). Finally, for each participant, reliable change (RC) was computed following the Jacobson and Truax (1991) reliable change index by subtracting first session peak SUDs (X_1) from the peak SUDs for the last session completed (X_2) and dividing by the standard error of the difference (S_{diff}) (Peak: $RC = (X_2 - X_1) / S_{Pdiff}$; Mean: $RC = (X_2 - X_1) / S_{Mdiff}$). The criterion for RC was greater than 1.96 (Jacobson & Truax, 1991), where less than 5% probability that a change score greater than two standard deviations from the mean occurred by chance.

2.5 Indirect Effects of Homework Adherence

To examine whether homework frequency and perceived helpfulness had an indirect effect on the relationship between reliable change and treatment outcome, simple indirect effects were tested using a macro on SPSS developed by Preacher and Hayes (2007). This macro includes a formal test of the indirect effect (i.e., reliable change on treatment outcome through homework adherence, path ab), which follows the same steps as the series of regression analysis required for causal model of moderation proposed by Baron and Kenny (1986). The difference is that the macro bootstraps the sample distribution for path ab (Preacher & Hayes, 2007). To assess the indirect effect of homework adherence, we utilized a bootstrapping method with $n = 5000$ bootstrap resamples.

3. Results

3.1 Reliable Change in Distress During Imaginal Exposure

To examine those who experienced a reliable change in subjective distress versus those who did not, we calculated reliable change scores in peak and mean SUDs. Of the 88 participants, only 35.3% ($n = 31$) displayed a reliable change in distress for peak SUDs and 28.4% ($n = 25$) for mean SUDs. Lack of reliable change in SUDs was found in 64.7% ($n = 57$) for peak SUDs and 71.2% ($n = 63$) for mean SUDs. Thus, inconsistent with our hypothesis, a lack of reliable change in SUDs was more prevalent than reliable change, peak SUDs: $\chi^2(N = 88, 1) = 7.68, p = .006$; mean SUDs $\chi^2(N = 88, 1) = 16.41, p < .001$.

3.2 PTSD Severity at Post-Treatment

Using a one-way ANOVA, controlling for pre-treatment PTSD severity, we examined the relationship of those who experienced a reliable change in distress versus those who did not on post-treatment PTSD severity (PSS-I). Means and deviations are presented in Table 1. Consistent with our hypothesis, individuals who showed a reliable change in peak and mean SUDs from first to last imaginal exposure session showed lower post-treatment PTSD severity (PSS-I) (peak: $M = 6.91, SE = 1.46$, mean: $M = 6.56, SE = 1.63$) than those who did not (peak: $M = 11.53, SE = 1.13$; mean: $M = 11.21, SE = 1.10$), peak: $F(1, 80) = 6.20, p = .02$, Hedges' $g = 0.55$; mean: $F(1, 80) = 5.70, p = .02$, Hedges' $g = 0.55$).

When examining lack of PTSD diagnostic status at post-treatment, there were no differences between those who showed a reliable change in distress (peak: 93.5%; mean: 92%) and

those who did not (peak: 84.6%; mean: 86.2%), arguing against the hypothesis that those who did not experience a reliable reduction in SUDs did not respond well to treatment.

3.2.1 PTSD symptoms clusters—We next examined PTSD symptom clusters of re-experiencing, hyperarousal, and avoidance at post-treatment for those displaying between-session habituation versus a lack of habituation. Consistent with our hypothesis, again controlling for respective pre-treatment severity, post-treatment re-experiencing (PSS-I) was lower for those who showed a reliable change in distress (peak: $M = 1.39$, $SE = 0.48$; mean: $M = 1.34$, $SE = 0.53$) versus those who did not (peak: $M = 2.84$, $SE = 0.37$; mean: $M = 2.71$, $SE = 0.35$) in the re-experiencing cluster, peak: $F(2, 80) = 5.71$, $p = .02$, Hedges' $g = 0.47$; mean: $F(2, 80) = 4.63$, $p = .04$, Hedges' $g = 0.45$). There was a similar pattern for post-treatment hyperarousal (PSS-I), with lower hyperarousal for those showed a reliable reduction in distress (peak: $M = 2.97$, $SE = 0.51$; mean: $M = 2.71$, $SE = .56$) than those who did not (peak: $M = 4.46$, $SE = 0.39$; mean: $M = 4.42$, $SE = 0.37$), $F(2, 80) = 5.32$, $p = .02$, Hedges' $g = 0.45$; mean: $F(2, 80) = 6.43$, $p = .01$, Hedges' $g = 0.53$). However, the difference did not reach significance for the avoidance cluster (PSS-I; peak: $p = .05$; mean: $p = .08$).

3.3 Depression and Functioning at Post-Treatment

Those who showed a reliable change in distress also had lower depression and social functioning at post-treatment than those who did not. Specifically, at post-treatment, controlling for pre-treatment severity, depression (BDI) for those who showed a reliable change in distress was lower (peak: $M = 5.14$, $SE = 1.36$; mean: $M = 4.89$, $SE = 1.53$) than those who did not (peak: $M = 9.86$, $SE = 1.03$, $F(2, 79) = 7.62$, $p = .007$, Hedges' $g = 0.55$; mean: $M = 9.47$, $SE = 0.98$, $F(2, 79) = 6.31$, $p = .01$, Hedges' $g = 0.53$). Further, functioning (SDS), controlling for pre-treatment functioning, was better in those displaying a reliable change in distress (peak: $M = 6.97$, $SE = 1.15$; mean: $M = 7.03$, $SE = 1.32$) than those who did not (peak: $M = 11.49$, $SE = 0.87$, $F(2, 76) = 9.80$, $p = .002$, Hedges' $g = 0.63$; mean: $M = 10.98$, $SE = 0.84$, $F(2, 76) = 6.41$, $p = .01$, Hedges' $g = 0.54$).

3.4 Predictors of Reliable Change in Distress

Using a logistic regression, we examined whether pre-treatment psychopathology including PTSD symptom severity, depression, functioning, and anxiety sensitivity were predictors of whether individuals would experience reliable change in distress during imaginal exposure or not. Groups were defined as (0 = *lack of reliable change*) and (1 = *reliable change*). Only anxiety sensitivity (ASI) predicted reliable change in distress for both peak and mean SUDs (peak SUDs: $\beta = 1.07$, $p = .002$, $R^2 = .19$; mean SUDs: $\beta = 1.07$, $p = .005$, $R^2 = .15$). Therefore, for every one unit of increase in anxiety sensitivity, a participant's likelihood to be classified as experiencing reliable change increased by a log likelihood of 7%.

Using a similar analysis, we also examined whether pre-treatment demographic factors, including gender, age, education, time since trauma, or history of childhood sexual abuse predicted reliable change. None of these variables predicted reliable change in distress (peak or mean SUDs).

3.5 Indirect Effect of Homework Adherence

We next examined whether there was an indirect effect of homework adherence (perceived helpfulness and frequency on the UTI) on the relationship between reliable change in distress and reported PTSD symptom severity at post-treatment. As seen in Table 2, perceived helpfulness of imaginal homework was positively associated with a reliable reduction of distress for peak SUDs and post-treatment PTSD severity. The indirect effect of

perceived helpfulness was only found to be significant when examining imaginal homework but not for *in vivo* homework.

3.6 Post-hoc Analysis: Role of Fear Activation and Lower Treatment Response

To test the post-hoc hypothesis that those with lower initial distress (SUDs) did not do as well in treatment, we examined the correlation between initial imaginal exposure distress (Peak and Mean SUDs at Session 3) and change in PTSD severity (PSS-I) from pre- to post-treatment. This association was not significant (peak SUDs: $r = .09$, *ns*; mean SUDs: $r = .15$, *ns*).

4. Discussion

Individuals with PTSD undergoing exposure therapy were actually more likely to exhibit a lack of reliable change in their distress during imaginal exposure over the course of treatment. Notably, individuals who showed a lack of reliable change in their subjective distress in response to the trauma memory also improved from pre- to post-treatment and had similar high rates of lack of PTSD diagnosis at post-treatment, at rates consistent with other PTSD treatment studies (e.g., Jaycox et al., 1998; Rauch et al., 2004; Rothbaum, Rief, Litz, Han, & Hodges, 2004; van Minnen & Hagennars, 2002). This argues against theories that purport necessity of between-session habituation as a key therapeutic mechanism (Foa & Kozak, 1986; Rachman, 1980). However, individuals who showed a reliable change in distress during imaginal exposure made larger clinical gains than those who did not. Further, perceived helpfulness of imaginal homework but not *in vivo* homework or actual frequency of homework completion had an indirect effect on the relationship reliable change in peak distress and better outcome.

Notably, individuals who did not show a reliable reduction of distress over sessions of imaginal exposure still showed marked improvement in PTSD symptom severity, depression, and functioning at post-treatment. These findings contribute to the current debate over the necessity of between-session habituation for successful treatment outcome (Baker et al., 2010; Craske et al., 2008). A recent study by Meuret et al. (2012) examined both within- and between-session habituation during *in vivo* exposures for individuals with panic disorder and agoraphobia. Results showed that neither within-session or between-session habituation indicated better outcomes (Meuret, Seidel, Rosenfield, Hofmann, & Rosenfield, 2012). As suggested by the authors, toleration of anxiety might be an important aspect to corrective learning. The presence of clinically meaningful gains despite the observed lack of distress reduction may be consistent with mismatch expectancy theories (e.g., Eifert & Heffner, 2003). Consistent with modern learning models of extinction (e.g., Bouton, 2004), the expectation of an aversive event followed by the absence of its occurrence leads to new inhibitory learning. That is, the ability to tolerate distress provides an experience to learn incompatible information, and suggests that one can handle the feelings of distress in the absence of an expected adverse event. Accordingly, the presence of distress tolerance may help explain the clinically meaningful gains despite the lack of between-session reliable change in distress.

Clinically, these findings should be reassuring in that a lack of distress reduction over the course of in-session imaginal exposure does not necessarily substantially impair recovery. Thus, not seeing a change in self-reported distress over the course of imaginal exposure need not alone raise clinical alarms that a client is not benefiting from treatment. Other clinical indicators such as reduction in PTSD symptoms themselves across individual sessions may be better markers of across session treatment response. That said, we cannot rule out that changes in PTSD symptoms were driving the changes in distress reduction. Lack of reliable change in distress did *not* result in *better* treatment outcome. Individuals who had a reliable

change in distress had lower post-treatment PTSD symptoms, depression, and better general functioning than those who did not. Although this pattern was also observed for PTSD re-experiencing and hyperarousal symptoms, the difference did not approach significance for avoidance symptoms. Consistent with Jaycox, Foa, and Morall (1998) who also showed a similar pattern, it may be that for these individuals, avoidance is directly addressed as they continue to approach the trauma memory despite elevated distress. Future PTSD research should further examine of the link between distress tolerance and reduced avoidance.

As mentioned above, slightly better treatment outcome is consistent with what is observed in the PTSD exposure literature and with the broader exposure literature (Grayson et al., 1982; Jaycox, Foa, & Morall, 1998; Kamphius & Telch, 2000; Kozak et al., 1998; van Minnen & Hageraars, 2002; Rauch et al., 2004; Telch et al., 2004), arguing for the theoretical role of between-session habituation. The present study extends these findings to broader indicators of treatment outcome. This finding is also consistent with the role between-session habituation may serve as an indicator of new inhibitory extinction learning in exposure therapy (Myers & Davis, 2007). Hofmann et al. (2006) suggest that this new inhibitory learning may reflect a change in meaning of the original fear memory, both in term of probability of harm and valence. Notably, those who did not experience reliable change in distress but also showed clinical improvement may also experience a change in meaning of the original fear memory (e.g., Thinking about the trauma is not the same as trauma happening again. I can think about it and not go crazy, etc.). Thus, a change in meaning of the feared memory may underlie the observed clinical improvement in both those that experienced a reliable change in their distress and those who did not.

Remarkably, perceived helpfulness of imaginal homework but not actual homework adherence had an indirect effect on the relationship between distress reduction over the course of treatment and eventual clinical outcome. For individuals who did not experience reliable change in their distress and those who found their imaginal homework to be more helpful had slightly lower PTSD symptom severity post-treatment. Thus, homework may be particularly important for these individuals. Given the focus on perception rather than actual completion, individuals may perceive homework to be an extension of in-session therapy and directly applicable to their eventual recovery. This is consistent with the quantity of homework completion not being as important as underlying beliefs that promote certain health behaviors (e.g., Cameron & Leventhal, 2003; Kanfer & Goldstein, 1991; Kazantzis, Whittington, & Dattilio, 2010). Therefore, clinicians may want to work harder to have participants “buy into” the importance of homework as part of therapy and later clinical improvement (Addis & Carpenter, 1999), particularly for those not displaying a reduction in distress during imaginal exposure. Similarly, clinicians may want to help draw a conceptual link for the client between learning occurring during homework and during therapy.

Finally, only pre-treatment anxiety sensitivity and not other pre-treatment factors (either demographic or psychopathology) predicted reliable change in distress over the course of imaginal exposure. Those who had higher initial anxiety sensitivity were slightly more likely to have a reliable change in distress during imaginal exposure from the first to the last exposure session. Although anxiety sensitivity is often not studied in the PTSD literature, anxiety sensitivity is associated with higher PTSD symptoms (e.g., Berenz, Vujanovic, Coffey & Zvolensky, 2012). The present study argues for an enhanced examination of the role anxiety sensitivity plays in the change process in PTSD and clinical attention to this construct when moving into imaginal exposure.

Several caveats to the study must be noted. First, our cut-off for reliable change may have been too stringent, resulting in the small number of individuals displaying between-session distress reduction. On the other hand, using a cutoff score based on the standard error of the

measure provides a straightforward way of assessing improvement (Jacobson & Truax, 1991). Although we examined a direct behavioral indicator of distress in session, we did not examine SUDs ratings for *in vivo* exposure. Patterns of distress reduction across *in vivo* exposure may differ from imaginal exposure, because patients may generalize what is learned in session to other real world stimuli. However, this behavioral measure is harder to systematically examine due to the greater degree of varying contexts and durations by which it occurs. Lack of observed distress reduction may also be a byproduct of the therapeutic protocol. Across sessions of imaginal exposure, there is consistent shifting of focus toward the most traumatic aspects or “hot spots” of the trauma memory (Foa, Hembree, & Rothbaum, 2007). Thus, between-session distress reduction may have been occurring in subsequent daily imaginal exposure homework practice but was not observed in the next session because the content of the focus of imaginal exposure changed in the next session. However, in this protocol, the first and the last imaginal exposure sessions utilize the same, full trauma memory, mitigating this issue. We also did not examine between-session distress reduction of imaginal exposure homework. This data is confounded by varying adherence to homework, returning of materials, and outside variables (e.g., vacation) that alter homework adherence and reporting. This study did not include a retrospective, self-report measure of the specific construct of distress tolerance. That said, the present study did ask all individuals to repeatedly engage in a potentially distress-provoking task and during the task repeatedly report distress during the task. Future studies need to examine whether lack of distress reduction during imaginal exposure is associated with distress tolerance per se and to explicitly examine distress tolerance as a predictor of treatment outcome in PTSD. Finally, individuals who were excluded from the analysis might provide further understanding as to why some individuals persist in goal directed activity despite heightened distress levels compared to those who dropout of treatment.

The results from this study highlight the need for a theoretical integration that allows for higher order mechanism, such as expectancy, that accounts for both habituation and lack of habituation during exposure therapy. Although individuals who did not experience a reliable change in their distress over the course of imaginal exposure showed clinical improvement, it did not result in better treatment outcome than those who did. Nevertheless, given the small number of individuals showing reliable change in fear, the present study raises further questions regarding the critical role of between-session habituation during imaginal exposure for the treatment of chronic PTSD.

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Highlights

- Examined fear reduction in those with PTSD
- Individuals received up to 10-sessions of prolonged exposure
- More individuals experienced a lack of fear reduction rather than fear reduction
- However, individuals with fear reduction showed lower post-treatment PTSD than those who did not
- Perceived helpfulness of homework had an indirect effect on better outcome

Table 1

Means and Standard Deviations for Peak and Mean Subjective Units of Distress (SUDs)

	Peak SUDs				Mean SUDs			
	No Reliable Change Distress (<i>n</i> = 57)		Reliable Change Distress (<i>n</i> = 31)		No Reliable Change Distress (<i>n</i> = 63)		Reliable Change in Distress (<i>n</i> = 25)	
	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)
Baseline SUDs Mean	61.08	(19.93)	70.35	(2.89)	60.21	(19.79)	74.77	(12.16)
Last SUDs Mean	54.30	(18.75)	25.14	(14.79)	52.70	(19.42)	22.19	(11.69)
Baseline SUDs Peak	77.72	(17.94)	89.45	(2.18)	77.79	(18.15)	91.40	(8.29)
Last SUDs Peak	67.81	(19.93)	32.10	(16.83)	65.00	(21.83)	30.60	(15.31)
Pre-Tx PTSD (PSS-I)	28.95	(6.67)	30.77	(5.93)	29.38	(6.62)	30.12	(6.04)
Post-Tx PTSD (PSS-I)	11.38	(8.95)	7.16	(6.75)	11.17	(8.69)	6.64	(6.89)
Pre-Tx Depression (BDI)	24.30	(10.51)	29.15	(9.64)	23.46	(9.78)	25.45	(6.57)
Post-Tx Depression (BDI)	9.71	(8.66)	5.41	(5.10)	9.71	(8.66)	5.19	(4.60)
Pre-Tx Sheehan (SDS)	17.77	(6.74)	17.56	(6.96)	17.48	(7.10)	18.04	(5.89)
Post-Tx Sheehan (SDS)	11.48	(7.34)	7.00	(5.71)	10.93	(7.36)	7.17	(5.69)

Notes. PTSD Symptom Scale-Interview (PSS-I); Beck Depression Inventory (BDI); Subjective Units of Distress (SUDs); Sheehan Disability Scale (SDS).

Table 2

Bootstrap Indirect Effects of Homework Adherence on PTSD Symptom Severity

	<i>Indirect Effect</i>	<i>SE</i>	Lower 95% CI	Upper 95% CI
Peak SUDs				
Imaginal Homework - Perceived Helpfulness	-1.09	0.75	-30.06	-0.05
Imaginal Homework - Frequency Completed	-0.52	0.59	-10.81	0.53
Peak SUDs				
<i>In vivo</i> Homework - Perceived Helpfulness	-0.99	0.76	-20.93	0.09
<i>In vivo</i> Homework - Frequency Completed	-0.06	0.29	-0.76	0.49
Mean SUDs				
Imaginal Homework - Perceived Helpfulness	-1.12	0.79	-30.20	0.00
Imaginal Homework - Frequency Completed	-0.31	0.49	-10.69	0.36
Mean SUDs				
<i>In vivo</i> Homework - Perceived Helpfulness	-1.03	0.80	-30.07	0.09
<i>In vivo</i> Homework - Frequency Completed	-0.02	0.24	-0.47	0.59

Note. Bootstrapping sample size = 5000 standardized coefficient. LL = lower limit; UL = upper limit; CI = confidence intervals.