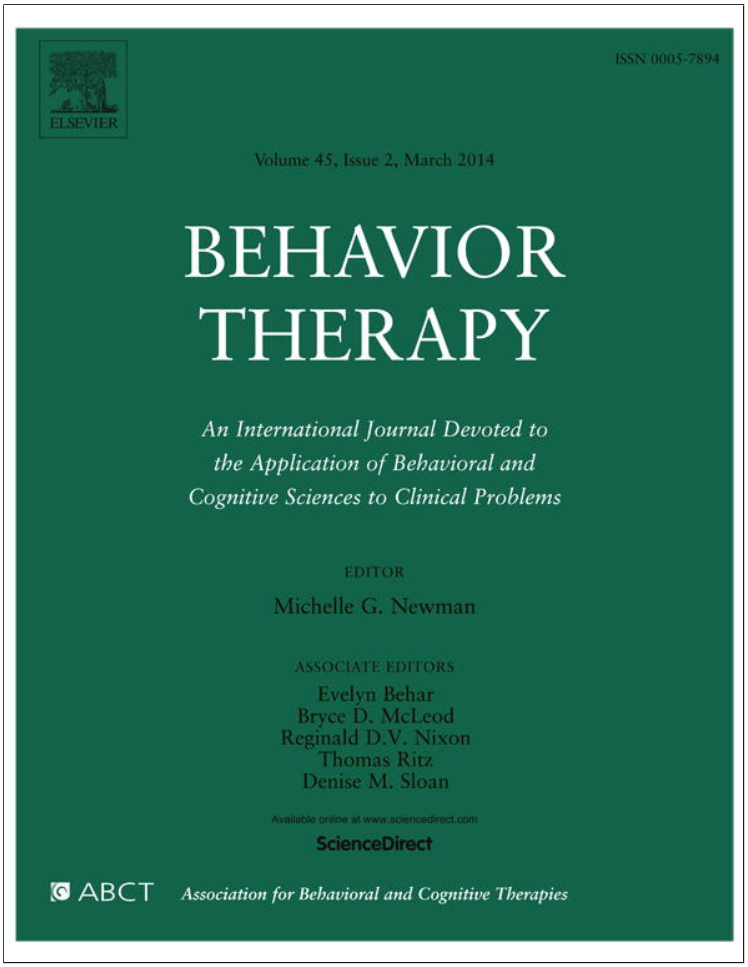

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Changes in Distress Intolerance and Treatment Outcome in a Partial Hospital Setting

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Despite the well-established role of distress intolerance (DI) in a wide range of psychological disorders, few studies have examined whether DI improves during treatment and whether these changes are associated with symptom outcomes. Patients (N = 626) enrolled in a brief cognitive-behavioral partial hospital program completed pre- and posttreatment measures of DI. Results indicated that DI decreased significantly during treatment, with more than 30% of the sample exhibiting a reduction of more than 2 standard deviations from the sample mean. Women reported higher DI than men at baseline; however, there were no gender differences in changes in DI over time. Participants also completed a pre- and posttreatment measure of depression and a subset completed a measure of anxiety (n = 167). DI was associated with more severe depression and anxiety at pre- and posttreatment, with participants who reported a decrease in DI also reporting lower depression and anxiety symptoms at post-treatment. These results further highlight the transdiagnostic relevance of DI and suggest that DI may be a relevant factor in treatment outcome for depression and anxiety.

Keywords: distress intolerance; treatment outcome; depression; anxiety; cognitive behavioral therapy

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Distress intolerance (DI) is defined as the perceived inability to manage negative emotional and somatic states and reflects a trait-like interpretation of and behavioral response to these states. Empirically, DI has been distinguished from distress (Bradley et al., 2011; Leyro, Bernstein, Vujanovic, McLeish, & Zvolensky, 2011; Simons & Gaher, 2005) and has been shown to be distinct from, yet related to, the broader construct of emotion regulation (McHugh, Reynolds, Leyro, & Otto, 2013; Vujanovic, Marshall-Berenz, & Zvolensky, 2011). Elevated DI (reflected either by elevations relative to healthy comparison samples or higher DI at greater symptom severity levels) has been shown in a broad range of psychological disorders, such as anxiety disorders (e.g., Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010; Schmidt, Richey, & Fitzpatrick, 2006), substance dependence (e.g., McHugh & Otto, 2012a), eating disorders (e.g., Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007), and personality disorders (e.g., Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Sargeant, Daughters, Curtin, Schuster, & Lejuez, 2011), among others (for review, see Leyro, Zvolensky, & Bernstein, 2010).

DI is hypothesized to be a risk factor for the development and maintenance of psychological disorders by interfering with goal-driven behavior in the context of distress. Consistent with this perspective, DI is linked to a number of outcomes involving a failure to persist toward goals in the context of negative emotional or somatic states, such as early lapse following a quit attempt in substance

use disorders (e.g., Brandon et al., 2003; Brown, Lejuez, Kahler, & Strong, 2002; Daughters, Lejuez, Kahler, Strong, & Brown, 2005; Hajek, 1991). In particular, DI has been associated with maladaptive avoidance-based behaviors that provide strong, proximal reduction of distress (e.g., self-harm, substance use), but are associated with a range of deleterious behavioral and mental health outcomes (e.g., Anestis, Selby, Fink, & Joiner, 2007; MacPherson et al., 2010; Nock & Mendes, 2008).

Although much of the research on DI has focused on substance use disorders, recent research has highlighted the relevance of this risk factor in depression and anxiety (e.g., Cummings et al., 2013; Daughters et al., 2009). DI is associated with greater severity of symptoms of internalizing disorders, such as posttraumatic stress disorder (Marshall-Berenz et al., 2010; Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011), social phobia (Macatee & Cougle, 2013), panic disorder (Marshall et al., 2008; Schmidt et al., 2006), and depression (Magidson et al., 2013). Moreover, cognitive avoidance strategies that are characteristic of depression and anxiety, such as worry and obsessions, are associated with DI (e.g., Keough, Riccardi, Timpano, Mitchell, & Schmidt, 2010), particularly in the context of stress (Macatee, Capron, Schmidt, & Cougle, 2013). Elevated DI also may increase the risk of substance use among those with depressive symptoms (Buckner, Keough, & Schmidt, 2007), consistent with the literature linking coping motives for substance use with elevated DI (Bujarski, Norberg, & Copeland, 2012; Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010; Zvolensky et al., 2009).

In addition to these links to the severity of psychological symptoms and the presence of disorders, DI has been shown to predict treatment outcome. Prospective studies have found that DI is associated with poor treatment outcomes for smoking cessation (Brown et al., 2009), drug dependence (Daughters, Lejuez, Kahler, et al., 2005), and depression (Williams, Thompson, & Andrews, 2013). In addition, DI has been shown to predict pretreatment attrition (MacPherson, Stipelman, Duplinsky, Brown & Lejuez, 2008) and treatment dropout (Daughters, Lejuez, Bornovalova, et al., 2005) in treatment for substance use disorders; however, DI was not associated with dropout in a recent study of depression (Williams et al., 2013).

Given its pervasiveness across psychological disorders, its relationship to symptom severity, and its prospective association with treatment outcome, DI may be an important target for treatment (Brown et al., 2008; Linehan, 1993; Otto et al., 2010). Although DI is relatively stable and traitlike (e.g., Cummings et al., 2013), it is also hypothesized to be modifiable with intervention. Indeed, treatments targeting DI have been associated with positive outcomes for substance use disorders (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012; Brown et al., 2013). Reduction of DI in treatment may both (a) enhance behavioral and functional outcomes by improving the ability to persist toward goals in the context of distress, and (b) reduce maladaptive avoidance behaviors motivated by DI. For example, treatments for substance use disorders have targeted the reduction of DI to enhance the ability to tolerate the discomfort of acute and protracted withdrawal in early abstinence (Brown et al., 2008). However, much of the treatment research in this area to date has focused on studies examining the impact of baseline DI on outcomes, with very few studies examining changes in DI over the course of treatment.

Studies of treatments that explicitly target DI have not consistently reported changes in DI over the course of treatment. A recent study found that a DI-targeted treatment for smoking cessation impacted hypothesized mediators (e.g., experiential avoidance), providing some support that the treatment successfully reduced DI (Brown et al., 2013). In addition, a pilot study of a DI treatment for substance use disorders found significant reductions in behavioral measures of DI over time (Bornovalova et al., 2012). Although these treatments explicitly target the reduction of DI, it is unclear whether cognitive-behavioral therapies that aim to change the ways in which individuals respond to their distress may also lead to changes in DI. For example, exposure-based therapies emphasize approach-oriented responding to distressing states (i.e., approaching a feared situation and persisting in that situation despite anxiety) and thus may reduce DI. One study of cognitive-behavioral therapy (CBT) for smoking cessation found no significant changes in DI from pre- to posttreatment (Kapson, Leddy, & Haaga, 2012); however, a recent study of a computerized CBT intervention for depression reported a significant, but modest, improvement in DI over the course of treatment (Williams et al., 2013). Thus, the literature to date is mixed with respect to whether standard or DI-targeted treatments are associated with reductions in DI.

The overarching aim of this study was to examine changes in DI during treatment in a diagnostically heterogeneous clinical sample enrolled in a brief partial hospitalization treatment program. Understanding the impact of treatment on DI is particularly important in such samples because DI may serve as a useful common target for treatment in service provision settings with populations characterized by diagnostic heterogeneity or co-occurring disorders. This study builds upon recent studies examining change in

DI in treatment and is novel in its examination of a large and complex sample representing common presentations of psychological disorders. In addition, this study extends previous research by examining changes in DI in a naturalistic setting, recruiting a sample at a partial hospitalization level of care, and examining both depression and anxiety symptom outcomes. Our specific aims included the following: (a) to examine changes in DI over the course of treatment, and (b) to examine whether DI was associated with depression and anxiety symptom outcomes. We hypothesized that DI would decrease over the course of treatment and that reductions in DI would be associated with better depression and anxiety outcomes.

Method

PARTICIPANTS

Participants were 656 patients admitted for treatment at McLean Hospital's Behavioral Health Partial Program (BHPP) from February 2012 to March 2013, who consented for their data to be used for research purposes. Participant age ranged from 18 to 71 years, with an average of 34 years (*SD* = 14). The sample was 57% female, and mostly Caucasian (91%), followed by 5% Asian, 4% Latino/a, 4% Multiracial, <1% American Indian or Alaskan Native, and <1% Native Hawaiian or Pacific Islander; the remaining participants chose not to report race/ethnicity (1%). In terms of marital status, 61% had never been married, 25% were currently married, 9% were separated or divorced, 1–2% each were widowed or living with a partner, and 3% declined to respond. Most participants (38%) had some college education, 24% completed an undergraduate education, and 30% had postgraduate education (3% declined to report educational background).

The majority of the sample (88.0%; *n* = 577) completed a clinician-administered semistructured diagnostic interview (see below). Diagnostic comorbidity was high, and current diagnoses at the time of assessment were as follows: major depressive episode (54.1%, *n* = 312), manic episode (1.9%, *n* = 11), hypomanic episode (<1%, *n* = 5), generalized anxiety disorder (35.7%, *n* = 204), social anxiety disorder (20.6%, *n* = 119), panic disorder (12.1%, *n* = 70), obsessive-compulsive disorder (9.5%, *n* = 55), posttraumatic stress disorder (11.3%, *n* = 65), alcohol dependence (11.8%, *n* = 68), alcohol abuse (8.6%, *n* = 47), anorexia nervosa (<1%, *n* = 1), and bulimia nervosa (4%, *n* = 23). A small percentage of participants were currently experiencing psychotic symptoms: 2.8% (*n* = 16) met criteria for mood disorder with psychotic features, and 6.3% (*n* = 36) met criteria for a psychotic disorder. Participants currently met criteria for an average of 1.8 (*SD* = 1.4; range = 0–8) diagnoses, with 63.6% of participants meeting criteria for more than one diagnosis (27.4% for 2, 15.6% for 3, 10.6% for 4 or more).

TREATMENT

The BHPP is a partial hospital program offering individual and group CBT and pharmacological treatment to patients presenting with symptoms from a range of psychological diagnoses. The program focuses on the acquisition of cognitive-behavioral skills, using a flexible approach to treatment informed by CBT principles and current evidence, adapted for a partial hospital setting (Neuhaus, 2006). The treatment consists of group CBT provided by BHPP staff including psychiatrists, psychologists, social workers, occupational therapists, postdoctoral- and predoctoral-level psychology trainees, and mental health counselors. Patients attend five 50-minute CBT skill-focused groups each day, 5 days per week (Monday–Friday). Of these, one group per day focuses on behavioral activation, based on a protocol adapted from Martell et al. (Martell, Dimidjian, & Herman-Dunn, 2010). A second daily group is focused on identifying and challenging negative automatic thoughts and is guided by a protocol adapted from Beck et al. (Beck, Rush, Shaw, & Emery, 1979). The remaining group content includes modules on psychoeduction, self-assessment, communication skills, stress management, and mindfulness protocols adapted from CBT manuals (e.g., Beck, Emery, & Greenberg, 1985; Segal, Teasdale, & Williams, 2002). In addition to group therapy, patients also receive two to three weekly individual CBT sessions from graduate-level psychologists to review material learned in groups. Treatment fidelity is emphasized through a focus on adherence to treatment protocols designed for the program. Postdoctoral fellows and staff psychologists periodically observe groups to evaluate adherence to the protocol and to provide feedback to maximize adherence. The CBT skills highlighted in the BHPP emphasize the importance of tolerating negative emotions and addressing negative cognitions, without engaging in problematic mood-dependent behaviors. Thus, addressing and modifying distress intolerance is an explicit goal of the treatment offered at the BHPP. The average length of treatment at the BHPP is 8.2 (*SD* = 3.2) days.

MEASURES

Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998)

The MINI is a structured diagnostic interview assessing for *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; American Psychiatric

Association, 1994) Axis I disorders. The MINI has strong reliability and validity with the Structured Clinical Interview for *DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996), and interrater reliabilities range from kappas of .89–1.0 (Sheehan et al., 1998). For the partial hospital patients, interrater reliability between the MINI and the program psychiatrists is .69 for major depressive disorder and .75 for bipolar disorder–depressed (Kertz, Bigda-Peyton, Rosmarin, & Björgvinsson, 2012).

The MINI was administered by predoctoral practicum students and interns in clinical psychology who received weekly supervision by a postdoctoral psychology fellow. Training included reviewing administration manuals and completing mock interviews. All clinicians were required to pass a final training interview with their supervisor before administering MINIs for the program.

Distress Intolerance Index (DII; McHugh & Otto, 2012b)

The DII is a 10-item self-report measure designed to assess the inability to tolerate negative states. Items are rated from 0 (*very little*) to 4 (*very much*) and are summed for a total score, with higher scores indicating greater DI. Items for the DII were derived from an analysis of commonly used self-report measures of DI including the Frustration Discomfort Scale (Harrington, 2005), the Distress Tolerance Scale (Simons & Gaher, 2005), and the Anxiety Sensitivity Index (Peterson & Reiss, 1992). This measure is intended to capture the strongest items from among these scales in order to best characterize the core construct of DI, while also minimizing participant burden. Although research has suggested that anxiety sensitivity (discomfort or fear of symptoms and sensations associated with anxiety) is distinct from DI (Bernstein, Zvolensky, Vujanovic, & Moos, 2009), others have found that anxiety sensitivity and DI share a common latent factor (McHugh & Otto, 2011), or that anxiety sensitivity is a lower-order facet of DI (Mitchell, Riccardi, Keough, Timpano, & Schmidt, 2013), suggesting that these constructs share substantial overlap. The DII has demonstrated strong internal consistency, reliability, and convergent and discriminant validity, and is correlated with behavioral measures of DI (McHugh & Otto, 2011, 2012b). Internal consistency was excellent in the current sample (α = .93).

Center for the Epidemiological Studies of Depression-10 (CES-D-10; Andresen, Malmgren, Carter, & Patrick, 1994)

The CES-D-10 is a widely used, brief instrument for assessing depressive symptoms. Response anchors range from 0 (*rarely or none of the time* [*less than 1 day*]) to 3 (*most or all of the time* [*5-7 days*]). The CES-D-10 has strong predictive and discriminant validity and adequate retest reliability (Andresen et al., 1994) and had high internal consistency in this study (α = .86).

Spielberger State Trait Anxiety Inventory–Brief (STAI-B; Marteau & Bekker, 1992)

The STAI-B is an 8-item anxiety scale derived from the original 20-item measure (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) to reduce administration burden. Participants rate items on a 1 (*not at all*) to 4 (*very much so*) scale. The measure has good internal reliability and its correlation with the full 20-item STAI is high (r = 0.95; Marteau & Bekker, 1992). Reliability in the current study was very high (α = 91). STAI-B data are available for the first 167 participants in the study; however, cannot be reported for remaining participants as it was removed from the questionnaire battery at that time.

PROCEDURE

Approval for the study was granted by the McLean Hospital Institutional Review Board, and all participants included in this analysis provided informed consent. Data were collected on site at the BHPP. At admission, patients completed the MINI, a demographics survey, and a battery of self-report measures described above; the battery of self-report measures was also completed at discharge. Study personnel provided instructions indicating the participant's freedom to withdraw from the research study at any point or decline to respond to any items.

STATISTICAL ANALYSIS

All variables of interest were screened for deviations from normality and univariate outliers. For participants who skipped or missed one question on the DI measure, mean substitution was used to allow for their inclusion in the analysis; participants missing more than one value were excluded from analyses. Preliminary analyses examined associations between DI and sociodemographic variables using bivariate correlations and univariate analyses of variance (ANOVAs). Those who did and did not complete the DII at both time points were compared to identify any differences in sociodemographic or clinical variables that may have confounded results of subsequent analyses. Specifically, we conducted a logistic regression comparing individuals who completed the Time 2 assessments versus those who did not on age, gender, race, education, marital status, and Time 1 depression (CES-D-10), anxiety (STAI-B), and DI.

For all outcome analyses, only participants who completed assessments at both time points were

included. We examined changes in DI from pre- to posttreatment using a repeated-measures analysis of variance (ANOVA). Given previous findings of gender differences in DI (Hearon et al., 2011; Zvolensky, Eifert, & Lejuez, 2001), we also examined whether gender was a moderator of this effect. Next, we examined the association between DI and changes in depression and anxiety during treatment using linear mixed effects models. Separate models were estimated with depression and anxiety as the dependent variables examining main effects of baseline levels of the dependent variable, time, and DI (entered as a time-varying predictor), controlling for gender. Mixed models appropriately accounted for the correlation among the repeated measures of the dependent variable by including random subject effects. Of note, depression outcomes are available for the full sample and anxiety outcomes are only available for part of the sample (n = 167) because the anxiety measure was removed from the assessment battery in the program prior to completion of this study.

Results

PRELIMINARY ANALYSES

The number of patients who completed the DII was 626 at Time 1 and 469 at Time 2. At Time 1, 23 participants did not complete the measure due to either technical (i.e., computer failure) or administration errors and 6 participants left more than one item missing. At Time 2, 188 participants (28%) did not complete the measure. Participants did not complete the Time 2 measure for the following reasons: skipped more than one item (n = 3), transferred to a higher (i.e., inpatient) level of care (n = 38), completed discharge but did not complete the DII due to a system or administration error (n = 28), and did not complete formal discharge (n = 157). The mean DII score at Time 1 was 22.5 (SD = 10.0, range 0–40) and at Time 2 was 18.6 (SD = 9.8, range 0–40). DI at baseline was not associated with age (r = -.04, p = .37), education ($F[5, 616] = 1.08$, p = .37, partial η^2 = .01), or race ($F[6, 612] = 1.25$, p = .28, partial η^2 = .01). Women reported significantly higher DI at pretreatment (mean difference = 2.60, t = 3.25, p < .01, d = 0.26).

Given that approximately 28% of the sample did not complete the assessment at Time 2 due to a variety of factors, it is possible that the primary analyses reflect important demographic or symptom-level differences at baseline rather than actual improvement in symptoms over time. With regard to demographic and symptom variables, including all variables included in main analyses, there were no significant differences between the groups (completers versus noncompleters, p's range from .09–.82). Thus, it is reasonable to believe that the completers did not differ from those who did not complete measures at both time points with respect to these baseline variables that may be associated with outcomes (e.g., symptom severity).

DI AND TREATMENT RESPONSE

In the examination of changes in DI there was a main effect of time, F (1, 458) = 94.27, p < .001, partial η^2 = .17, but no gender-by-time interaction, F (1, 458) = 0.81, p = .37, partial η^2 = .00. The average change (posttreatment subtracted from pretreatment) in DI was 4.1 (SD = 8.8), with 65% (n = 299) of the sample reporting a reduction in DI, 4.8% (n = 22) reporting no change, and 30.2% (n = 139) reporting an increase.

Using the definition of clinically significant change as a reduction of two or more standard deviations from the pretreatment mean (Jacobson & Truax, 1991), 30.9% of the sample exhibited a clinically significant reduction in DI. A small percentage of the sample (4.3%) exhibited very large improvements (a decrease of 20 or more points), 27% reported improvement of 10 or more points, and 42.8% reported a decrease of 5 or more points. Nearly half (45.4%) of the sample experienced a reduction of DI by at least 20% during treatment.

Results from the mixed effects model examining depressive symptoms indicated significant main effects of time, baseline depression, and DI on changes in depression, such that depression decreased over time and higher DI was associated with more depressive symptoms (Table 1). Results from the mixed model with anxiety as the dependent variable similarly found significant main effects of time and DI on anxiety, characterized by a reduction in anxiety over time and higher anxiety for those with elevated DI. See Table 2.

Table 1
Linear Mixed Model Examining Change in Depression Symptoms (N = 469)

Variable	Estimate	SE	t	p	95% CI	
					Lower Bound	Upper Bound
Intercept	5.76	0.53	10.83	<.001	4.71	6.81
Gender	0.11	0.27	0.41	.680	−0.43	0.65
Time	−5.81	0.26	−22.62	<.001	−6.31	−5.30
Baseline CESD	0.93	0.02	43.24	<.001	0.89	0.97
DII	0.05	0.01	3.83	<.001	0.03	0.08

Note. CESD = Center for Epidemiological Studies of Depression; DII = Distress Intolerance Index. DII was included in the model as a time-varying predictor.

Table 2
Linear Mixed Model Examining Change in Anxiety Symptoms (N = 167)

Parameter	Estimate	*SE*	*t*	*p*	95% CI	
					Lower	Upper
Intercept	3.86	0.65	5.91	<.001	2.57	5.16
Gender	0.12	0.29	0.69	0.69	−.460	0.69
Time	−3.50	0.28	−2.32	<.001	−4.06	−2.94
Baseline STAI	0.91	0.03	34.47	<.00	0.86	0.96
DII	0.07	0.01	4.47	<.001	0.04	0.09

Note. STAI = State Trait Anxiety Inventory; DII = Distress Intolerance Index. DII was included in the model as a time-varying predictor.

Those who exhibited clinically significant change (more than a two standard deviation reduction) in DI also reported significantly less depression, $t(447) = 4.39$, $p < .001$, $d = 0.46$, and anxiety, $t(166) = 3.97$, $p < .001$, $d = 0.69$, at Time 2.

Discussion

DI has been implicated in the development and maintenance of a wide range of psychological disorders and negative behavioral health outcomes (Leyro et al., 2010), making it a common target of treatment; however, few studies have examined changes in this vulnerability factor in treatment. In this study, patients who completed a brief partial hospitalization program reported statistically significant reductions in DI on average. These effects were in the moderate range and indicated clinically significant change in over 30% of the sample. Previous studies examining changes in DI with treatment have found reductions in treatment for depression (Williams et al., 2013) and a DI-specific treatment for substance use disorders (Bornovalova et al., 2012), but not in a study of smoking cessation (Kapson et al., 2012). Thus, it is possible that the degree of change in DI may be dependent on the treatment administered or the population. In this diagnostically heterogeneous and complex sample, it is promising to see reductions in DI given its potential linkage to symptoms across disorders. This is the first study—to our knowledge—to demonstrate reductions in DI in a brief treatment program and with this population.

Moreover, higher DI was associated with more severe depression and anxiety throughout treatment. Thus, those who exhibited improvement in DI over the course of treatment reported less anxiety and depression following treatment. These findings are consistent with early evidence from substance use disorders suggesting that DI can be successfully targeted in treatment and that this, in turn, is associated with better outcomes (Bornovalova et al., 2012; Brown et al., 2008). Moreover, the current study expands previous work to provide preliminary evidence that targeting DI may also be relevant for the treatment of depression and anxiety. However, in the current study we were unable to test whether changes in DI mediated depression and anxiety outcomes. Future studies aimed to test this potential mechanism are needed to better understand the association between DI and outcomes.

A number of behavioral treatments target DI, either implicitly or explicitly. The reduction of DI is targeted with skill building and acceptance interventions in Dialectical Behavior Therapy (Linehan, 1993) and is inherent in exposure-based therapies or therapies that aim to enhance the ability to select alternative behaviors in the context of distress. As the current study is unable to identify which specific components of the treatment program may best enhance tolerance of distress (or whether multiple approaches can achieve this change), future studies are needed to directly address this question. Of note, there was variability in DI response to treatment. Although the sample on average reported reductions in DI and 30% of the sample reported reductions of more than two standard deviations in DI during treatment, 5% reported no improvement and 30% reported worsening of DI. Given that DI was associated with anxiety and depression at both pre- and posttreatment, attempting to improve the response of those who exhibited little or no improvement may be helpful to enhancing treatment outcomes.

In this sample, there were no differences in DI between those who did and did not complete both pre- and posttreatment assessment sessions. Previous studies have found that DI was associated with treatment dropout for substance use disorders (Daughters, Lejuez, Bornovalova, et al., 2005; MacPherson et al., 2008); however, these results are consistent with a finding that DI was not associated with retention in a study of depression (Williams et al., 2013). A notable difference between our study and these previous investigations is that the treatment offered to patients in this study was a short-term, acute, partial hospitalization. Thus, the very short length of stay impacted our ability to predict dropout. It is possible that DI would be associated with treatment completion in this population over a longer period of time (e.g., residential or outpatient levels of care).

Several limitations should be noted when interpreting results of the present study. First, with regard to the sample, given that the study was conducted in the context of an intensive partial hospitalization program, the acute nature of the sample may limit generalizability to other, less symptomatic psychiatric

samples. Nonetheless, the extension of the study of DI to this sample adds to the growing literature highlighting its relevance across the spectrum of psychological functioning.

With regard to design, given that the study was conducted within a naturalistic setting, the possibility for implementing methods consistent with a randomized controlled study was limited (e.g., control group, assuring heterogeneity in sample in terms of ethnicity and education, including a variety of self-report and behavioral measures, use of protocol-driven treatment). Specifically, due to this methodological approach, we cannot rule out that both changes in DI and symptoms were attributable to maturation or regression to the mean. However, unlike symptoms of mood and anxiety disorders that may improve over time without intervention, DI is hypothesized to be a stable, traitlike variable requiring targeted treatment to modify (Cummings et al., 2013; Leyro et al., 2010), which mitigates this concern to some degree. Given that assessments were conducted at pre- and posttreatment, it is not possible to definitively establish temporal precedence of changes in DI and other symptoms (e.g., whether changes in DI preceded changes in other symptoms). Additionally, we relied exclusively on self-report measures for symptoms. Although the measure used in this study has demonstrated significant correlations with behavioral measures of DI (McHugh & Otto, 2011), examination of behavioral measures, and other measures related to DI (e.g., anxiety sensitivity) will provide important information about these relationships. Also, due to the lack of diagnostic data at posttreatment and longer-term follow-up, we were unable to test for the association between DI and disorder remission or sustainability of the DI reduction. Future studies that compare various disorders and include longer-term follow-up are needed to examine whether DI demonstrates predictive validity with respect to symptom levels and functional outcomes over follow-up periods and whether changes in DI remain stable following treatment.

Lastly, it is somewhat difficult to interpret the magnitude of change in this study. Given the absence of an agreed-upon measure of effect size in mixed model analyses, we are unable to report a measure of the magnitude of effect for these analyses. Additionally, the lack of validated cutoff or normative scores for DI precluded us from fully utilizing the Jacobson and Truax (1991) criteria for determining clinically significant change. Nonetheless, the magnitude of change (>2 *SD* from the mean) identified by their model was reported in a large proportion of the sample. Identifying clinical cutoffs and degrees of meaningful change is an important future direction for the measurement of DI. However, as noted above, the treatment appeared to produce clinically significant change in over 30% of the sample after a brief episode of treatment.

In summary, the results of this analysis of DI in a heterogeneous patient sample from a partial hospitalization program found that the majority of the sample experienced a reduction in DI during this brief treatment period and DI was associated with higher anxiety and depression throughout treatment. Participants whose DI improved in treatment had better depression and anxiety outcomes. Although these results must be interpreted cautiously in the light of several important limitations, this study further highlights the importance of distress intolerance across psychological disorders and suggests that CBT may enhance tolerance of distress. Ultimately, identifying the mechanisms by which distress intolerance may contribute to disorder maintenance and change processes in treatment may further enhance prevention and treatment programs for a wide range of disorders.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

References

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *American Journal of Preventative Medicine*, *10*, 77–84.

Anestis, M. D., Selby, E. A., Fink, E. L., & Joiner, T. E. (2007). The multifaceted role of distress tolerance in dysregulated eating behaviors. *International Journal of Eating Disorders*, *40*, 718–726. http://dx.doi.org/10.1002/eat.20471

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Beck, A. T., Emery, G., & Greenberg, R. L. (1985). *Anxiety disorders and phobias: A cognitive perspective*. New York, NY: Basic Books.

Beck, A. T., Rush, J. A., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy for depression*. New York, NY: Basic Books.

Bernstein, A., Zvolensky, M. J., Vujanovic, A. A., & Moos, R. (2009). Integrating anxiety sensitivity, distress tolerance, and discomfort intolerance: A hierarchical model of affect sensitivity and tolerance. *Behavior Therapy*, *40*, 291–301. http://dx.doi.org/10.1016/j.beth.2008.08.001

Bornovalova, M. A., Gratz, K. L., Daughters, S. B., Hunt, E. D., & Lejuez, C. W. (2012). Initial RCT of a distress tolerance treatment for individuals with substance use disorders. *Drug and Alcohol Dependence*, *122*, 70–76. http://dx.doi.org/10.1016/j.drugalcdep.2011.09.012

Bradley, B., DeFife, J. A., Guarnaccia, C., Phifer, J., Fani, N., Ressler, K. J., … Westen, D. (2011). Emotion dysregulation and negative affect: Association with psychiatric symptoms. *Journal of Clinical Psychiatry*, *72*, 685–691. http://dx.doi.org/10.4088/JCP.10m06409blu

Brandon, T. H., Herzog, T. A., Juliano, L. M., Irvin, J. E., Lazev, A. B., & Simmons, V. N. (2003). Pretreatment task persistence predicts smoking cessation outcome. *Journal of Abnormal Psychology*, *112*, 448–456. http://dx.doi.org/10.1037/0021-843X.112.3.448

Brown, R. A., Lejuez, C. W., Kahler, C. W., & Strong, D. R. (2002). Distress tolerance and duration of past smoking cessation attempts. *Journal of Abnormal Psychology*, *111*, 180–185. http://dx.doi.org/10.1037//0021-843X.111.1.180

Brown, R. A., Lejuez, C. W., Strong, D. R., Kahler, C. W., Zvolensky, M. J., Carpenter, L. L., … Price, L. H. (2009). A prospective examination of distress tolerance and early smoking lapse in adult self-quitters. *Nicotine and Tobacco Research*, *11*, 493–502. http://dx.doi.org/10.1093/ntr/ntp041

Brown, R. A., Palm, K. M., Strong, D. R., Lejuez, C. W., Kahler, C. W., Zvolensky, M. J., … Gifford, E. V. (2008). Distress tolerance treatment for early-lapse smokers: Rationale, program description, and preliminary findings. *Behavior Modification*, *32*, 302–332. http://dx.doi.org/10.1177/0145445507309024

Brown, R. A., Reed, K. M., Bloom, E. L., Minami, H., Strong, D. R., Lejuez, C. W., … Hayes, S. C. (2013). Development and preliminary randomized controlled trial of a distress tolerance treatment for smokers with a history of early lapse. *Nicotine and Tobacco Research*, *15*, 2005–2015. http://dx.doi.org/10.1093/ntr/ntt093

Buckner, J. D., Keough, M. E., & Schmidt, N. B. (2007). Problematic alcohol and cannabis use among young adults: The roles of depression and discomfort and distress tolerance. *Addictive Behaviors*, *32*, 1957–1963. http://dx.doi.org/10.1016/j.addbeh.2006.12.019

Bujarski, S. J., Norberg, M. M., & Copeland, J. (2012). The association between distress tolerance and cannabis use-related problems: The mediating and moderating roles of coping motives and gender. *Addictive Behaviors*, *37*, 1181–1184. http://dx.doi.org/10.1016/j.addbeh.2012.05.014

Corstorphine, E., Mountford, V., Tomlinson, S., Waller, G., & Meyer, C. (2007). Distress tolerance in the eating disorders. *Eating Behaviors*, *8*, 91–97. http://dx.doi.org/10.1016/j.eatbeh.2006.02.003

Cummings, J. R., Bornovalova, M. A., Ojanen, T., Hunt, E., MacPherson, L., & Lejez, C. (2013). Time doesn't change everything: The longitudinal course of distress tolerance and its relationship with externalizing and internalizing symptoms during early adolescence. *Journal of Abnormal Child Psychology*, *41*, 735–748. http://dx.doi.org/10.1007/s10802-012-9704-x.

Daughters, S. B., Lejuez, C. W., Bornovalova, M. A., Kahler, C. W., Strong, D. R., & Brown, R. A. (2005). Distress tolerance as a predictor of early treatment dropout in a residential substance abuse treatment facility. *Journal of Abnormal Psychology*, *114*, 729–734. http://dx.doi.org/10.1037/0021-843X.114.4.729

Daughters, S. B., Lejuez, C. W., Kahler, C. W., Strong, D. R., & Brown, R. A. (2005). Psychological distress tolerance and duration of most recent abstinence attempt among residential treatment-seeking substance abusers. *Psychology of Addictive Behaviors*, *19*, 208–211. http://dx.doi.org/10.1037/0893-164X.19.2.208

Daughters, S. B., Reynolds, E. K., MacPherson, L., Kahler, C. W., Danielson, C. K., Zvolensky, M. J., …Lejuez, C. W. (2009). Distress tolerance and early adolescent externalizing and internalizing symptoms: The moderating role of gender and ethnicity. *Behaviour Research and Therapy*, *47*, 198–205. http://dx.doi.org/10.1016/j.brat.2008.12.001

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *Structured Clinical Interview for DSM-IV Axis I Disorders: Patient Edition*. New York, NY: New York State Psychiatric Institute.

Gratz, K. L., Rosenthal, M. Z., Tull, M. T., Lejuez, C. W., & Gunderson, J. G. (2006). An experimental investigation of emotion dysregulation in borderline personality disorder. *Journal of Abnormal Psychology*, *115*, 850–855. http://dx.doi.org/10.1037/0021-843X.115.4.850

Hajek, P. (1991). Individual differences in difficulty quitting smoking. *British Journal of Addiction*, *86*, 555–558. http://dx.doi.org/10.1111/j.1360-0443.1991.tb01807.x

Harrington, N. (2005). The Frustration Discomfort Scale: Development and psychometric properties. *Clinical Psychology and Psychotherapy*, *12*, 374–387. http://dx.doi.org/10.1002/cpp.465

Hearon, B. A., Calkins, A. W., Halperin, D. M., McHugh, R. K., Murray, H. W., & Otto, M. W. (2011). Anxiety sensitivity and illicit sedative use among opiate-dependent women and men. *American Journal of Drug and Alcohol Abuse*, *37*, 43–47. http://dx.doi.org/10.3109/00952990.2010.535581

Howell, A. N., Leyro, T. M., Hogan, J., Buckner, J. D., & Zvolensky, M. J. (2010). Anxiety sensitivity, distress tolerance, and discomfort intolerance in relation to coping and conformity motives for alcohol use and alcohol use problems among young adult drinkers. *Addictive Behaviors*, *35*, 1144–1147. http://dx.doi.org/10.1016/j.addbeh.2010.07.003

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*, 12–19. http://dx.doi.org/10.1037//0022-006X.59.1.12

Kapson, H. S., Leddy, M. A., & Haaga, D. A. (2012). Specificity of effects of cognitive behavior therapy on coping, acceptance, and distress tolerance in a randomized controlled trial for smoking cessation. *Journal of Clinical Psychology*, *68*, 1231–1240. http://dx.doi.org/10.1002/jclp.21903

Keough, M. E., Riccardi, C. J., Timpano, K. R., Mitchell, M. A., & Schmidt, N. B. (2010). Anxiety symptomatology: The association with distress tolerance and anxiety sensitivity. *Behavior Therapy*, *41*, 567–574. http://dx.doi.org/10.1016/j.beth.2010.04.002

Kertz, S. J., Bigda-Peyton, J. S., Rosmarin, D. H., & Björgvinsson, T. (2012). The importance of worry across diagnostic presentations: Prevalence, severity and associated symptoms in a partial hospital setting. *Journal of Anxiety Disorders*, *26*, 126–133. http://dx.doi.org/10.1016/j.janxdis.2011.10.005

Leyro, T. M., Bernstein, A., Vujanovic, A. A., McLeish, A. C., & Zvolensky, M. J. (2011). Distress Tolerance Scale: A confirmatory factor analysis among daily cigarette smokers. *Journal of Psychopathology and Behavioral Assessment*, *33*, 47–57. http://dx.doi.org/10.1007/s10862-010-9197-2

Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2010). Distress tolerance and psychopathological symptoms and disorders: A review of the empirical literature among adults. *Psychological Bulletin*, *136*, 576–600. http://dx.doi.org/10.1037/a0019712

Linehan, M. M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*. New York, NY: Guilford Press.

Macatee, R. J., Capron, D. W., Schmidt, N. B., & Cougle, J. R. (2013). An examination of low distress tolerance and life stressors as factors underlying obsessions. *Journal of Psychiatric Research*, *47*, 1462–1468. http://dx.doi.org/10.1016/j.jpsychires.2013.06.019

Macatee, R. J., & Cougle, J. R. (2013). The roles of emotional reactivity and tolerance in generalized, social, and health anxiety: A multimethod exploration. *Behavior Therapy*, *44*, 39–50. http://dx.doi.org/10.1016/j.beth.2012.05.006.

MacPherson, L., Reynolds, E. K., Daughters, S. B., Wang, F., Cassidy, J., Mayes, L. C., & Lejuez, C. W. (2010). Positive and negative reinforcement underlying risk behavior in

early adolescents. *Prevention Science*, *11*, 331–342. http://dx.doi.org/10.1007/s11121-010-0172-7

MacPherson, L., Stipelman, B. A., Duplinsky, M., Brown, R. A., & Lejuez, C. W. (2008). Distress tolerance and pre-smoking treatment attrition: Examination of moderating relationships. *Addictive Behaviors*, *33*, 1385–1393. http://dx.doi.org/10.1016/j.addbeh.2008.07.001.

Magidson, J. F., Listhaus, A. R., Seitz-Brown, C. J., Anderson, K. E., Lindberg, B., Wilson, A., & Daughters, S. B. (2013). Rumination mediates the relationship between distress tolerance and depressive symptoms among substance users. *Cognitive Therapy and Research*, *37*, 456–465.

Marshall-Berenz, E. C., Vujanovic, A. A., Bonn-Miller, M. O., Bernstein, A., & Zvolensky, M. J. (2010). Multimethod study of distress tolerance and PTSD symptom severity in a trauma-exposed community sample. *Journal of Traumatic Stress*, *23*, 623–630. http://dx.doi.org/10.1002/jts.20568

Marshall, E. C., Zvolensky, M. J., Vujanovic, A. A., Gregor, K., Gibson, L. E., & Leyro, T. M. (2008). Panic reactivity to voluntary hyperventilation challenge predicts distress tolerance to bodily sensations among daily cigarette smokers. *Experimental and Clinical Psychopharmacology*, *16*, 313–321. http://dx.doi.org/10.1037/a0012752.

Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology*, *31*, 301–306. http://dx.doi.org/10.1111/j.2044-8260.1992.tb00997.x

Martell, C. R., Dimidjian, S., & Herman-Dunn, R. (2010). *Behavioral activation for depression: A clinician's guide*. New York, NY: Guilford Press.

McHugh, R. K., & Otto, M. W. (2011). Domain-general and domain-specific strategies for the assessment of distress intolerance. *Psychology of Addictive Behaviors*, *25*, 745–749. http://dx.doi.org/10.1037/a0025094

McHugh, R. K., & Otto, M. W. (2012a). Profiles of distress intolerance in a substance-dependent sample. *American Journal of Drug and Alcohol Abuse*, *38*, 161–165. http://dx.doi.org/10.3109/00952990.2011.643990

McHugh, R. K., & Otto, M. W. (2012b). Refining the measurement of distress intolerance. *Behavior Therapy*, *43*, 641–651. http://dx.doi.org/10.1016/j.beth.2011.12.001

McHugh, R. K., Reynolds, E. K., Leyro, T. M., & Otto, M. W. (2013). An examination of the association of distress intolerance and emotion regulation with avoidance. *Cognitive Therapy and Research*, *37*, 363–367. http://dx.doi.org/10.1007/s10608-012-9463-6

Mitchell, M. A., Riccardi, C. J., Keough, M. E., Timpano, K. R., & Schmidt, N. B. (2013). Understanding the associations among anxiety sensitivity, distress tolerance, and discomfort intolerance: A comparison of three models. *Journal of Anxiety Disorders*, *27*, 147–154. http://dx.doi.org/10.1016/j.janxdis.2012.12.003

Neuhaus, E. C. (2006). Fixed values and a flexible partial hospital program model. *Harvard Review of Psychiatry*, *14*, 1–14. http://dx.doi.org/10.1080/10673220500519706

Nock, M. K., & Mendes, W. B. (2008). Physiological arousal, distress tolerance, and social problem-solving deficits among adolescent self-injurers. *Journal of Consulting and Clinical Psychology*, *76*, 28–38. http://dx.doi.org/10.1037/0022-006X.76.1.28

Otto, M. W., McHugh, R. K., Simon, N. M., Farach, F. J., Worthington, J. J., & Pollack, M. H. (2010). Efficacy of CBT for benzodiazepine discontinuation in patients with panic disorder: Further evaluation. *Behaviour Research and Therapy*, *48*, 720–727. http://dx.doi.org/10.1016/j.brat.2010.04.002

Peterson, R. A., & Reiss, S. (1992). *Anxiety Sensitivity Index revised manual*. Worthington, OH: International Diagnostic Systems.

Sargeant, M. N., Daughters, S. B., Curtin, J. J., Schuster, R., & Lejuez, C. W. (2011). Unique roles of antisocial personality disorder and psychopathic traits in distress tolerance. *Journal of Abnormal Psychology*, *120*, 987–992. http://dx.doi.org/10.1037/a0024161

Segal, Z., Teasdale, J., & Williams, M. (2002). *Mindfulness-based cognitive therapy for depression*. New York, NY: Guilford Press.

Schmidt, N. B., Richey, J. A., & Fitzpatrick, K. K. (2006). Discomfort intolerance: Development of a construct and measure relevant to panic disorder. *Journal of Anxiety Disorders*, *20*, 263–280. http://dx.doi.org/10.1016/j.janxdis.2005.02.002

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., … Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, *59* Suppl 20, 22–33.

Simons, J. S., & Gaher, R. M. (2005). The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and Emotion*, *29*, 83–102. http://dx.doi.org/10.1007/s11031-005-7955-3

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Vujanovic, A. A., Bonn-Miller, M. O., Potter, C. M., Marshall, E. C., & Zvolensky, M. J. (2011). An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. *Journal of Psychopathology and Behavioral Assessment*, *33*, 129–135. http://dx.doi.org/10.1007/s10862-010-9209-2

Vujanovic, A. A., Marshall-Berenz, E. C., & Zvolensky, M. J. (2011). Posttraumatic stress and alcohol use motives: A test of the incremental and mediating role of distress tolerance. *Journal of Cognitive Psychotherapy*, *25*, 130–141. http://dx.doi.org/10.1891/0889-8391.25.2.130

Williams, A. D., Thompson, J., & Andrews, G. (2013). The impact of psychological distress tolerance in the treatment of depression. *Behaviour Research and Therapy*, *51*, 469–475. http://dx.doi.org/10.1016/j.brat.2013.05.005.

Zvolensky, M. J., Eifert, G. H., & Lejuez, C. W. (2001). Offset control during recurrent 20% carbon dioxide-enriched air induction: relation to individual difference variables. *Emotion*, *1*, 148–165. http://dx.doi.org/10.1037//1528-3542.1.2.148

Zvolensky, M. J., Marshall, E. C., Johnson, K., Hogan, J., Bernstein, A., & Bonn-Miller, M. O. (2009). Relations between anxiety sensitivity, distress tolerance, and fear reactivity to bodily sensations to coping and conformity marijuana use motives among young adult marijuana users. *Experimental and Clinical Psychopharmacology*, *17*, 31–42. http://dx.doi.org/10.1037/a0014961

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