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The impact of changes in distress tolerance on PTSD symptom severity post-treatment among veterans in residential trauma treatment

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ABSTRACT

Given that rates of PTSD, particularly among military populations, are increasing, it is critical to gain a better understanding of factors associated with treatment response. Low distress tolerance (DT), conceptualized as the perceived or actual inability to tolerate negative emotional states, may impacts veterans' responses to PTSD treatment. Low DT has been associated with more severe PTSD symptoms in clinical and non-clinical samples; however, its impact on PTSD symptomatology across treatment has yet to be assessed. We examined the impact of changes in DT, from intake to discharge, on post-treatment PTSD symptom severity within two samples of veterans recruited from Veterans Affairs residential PTSD treatment facilities in the northwestern and southern United States (Total $N = 86$; 87% male; 46% White, 39% Black, 9% Latino, 6% Other). Veterans completed the Distress Tolerance Scale and PTSD Checklist (PCL) at intake and discharge from residential PTSD treatment. Regression analyses revealed that, within each veteran sample, those with the greatest improvements in DT had the lowest PCL total and subscale scores at discharge after controlling for respective intake PCL scores. This suggests increases in DT across treatment help explain the degree of benefits experienced by veterans following PTSD treatment.
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Veterans are significantly more likely to develop posttraumatic stress disorder (PTSD) than civilians (Magruder & Yeager, 2009), with rates of PTSD among veterans ranging from 10 to 30% across studies (Dohrenwend et al., 2006; Ramchand et al., 2010). About 500,000 veterans seek services for PTSD annually (Disorder and Medicine, 2014) and although evidence-based psychotherapies (EBPs) for PTSD provide benefits, veterans respond less favorably to these interventions than civilians (Goodson et al., 2011; Steenkamp & Litz, 2013). Indeed, residential PTSD treatment, which is the most intensive treatment offered by Veterans Affairs (VA), has often been associated with small reductions in PTSD symptoms ($d = 0.19$), see meta-analysis; (Goodson et al., 2011). Thus, despite strong attempts to address veterans' needs, veterans who complete EBPs within residential treatment continue to experience significant levels of PTSD symptoms (i.e., only 16%) "recover" from PTSD; (Alvarez et al., 2011). To better determine why many veterans may not respond to treatment, it is critical to identify individual factors associated with symptom changes. Although there are system- and structural-level factors influencing treatment outcomes, gaining a stronger understanding of individual factors impacting change is critical at this juncture; in many cases, targeting individual factors is more practical and less costly than attempting to change system- and structural-level factors.

One cognitive-affective risk factor hypothesized as being central to PTSD symptomatology and treatment response is low distress tolerance (DT), conceptualized as the perceived or actual inability to tolerate negative experiential states (e.g., negative emotions (Leyro,

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Zvolensky, & Bernstein, 2010)). To individuals who feel incapable of tolerating emotional distress, PTSD can be particularly challenging because of the inescapable and repetitive nature of the symptoms, coupled with the fact that their predisposition to avoidance reinforces the strength of the symptoms and resulting distress, over time. There are a number of hypotheses explaining how and why low DT is linked to more severe PTSD symptomatology, including that: low DT, pre-trauma, may predispose individuals to develop PTSD following traumatic events because of their propensity to avoid; experiencing traumatic events may impact individuals' perceptions of their ability to tolerate distress following the events (they may find thoughts, situations, and emotions to be intolerable and themselves to be incompetent in coping); or symptoms of PTSD and DT may have bidirectional relations. Following from this, we would expect strong relations between PTSD symptoms and low DT more broadly, but it is less clear whether increases in DT, within the context of treatment, might impact PTSD symptom severity post-treatment.

Although low DT and more severe PTSD symptomatology are strongly correlated among civilian (Fetzner, Peluso, & Asmundson, 2014; Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010; Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011a; Vujanovic et al., 2013), cocaine using (Vujanovic, Rathnayaka, Amador, & Schmitz, 2015), and veteran samples (Banducci, Bujarski, Bonn-Miller, Patel, & Connolly, 2016), the impact of changes in DT across the course of treatment, on PTSD symptom severity, has yet to be examined. This is a critical gap in the literature, as it is unclear whether increases in DT over the course of treatment might impact PTSD symptomatology over time. Determining the impact of changes in DT on symptomatology is relevant when considering how to present and target PTSD treatments. Moreover, if individuals with the greatest increases in DT are most successful in treatment, different treatment avenues may be suggested for those who do not see improvements.

Informed by existing gaps in the literature, the current study sought to examine whether changes in DT across the course of residential PTSD treatment impacted PTSD symptomatology post-treatment within two samples of veterans. Given previous research and theory, we hypothesized that veterans with PTSD, who had the greatest increases in DT across the course of treatment, would have the lowest levels of PTSD symptoms post-treatment, after controlling for pre-treatment PTSD symptom severity. As depression and PTSD have strong bidirectional relations (Horesh, Lowe, Galea, Uddin, & Koenen, 2015), we controlled for depressive symptoms in all of our analyses.

1. Materials and methods

The current study recruited veterans from two residential PTSD treatment programs within VA, who completed measures of DT and PTSD at intake and discharge, as a part of a larger program evaluation study. All veterans completed the intake assessment measures; some veterans who discharged from treatment early did not complete the discharge assessment packet. Veterans who completed the discharge assessment packet did not differ significantly from those who did not complete the discharge assessment on baseline characteristics within either sample (i.e., age, gender, baseline PTSD symptoms, baseline depressive symptoms, and baseline DT), when comparing them using *t*-tests (all *p*'s > 0.05). Internal Review Boards at both VA facilities approved of study procedures.

1.1. Study 1 participants

This sample included 53 veterans with PTSD (M_{age} = 44.2, *SD* = 15.2; 82.7% male; 56.6% non-Hispanic White, 15.1% Hispanic, 17% African American, 11.4% other) from a residential trauma recovery program (TRP) in the northwestern United States. These veterans were deployed 0–7 times, with 1.58 (*SD* = 1.07) deployments on average. Approximately 83% had served in a war zone, including Vietnam (26.4%), Desert Storm (21.2%), peacekeeping operations (11.5%), and Iraq and Afghanistan (71.2%). Related to military trauma, 83% reported combat exposure and 20.8% military sexual trauma. Additionally, 67.3% reported serious accidents, 64.2% physical assault, and 30.8% sexual assault. Within this sample, 37.7% of veterans were married, 37.1% divorced/separated, and 9.4% never married. Only 17.3% were employed; 50.0% were unemployed, 17.0% disabled, 13.2% retired, and 1.9% students. The majority were Army veterans (50.3%), with Air Force (17.6%), Marines (22.6%), Navy (3.8%), and National Guard (5.7) comprising the remainder of the sample.

Veterans participated in a 60–90 day group-based treatment program consisting of cognitive processing therapy (CPT), cognitive behavioral therapy (CBT), communication skills, process groups, recreation therapy, and 12-step groups (for veterans reporting substance use problems). Veterans attended treatment programming from 8 a.m.–4 p.m. daily, Monday–Friday; veterans attended 3–6 groups daily. Exclusion criteria included: (1) imminent risk of harm to self/others, (2) unwilling to remain substance-free (except nicotine and caffeine) during treatment, and (3) current medical, psychiatric (e.g., disorders requiring intensive inpatient medical treatment), or legal problems (e.g., current arrest warrant) preventing treatment participation.

1.2. Study 2 participants

This sample included 33 military veterans (M_{age} = 48.42; *SD* = 10.40; 97% men; 72.7% Black; 27.3% White) recruited from a residential substance use PTSD treatment (SUPT) program in the southern United States. These veterans were deployed 0–12 times, with 1.66 (*SD* = 2.57) deployments on average. Of veterans in this sample, 48.5% reported combat as their primary trauma, 6.1% endorsed military sexual trauma, 12.2% childhood abuse, 15.2% viewing dead bodies, 6.1% civilian sexual trauma, and the remainder accidents/other. Within this sample, 15.2% were married, 60.7% divorced/separated, and 24.1% never married. The majority were Army veterans (60.6%), with Air Force (12.1%), Navy (15.2%), Marines (3%) and the National Guard (9.1%) comprising the remainder of the sample. Only 9.1% of these veterans reported full-time employment, with 39.2% unemployed, 6.1% retired, and 45.5% disabled. All veterans included in this study met diagnostic criteria for PTSD-SUD based on diagnostic assessments utilizing the Mini International Neuropsychiatric Interview (Sheehan et al., 1998).

Veterans participated in SUPT programming consisting of six weeks of thrice-weekly individual and group CPT, as well as relapse prevention, case management, behavioral activation, CBT, and medication management. Veterans attended treatment programming from 8 a.m.–4 p.m. daily, Monday-Friday; veterans attended 4–6 individual and groups sessions daily. Exclusion criteria for the SUPT involved: (1) imminent risk of harm to self/others, (2) current untreated psychosis, and (3) current medical, legal, or psychiatric problems requiring a higher level of care and preventing participation in treatment.

1.3. Procedure

1.3.1. Study 1

Veterans completed an intake assessment within the first week of arriving to the TRP (veterans did not receive any trauma-focused treatment within the TRP prior to completing the intake

assessment) and a discharge assessment during the week prior to completing the program.

1.3.2. Study 2

Veterans completed an intake assessment within the first week of arriving to the SUPT (veterans did not receive any trauma-focused treatment within the SUPT prior to completing the intake assessment) and a discharge assessment during the week prior to completing the program.

1.4. Measures

The Posttraumatic Stress Disorder Checklist (Weathers, Litz, Herman, Huska, & Keane, 1993) is a 17-item, self-report measure assessing PTSD symptoms, according to DSM-IV-TR criteria (American Psychiatric Association, 2000). We utilized the PCL-Civilian version of the measure, so that veterans were able to report symptoms related to military or non-military traumas, rather than requiring they endorse items based on military trauma experiences. Items on the PCL are scored on a five-point Likert scale based on how much individuals have been bothered by PTSD symptoms during the prior month (1 = not at all to 5 = extremely). We examined the PCL Total score and four subscale scores (Intrusions, Avoidance, Numbing and Hyperarousal); (King, Leskin, King, & Weathers, 1998). We elected to examine these four subscale scores given support within the literature for four separate symptom clusters (King et al., 1998; Yufik & Simms, 2010) as well as adaptations in DSM-5 to reflect these findings. Psychometric support has been established (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). A score of 50 (Forbes, Creamer, & Biddle, 2001) was used as a cutoff to examine what percentage of veterans likely had PTSD, based on the PCL at intake and discharge. A 10 or more point decrease on the PCL was considered clinically significant (Monson et al., 2008). Study 1 Cronbach's alpha for the PCL Total was 0.92 at intake and 0.94 at discharge. Cronbach's alpha was 0.87 for Intrusions, 0.76 for Avoidance, 0.78 for Numbing, and 0.79 for Hyperarousal at intake and 0.91, 0.78, 0.83, and 0.84 at discharge, respectively. Study 2 Cronbach's alpha was 0.77 at intake and 0.93 at discharge. Cronbach's alpha was 0.79 for Intrusions, 0.47 for Avoidance, 0.66 for Numbing, and 0.71 for Hyperarousal at intake and 0.87, 0.67, 0.93, and 0.77 at discharge, respectively.

The Distress Tolerance Scale (Simons & Gaher, 2005) is a 15-item self-report measure assessing individuals' ability to tolerate emotional distress. Items on the DTS are rated on a five-point Likert scale (1 = strongly agree to 5 = strongly disagree). Lower scores indicate individuals perceive themselves as being less able to tolerate distress. The DTS has good 6-month test-rest reliability, convergent and discriminant validity (Simons & Gaher, 2005), and captures changes in DT across treatment (Medina, Hopkins, Powers, Baird, & Smits, 2015). Study 1 Cronbach's alpha was 0.89 at intake and 0.93 at discharge. Study 2 Cronbach's alpha was 0.88 at intake and 0.93 at discharge.

The Beck Depression Inventory-II (Beck, Steer, & Brown, 1996) is a well-validated 21-item self-report measure assessing the existence and severity of depressive symptoms. Items on the BDI-II are rated on a four-point Likert scale. The BDI-II was administered at intake and the total score was used. Study 1 Cronbach's alpha was 0.88, Study 2 Cronbach's alpha was 0.90.

1.5. Analysis plan

To determine relations between variables over time, zero-order correlations were examined. Paired samples *t*-tests were used to determine whether DT and PTSD changed from intake to discharge. We utilized DT change scores, as is typical for observational studies (Fitzmaurice, Laird, & Ware, 2012) to assess whether changes in DT from intake to discharge predicted PTSD symptom severity at discharge. For each regression model, step 1 included the intake PCL score relevant to the analysis (to control for intake symptom severity) and the DT change score (Δ DT = discharge DT – intake DT); step 2 added covariates to determine whether significant effects held when these covariates were included. Given that age and gender have previously been associated with PTSD symptom severity (Jacobson, Donoho, Crum-Cianflone, & Maguen, 2015; Smith, Tyzik, & Iverson, 2015), and that depression and PTSD are interrelated (Horesh et al., 2015), these factors were included in the final step of our regression models when they were significantly correlated with our dependent variables. Adding significant correlates to the *final* step allowed us to determine whether significant effects held when relevant covariates were included and avoided potentially inflated estimates associated with including covariates in the first step of regression analyses (Simmons, Nelson, & Simonsohn, 2011).

2. Results

2.1. Study 1

PCL Total scores were 67.32 ($SD = 12.07$) at intake and 55.28 ($SD = 13.59$) at discharge. At intake, 87.4% of veterans had PCL scores above the cutoff of 50, whereas at discharge, 52.6% of veterans had PCL scores above the cutoff of 50. Within this sample, 54.7% of veterans had clinically significant change in their PTSD symptoms (change ≥ 10 points on the PCL) from intake to discharge (Monson et al., 2008). DTS scores were 35.13 ($SD = 10.57$) at baseline and 40.83 ($SD = 14.01$) at discharge. BDI-II scores were 31.55 ($SD = 10.71$) at baseline. Intake DTS scores were significantly negatively correlated with intake PCL Total and Numbing (Table 1), but not with other PCL subscales. Discharge DTS was significantly negatively correlated with all discharge PCL subscales (Table 1). Intake BDI-II was significantly correlated with all PCL subscales at intake and discharge, and with the DTS at intake (Table 1), and was thus included as a covariate. Gender and age were not correlated with the DTS or PCL and were not included in our models. DT significantly increased from intake to discharge $t(52) = 2.52$, $p = 0.015$, while PCL Total $t(52) = -6.10$, $p < 0.001$, Intrusions $t(52) = -4.08$, $p < 0.001$, Avoidance $t(52) = -4.53$, $p < 0.001$, Numbing $t(52) = -6.24$, $p < 0.001$, and Hyperarousal $t(52) = -6.00$ $p < 0.001$ decreased significantly.

The models examining the relations between the DT change score, intake PCL (Total, Intrusions, Avoidance, Numbing, and Hyperarousal, subscales respectively), and BDI-II explained 39.6% of variance in the discharge PCL Total, 30.6% of the variance in the discharge PCL Intrusions, 35.6% of the variance in discharge PCL Avoidance, 28.9% of the variance in discharge PCL Numbing, and 43.9% of the variance in discharge PCL Hyperarousal scores.

PTSD symptoms at discharge were significantly predicted by changes in DT across treatment (Table 2), such that those with larger increases in DT had lower PCL Total and subscale (Intrusions, Avoidance, Numbing, and Hyperarousal) scores, when controlling for relevant intake PCL scores. For all regressions, results remained significant when baseline depression symptoms were added to the model.

2.2. Study 2

PCL Total scores were 65.06 ($SD = 8.44$) at intake and 50.97 ($SD = 14.34$) at discharge. At intake, 97.1% of veterans had PCL scores above the cutoff of 50, whereas at discharge, 41.2% of veterans had PCL scores above the cutoff of 50. Within this sample, 57.6% of veterans had clinically significant change in their PTSD symptoms (change ≥ 10 points on the PCL) from intake to discharge (Monson et al., 2008). DTS scores were 37.15 ($SD = 11.20$) at base-

Table 1
Correlations between dependent and independent variables for study 1.

	T1 PCL Total	T2 PCL Total	T1 PCL Intr.	T2 PCL Intr.	T1 PCL Avoid	T2-PCL Avoid	T1-PCL Numb	T2-PCL Numb	T1 PCL Hyp	T2 PCL Hyp	T1 BDI-II	T1 DT
T2 PCL Total	**0.38****	–										
T1 PCL Intr.	**0.88****	**0.34***	–									
T2 PCL Intr.	**0.40****	**0.92****	**0.41****	–								
T1 PCL Avoid	**0.80****	0.27	**0.59****	**0.27***	–							
T2-PCL Avoid	0.22	**0.78****	0.206	**0.66****	0.25	–						
T1-PCL Numb	**0.80****	0.19	**0.57****	0.19	**0.58****	0.02	–					
T2-PCL Numb	0.24	**0.87****	0.20	**0.70****	0.19	**0.58****	0.11	–				
T1 PCL Hyp	**0.91****	**0.44****	**0.74****	**0.43****	**0.63****	0.26	**0.67****	0.28*	–			
T2 PCL Hyp	**0.43****	**0.92****	**0.35***	**0.82****	0.24	**0.61****	**0.31***	0.76**	**0.55****	–		
T1 BDI-II	**0.67****	**0.39****	**0.56****	**0.33***	**0.53****	0.29*	**0.62****	0.28*	**0.60****	**0.45****	–	
T1 DT	**−0.30***	−0.09	−0.17	−0.07	−0.26	0.03	**−0.39****	−0.06	−0.25	−0.18	**−0.50****	–
T2 DT	−0.03	**−0.51****	0.03	**−0.37****	−0.17	**−0.51****	0.09	**−0.52****	−0.08	**−0.44****	−0.16	0.13

T1 = Time 1 (intake), T2 = Time 2 (discharge), PCL = PTSD Checklist, Intr. = Intrusions, Avoid = Avoidance, Numb = Numbing, Hyp = Hyperarousal, DT = distress tolerance, BDI-II = Beck Depression Inventory-II.
*$p < 0.05$, ** $p < 0.01$.
Bolded variables are those that are significant.

line and 44.27 ($SD = 13.41$) at discharge, and BDI-II scores were 28.97 ($SD = 10.77$) at baseline. Intake DTS scores were significantly negatively correlated with intake PCL Total, Avoidance, Numbing, and Hyperarousal (Table 3), but not with Intrusions. Discharge DTS was significantly negatively correlated with discharge PCL Total, Numbing, and Hyperarousal (Table 3), but not with Avoidance or Intrusions. Intake BDI-II was significantly correlated with intake PCL Total, Numbing, and Hyperarousal, and with the DTS at intake (Table 3), and was thus included as a covariate. Gender and age were not correlated with the DTS or PCL and were not included in our models. DT significantly increased from intake to discharge $t(32) = 3.05$, $p = 0.005$, while PCL Total $t(32) = -5.73$, $p < 0.001$, Intrusions $t(32) = -4.16$, $p < 0.001$, Avoidance $t(32) = -4.96$, $p < 0.001$, Numbing $t(32) = -4.44$, $p < 0.001$, and Hyperarousal $t(32) = -4.49$ $p < 0.001$ decreased.

The model examining the relations between the DT change score, intake PCL (Total, Intrusions, Avoidance, Numbing, and Hyperarousal, subscales respectively), and BDI-II explained 28.4% of variance in the discharge PCL Total, 24.2% of the variance in the discharge PCL Intrusions, 11.9% of the variance in discharge PCL Avoidance, 33.9% of the variance in discharge PCL Numbing, and 25.6% of the variance in discharge PCL Hyperarousal scores (Table 4).

PTSD symptoms at discharge were significantly predicted by changes in DT from intake to discharge (Table 3), such that those with significant increases in DT had lower PCL Total, Numbing, and Hyperarousal scores at discharge, when controlling for intake PCL scores; Intrusions and Avoidance were non-significant. For all regressions, results remained significant when baseline depression symptoms were added to the model.[1]

3. Discussion

In line with our hypotheses, veterans within two residential PTSD treatment programs who experienced the greatest increases in DT from intake to discharge had the lowest levels of PTSD symptoms post-treatment. This expands upon prior cross-sectional work demonstrating associations between DT and PTSD symptoms in

Table 2
Study 1 PCL Models.

	est.	*SE*	*β*	*t*	*p*
Predictors of Discharge PCL Total					
Step 1					
Baseline PCL Total	0.51	0.13	0.45	3.89	<0.001
DT Change Score	−0.38	0.10	−0.45	−3.91	<0.001
Step 2					
Baseline PCL Total	0.28	0.17	0.25	1.64	0.108
DT Change Score	−0.39	0.10	−0.48	−4.22	<0.001
Baseline BDI-II	0.39	0.19	0.31	2.05	0.046
Predictors of Discharge PCL Intrusions					
Step 1					
Baseline PCL Intrusions	0.46	0.12	0.46	3.77	<0.001
DT Change Score	−0.08	0.03	−0.33	−2.75	0.008
Step 2					
Baseline PCL Intrusions	0.35	0.14	0.35	2.41	0.020
DT Change Score	−0.09	0.03	−0.36	−2.93	0.005
Baseline BDI-II	0.08	0.06	0.20	1.39	0.169
Predictors of Discharge PCL Avoidance					
Step 1					
Baseline PCL Avoidance	0.26	0.12	0.26	2.12	0.039
DT Change Score	−0.08	−0.02	−0.46	−3.80	<0.001
Step 2					
Baseline PCL Avoidance	0.07	0.14	0.07	0.51	0.611
DT Change Score	−0.09	0.02	−0.52	−4.43	<0.001
Baseline BDI-II	0.10	0.04	0.35	2.53	0.015
Predictors of Discharge PCL Numbing					
Step 1					
Baseline PCL Numbing	0.35	0.17	0.26	1.99	0.052
DT Change Score	−0.11	0.03	−0.49	−3.69	0.001
Step 2					
Baseline PCL Numbing	0.08	0.21	0.06	0.37	0.716
DT Change Score	−0.11	0.03	−0.48	−3.77	<0.001
Baseline BDI-II	0.12	0.06	0.33	2.13	0.039
Predictors of Discharge PCL Hyperarousal					
Step 1					
Baseline PCL Hyperarousal	0.64	0.12	0.58	5.22	<0.001
DT Change Score	−0.08	0.03	−0.31	−2.85	0.006
Step 2					
Baseline PCL Hyperarousal	0.47	0.15	0.42	3.18	0.003
DT Change Score	−0.09	0.03	−0.35	−3.19	0.003
Baseline BDI-II	0.10	0.05	0.26	1.94	0.058

PCL = PTSD Checklist, DT = distress tolerance, BDI-II = Beck Depression Inventory-II, est. = unstandardized beta, SE = standard error, β = standardized beta.

[1] To increase our confidence in these findings, we combined the data from both samples (N = 86) and re-ran the analyses. For the combined sample, the DT change score significantly predicted post treatment PCL Total, Intrusions, Numbing, Avoidance, and Hyperarousal scores (controlling for baseline BDI-II and respective baseline PCL scores), mirroring the pattern of results when examining relations by sample.

Table 3
Correlations between dependent and independent variables for study 2.

	T1 PCL Total	T2 PCL Total	T1 PCL Intr.	T2 PCL Intr.	T1 PCL Avoid	T2-PCL Avoid	T1-PCL Numb	T2-PCL Numb	T1 PCL Hyp	T2 PCL Hyp	T1 BDI-II	T1 DT
T2 PCL Total	0.32	–										
T1 PCL Intr.	**0.71****	0.18	–									
T2 PCL Intr.	0.34	**0.86****	**0.35***	–								
T1 PCL Avoid	**0.51****	0.31	0.13	0.22	–							
T2-PCL Avoid	0.12	**0.88****	0.01	**0.70****	0.25	–						
T1-PCL Numb	**0.48****	0.32	−0.04	0.10	0.15	0.18	–					
T2-PCL Numb	0.23	**0.89****	0.05	**0.64****	0.17	**0.74****	**0.43***	–				
T1 PCL Hyp	**0.90****	0.15	**0.56****	0.19	0.34	−0.04	**0.46****	0.07	–			
T2 PCL Hyp	**0.41***	**0.91****	0.22	**0.71****	**0.42***	**0.74****	**0.37***	**0.76****	0.25	–		
T1 BDI-II	**0.42***	**0.26**	−0.10	0.19	0.21	0.10	**0.65****	0.34	**0.46****	0.24	–	
T1 DT	**−0.44****	−0.08	0.01	0.01	**−0.39***	−0.04	**−0.39***	0.10	**−0.48****	−0.17	**0.59****	–
T2 DT	−0.18	**−0.37***	0.03	−0.18	−0.25	−0.23	−0.31	**−0.42***	−0.08	**−0.43***	−0.24	**0.42***

T1 = Time 1 (intake), T2 = Time 2 (discharge), PCL = PTSD Checklist, Intr. = Intrusions, Avoid = Avoidance, Numb = Numbing, Hyp = Hyperarousal, DT = distress tolerance, BDI-II = Beck Depression Inventory-II.
*$p < 0.05$, ** $p < 0.01$.
Bolded variables are those that are significant.

Table 4
Study 2 PCL models.

	est.	*SE*	*β*	*t*	*p*
Predictors of Discharge PCL Total					
Step 1					
Baseline PCL Total	0.67	0.28	0.39	2.42	0.022
DT Change Score	−0.40	0.17	−0.38	−2.32	0.028
Step 2					
Baseline PCL Total	0.51	0.30	0.30	1.73	0.093
DT Change Score	−0.45	0.18	−0.42	−2.57	0.015
Baseline BDI-II	0.32	0.24	0.24	1.36	0.184
Predictors of Discharge PCL Intrusions					
Step 1					
Baseline PCL Intrusions	0.41	0.19	0.35	2.11	0.043
DT Change Score	−0.07	0.06	−0.20	−1.87	0.244
Step 2					
Baseline PCL Intrusions	0.44	0.19	0.39	2.37	0.025
DT Change Score	−0.09	0.06	−0.28	−1.65	0.111
Baseline BDI-II	0.12	0.07	0.30	1.76	0.089
Predictors of Discharge PCL Avoidance					
Step 1					
Baseline PCL Avoidance	0.36	0.23	0.27	1.55	0.131
DT Change Score	−0.05	0.04	−0.21	−1.23	0.228
Step 2					
Baseline PCL Avoidance	0.33	0.24	0.25	1.39	0.176
DT Change Score	−0.05	0.04	−0.24	−1.32	0.197
Baseline BDI-II	0.03	0.05	0.10	0.57	0.576
Predictors of Discharge PCL Numbing					
Step 1					
Baseline PCL Numbing	0.66	0.24	0.43	2.82	0.008
DT Change Score	−0.10	0.04	−0.34	−2.22	0.034
Step 2					
Baseline PCL Numbing	0.38	0.31	0.25	1.24	0.226
DT Change Score	−0.12	0.05	−0.41	−2.57	0.016
Baseline BDI-II	0.10	0.07	0.28	1.34	0.190
Predictors of Discharge PCL Hyperarousal					
Step 1					
Baseline PCL Hyperarousal	0.46	0.20	0.39	2.27	0.031
DT Change Score	−0.13	0.05	−0.41	−2.42	0.022
Step 2					
Baseline PCL Hyperarousal	0.35	0.22	0.29	1.57	0.126
DT Change Score	−0.14	0.05	−0.44	−2.58	0.015
Baseline BDI-II	0.09	0.07	0.22	1.22	0.232

PCL = PTSD Checklist, DT = distress tolerance, BDI-II = Beck Depression Inventory-II, est. = unstandardized beta, SE = standard error, β = standardized beta.

clinical (Banducci et al., 2016), non-clinical (Fetzner et al., 2014; Marshall-Berenz et al., 2010; Vujanovic et al., 2011a; Vujanovic et al., 2013), and cocaine-using samples (Vujanovic et al., 2015). Further, this work expands upon the few studies that explicitly target and measure changes in DT, or examine how these changes impact symptomatology across a variety of disorders, other than PTSD (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012; Macatee & Cougle, 2015; McHugh et al., 2014; Medina et al., 2015; Williams, Thompson, & Andrews, 2013). Thus, our findings meaningfully extend prior work by examining the impact of changes in DT across treatment, within two unique samples of veterans diagnosed with PTSD. These findings suggest the potential utility of examining levels of DT more regularly across PTSD treatment to better understand which individuals are experiencing benefits and why, as well as in considering specifically targeting increases in DT during PTSD treatment for those not experiencing improvements in symptomatology. Given that there was a significant subsample of veterans with significant PTSD symptoms at discharge, considering novel strategies addressing low DT might offer an inroad to target entrenched symptoms. Importantly, these results were consistent across racially/ethnically and socioeconomically diverse samples of veterans from two distinct regions in the United States. Further adding to the confidence in our findings was the observation that significant associations remained even when accounting for co-occurring depression symptoms and when combining both samples.

Building upon prior literature demonstrating cross-sectional associations between PCL Total, Numbing, and Hyperarousal scores and low DT (e.g., Vujanovic et al., 2011a, 2013), increases in DT were associated with lower PCL Total, Numbing and Hyperarousal across both samples in the current study. However, associations between DT change and PCL Avoidance and Intrusions subscales were not observed in Study 2. Although limited power may explain the lack of associations in Study 2, it is important to note that the majority of studies among community samples have demonstrated DT to be significantly associated with PTSD Total scores, with less consistent relations observed for PCL subscale scores (Duranceau, Fetzner, & Carleton, 2014; Farris, Vujanovic, Hogan, Schmidt, & Zvolensky, 2014; Fetzner et al., 2014; Vujanovic et al., 2011a; Vujanovic et al., 2013; Vujanovic, Marshall-Berenz, & Zvolensky, 2011b). Thus, future work is needed in this area to better understand these relations over time, especially given that post-hoc analyses with the combined sample demonstrated significant relations between the DT change score and all PCL subscales.

Despite these promising findings, there are a number of limitations of the current work. First, the majority of our sample was male, prohibiting our ability to determine whether gender might have impacted these relations. Second, the studied samples were relatively small and were veterans within residential treatment; replication within larger, outpatient samples of veterans and non-veterans is necessary to determine whether findings generalize. Third, consistent with the literature, we did not detect significant relations between DT and some of the PCL subscales in Study 2 (Duranceau et al., 2014; Fetzner et al., 2014; Vujanovic et al., 2011a, 2011b, 2013), which may be due to a lack of power or to genuine differences. Further, low internal consistency for the PCL Avoidance subscale at intake in Study 2 may have contributed to lack of differences. Fourth, we did not have the ability to examine whether observed changes in DT and PTSD symptoms persisted following veteran reengagement in the community; it would be fruitful to examine these relations across longer periods of time with additional follow-ups. Fifth, it is currently unclear what constitutes a clinically significant change in DT. Sixth, data regarding these relations were obtained via self-report measures; clinician administered measures were not utilized, although it is relevant to note clinician administered and self-report measures of PTSD are highly correlated (Monson et al., 2008). Finally, diagnostic information regarding other (non-PTSD) psychopathology was not collected in Study 1, limiting our ability to determine the impact of other psychiatric and/or substance use disorders on our findings.

4. Conclusions

Despite the above limitations, the present study advances the field by serving as the first examination of the impact of changes in DT on PTSD symptomatology, within a clinical sample of military veterans diagnosed with PTSD. Our findings suggest the importance of considering DT both in the assessment and treatment of PTSD, as increases in DT predicted lower PCL total and subscale scores at discharge in both of our samples.

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