Published in final edited form as:

Psychol Addict Behav. 2013 September ; 27(3): 763–773. doi:10.1037/a0029911.

Examining the Interactive Effect of Posttraumatic Stress Disorder, Distress Tolerance, and Gender on Residential Substance Use Disorder Treatment Retention

Matthew T. Tull, Kim L. Gratz, and Scott F. Coffey

University of Mississippi Medical Center Jackson, Mississippi, USA

Nicole H. Weiss

Jackson State University Jackson, Mississippi, USA

Michael J. McDermott

University of Mississippi Oxford, Mississippi, USA

Abstract

An extensive body of research has demonstrated that patients with a co-occurring posttraumatic stress disorder (PTSD) and substance use disorder (SUD) diagnosis are at high risk for a wide range of negative clinical outcomes, including treatment non-completion. However, no studies to date have explored the effect of a PTSD-SUD diagnosis on residential SUD treatment completion, as well as potential moderators of this effect. Consequently, the goal of this study was to examine the interactive effect of a PTSD diagnosis, distress tolerance (DT), and gender on residential SUD treatment retention. Participants were 214 substance dependent patients consecutively admitted to a residential SUD treatment facility. Participants were administered diagnostic interviews, completed a laboratory-based measure of DT, and were followed throughout the course of treatment. Although no significant main effects were found, results did reveal a significant PTSD $\times$ gender $\times$ DT interaction. Post-hoc analyses indicated that, among men, those with a current diagnosis of PTSD and low DT completed a significantly lower proportion of residential SUD treatment compared to all other groups. The implications of the study's findings for identifying ways to improve residential SUD treatment retention among patients with a PTSD-SUD diagnosis are discussed.

Posttraumatic stress disorder (PTSD) is characterized by the presence of re-experiencing (e.g., intrusive thoughts and memories about a traumatic event, nightmares), avoidance (e.g., avoidance of situations, people, and places that serve as reminders of a traumatic event), emotional numbing (e.g., restriction in the experience of positive emotions), and hyperarousal (e.g., difficulties sleeping, anger, hypervigilance) symptoms following exposure to a traumatic event (American Psychiatric Association [APA], 2000). Although the lifetime prevalence of PTSD in the general population is 6.8% (Kessler et al., 2005), individuals with substance use disorders (SUDs) have been found to have elevated rates of this disorder (Brady, Back, & Coffey, 2004), with the lifetime prevalence of PTSD among SUD patients ranging from 36–50% and current prevalence rates ranging from 25–42% (Brady et al., 2004).

The co-occurrence of PTSD among SUD patients is clinically-relevant as well, with extensive research indicating more severe negative clinical outcomes among SUD patients with (vs. without) PTSD (Ouimette, Brown, & Najavits, 1998), including quicker relapse and more severe substance use following SUD treatment (Brown, Stout, & Mueller, 1996; Hien, Nunes, Levin, & Fraser, 2000; Najavits et al., 2007; Ouimette, Finney, & Moos, 1999), more severe substance use patterns (Najavits, Weiss et al., 1998), higher rates of suicide attempts (Najavits, Weiss, & Shaw, 1999), more functional impairment (both in general and following SUD treatment; Mills, Teesson, Ross, & Darke, 2007; Mills, Teesson, Ross, & Peters, 2006; Ouimette et al., 1999), heightened rates of co-occurring Axis I and II disorders (Back et al., 2000; Najavits, Gastfriend et al., 1998; Read, Brown, & Kahler, 2004), more severe history of traumatic exposure (Back et al., 2000; Najavits, Gastfriend et al., 1998), and greater utilization of inpatient SUD treatment (Brown, Stout, & Mueller, 1999).

However, one important clinical outcome that has not been examined among patients with co-occurring PTSD-SUD is residential SUD treatment completion. SUD treatment drop-out is a serious clinical concern, associated with negative outcomes for both treatment providers (e.g., financial costs, lowered staff morale) and patients (Deane, Wootton, Hsu, & Kelly, 2012; Pulford, Adams, & Sheridan, 2010). In particular, evidence suggests that patients who leave SUD treatment prematurely closely resemble those who never receive SUD treatment (see Stark, 1992). Although no studies to date have explored the effect of a PTSD-SUD diagnosis on residential SUD treatment completion, findings of high rates of treatment non-completion among PTSD-SUD patients receiving other forms of treatment suggest that the presence of co-occurring PTSD among SUD patients may interfere with residential SUD treatment completion as well.

For example, in a combined PTSD exposure-SUD treatment (Concurrent Treatment of PTSD and Cocaine Dependence; Back, Dansky, Carroll, Foa, & Brady, 2001), 62% of the patients did not complete the treatment (with treatment completer status defined as participation in at least 10 of the 16 sessions; Brady, Dansky, Back, Foa, & Carroll, 2001). Likewise, in an evaluation of a PTSD-SUD treatment (Seeking Safety; Najavits, Weiss, & Liese, 1996), Najavits, Weiss, Shaw, and Muenz (1998) reported a treatment non-completion rate of 45% (with treatment completer status defined as attendance at 25% of sessions), consistent with results obtained by Hien et al. (2009) in an evaluation of Seeking Safety and a women's health education group for women with a PTSD-SUD diagnosis (where rates of treatment non-completion were 54% and 52%, respectively). In examining the efficacy of trauma-focused imaginal exposure or imagery-based relaxation among PTSD-SUD patients, Coffey, Stasiewicz, Hughes, and Brimo (2006) also found high rates of attrition (i.e., 60% did not attend all sessions). Further, attrition did not differ as a function of the type of treatment to which patients were assigned, suggesting that individuals with a PTSD-SUD diagnosis may be at greater risk for treatment non-completion regardless of treatment type. Finally, Ford, Hawke, Alessi, Ledgerwood, and Petry (2007) found that SUD patients in intensive outpatient treatment who did not complete 12 weeks of treatment were more likely to exhibit severe PTSD symptoms.¹

In addition to documenting high rates of treatment non-completion among PTSD-SUD patients, the results of these studies suggest that the association between PTSD and treatment non-completion among SUD patients is robust, emerging as significant even when

---

¹Although the majority of studies examining the effect of a combined PTSD-SUD diagnosis of treatment completion have demonstrated high rates of treatment attrition within this population, it is important to note that Najavits et al. (2007) found no significant differences in treatment drop-out rates between SUD patients with and without PTSD during a randomized controlled trial of manual-based psychotherapies for SUDs.

taking into account a number of other relevant factors, including demographics (e.g., gender, age, income, marital status), psychological distress, number of psychiatric or substance-related hospitalizations, childhood physical or sexual abuse, substance use severity, type of SUD treatment, or the presence of other Axis I disorders (Brady et al., 2001; Coffey et al., 2006; Ford et al., 2007; Najavits, Weiss, Shaw, & Muenz, 1998). Of note, however, all of these studies examined outpatient or specialized/combined PTSD-SUD treatments, resulting in a dearth of information on the impact of PTSD on treatment completion among SUD patients not in specialized treatment, such as residential SUD treatment. This is an important area of inquiry because 12% of SUD treatment seekers receive treatment in residential or day treatment settings (SAMHSA, 2009) and there is evidence to suggest that this group may represent a more impaired sub-sample of substance abusers (with greater co-occurring mental health issues and more severe substance abuse; see Chen et al., 2011).

Although findings from the previously discussed studies provide compelling evidence that patients with a PTSD-SUD diagnosis may be at high risk for not completing treatment, these studies also clearly indicate that many PTSD-SUD patients are able to complete treatment. Consequently, research is needed to identify factors that may moderate the relationship between co-occurring PTSD-SUD and SUD treatment completion. One such factor that warrants particular attention is distress tolerance (DT), defined as the willingness to withstand or persist in the face of aversive psychological states (Simons & Gaher, 2005). Emerging research indicates that PTSD symptom severity is associated with low DT (Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010; Vujanovic, Bonn-Miller, Potter, Marshall, & Zvolensky, 2011). In addition, low DT has been found to account for substance use motives among trauma-exposed individuals with PTSD symptoms (Potter, Vujanovic, Marshall-Berenz, Bernstein, & Bonn-Miller, 2011; Vujanovic, Marshall-Berenz, & Zvolensky, 2011), and to moderate the relation between anxiety sensitivity and PTSD symptoms (Berenz, Vujanovic, Coffey, & Zvolensky, 2012). Low DT has also been found to be associated with relapse and treatment failure among substance users. For example, the length of an individual's most recent duration of abstinence from alcohol or drugs has been found to be negatively associated with DT (Daughters, Lejuez, Kahler, Strong, & Brown, 2005). Likewise, Daughters, Lejuez, Bornovalova et al. (2005) found that low DT predicted 30-day residential SUD treatment drop-out among SUD patients (above and beyond other relevant predictors of SUD treatment drop-out). Together, this research provides evidence for the relevance of DT to the early stages of SUD recovery and SUD treatment completion, as well as the relevance of low DT to SUD patients with PTSD in particular.

The goal of the present study was to examine the main and interactive effects of a current PTSD diagnosis and low DT on the completion of residential SUD treatment. Although past research on DT in PTSD has relied primarily on self-report measures of DT that assess an individual's perceived ability to tolerate distress (Berenz et al., 2012; Marshall-Berenz et al., 2010; Marshall-Berenz et al., 2010; Potter et al., 2011; Vujanovic, Bonn-Miller et al., 2011, Vujanovic, Marshall-Berenz, & Zvolensky, 2011), we chose to use a behavioral measure of DT that assesses an individual's actual ability to tolerate distress in the moment. Such a behavioral measure has the benefit of providing an objective (vs. subjective) assessment of DT, and is consistent with past research examining the association between low DT and SUD treatment non-completion (which have likewise used behavioral DT measures; Daughters, Lejuez, Bornovalova, et al. 2005).

We also explored the moderating role of gender in the relation between PTSD, DT, and SUD treatment completion, given the well-documented gender differences in: (a) SUD treatment completion (e.g., King & Canada, 2004; Maglione, Chao, & Anglin, 2000); (b) DT (Gratz et al., 2011); and (c) the clinical manifestation of PTSD within both non-SUD

(Zlotnick, Zimmerman, Wolfsdorf, & Mattia, 2001) and SUD samples (Sonne, Back, Zuniga, Randall, & Brady, 2003). We hypothesized significant main effects of current PTSD and low DT on SUD treatment completion, such that patients with a current diagnosis of PTSD or low DT would complete a smaller proportion of their contracted treatment, consistent with previous studies examining the effects of PTSD (Ford et al., 2007) and DT (Daughters, Lejuez, Bornovalova et al., 2005) on SUD treatment completion. In addition, we hypothesized that these main effects would be qualified by a significant interaction between PTSD and DT, such that patients with PTSD and low DT would exhibit the lowest proportion of completed SUD treatment than all other groups. Given equivocal findings with regard to the specific nature and direction of gender differences in SUD treatment completion (with some studies finding that men are more likely to drop-out of treatment [Condelli, Koch, & Fletcher, 2000; Maglione et al., 2000] and others finding higher rates of treatment drop-out among women [Arfken, Klein, di Menza, & Schuster, 2001; King & Canada, 2004; Sayre et al., 2002]), no specific hypotheses were made with regard to the main or interactive effects of gender on SUD treatment completion.

Method

Participants

Participants were 214 substance dependent patients (63% male) consecutively admitted to a residential SUD treatment facility in the Jackson, Mississippi area. Participants ranged in age from 18 to 61, with an average age of 36 ($SD = 10.38$). In regard to their racial/ethnic background, 55% were White, 36% were Black/African-American, 5% were Native American, and 4% were of another racial/ethnic background. The majority of the participants were single (70%) and low-income ($< \$10,000$ income = 47%; $> \$30,001$ = 21%). With regard to their educational attainment, 27% had not completed high school or received a GED, 35% had completed high school or received a GED, 32% had attended at least some college or technical school, and 7% had completed college or beyond.

Setting

Standard treatment at this residential SUD treatment facility involves a mix of strategies from Alcoholics Anonymous and Narcotics Anonymous, as well as groups on relapse prevention. The center requires complete abstinence from drugs and alcohol, with the exception of nicotine and caffeine (methadone maintenance is not available). Drug testing is done, and any use results in immediate dismissal from the facility. Aside from scheduled activities, residents are not permitted to leave the treatment facility. Contract durations for the treatment facility range from approximately 30 to 45 days. Average contract duration for the present sample was 34.28 days ($SD = 5.72$).

Measures

Assessment of demographic information—All participants completed a general demographics form assessing age, racial/ethnic background, marital status, education, income in the past year, current use of psychotropic medications, and court-ordered treatment status (court-ordered vs. voluntary).

Diagnostic assessment measures—In order to establish current PTSD diagnoses, all participants were interviewed using the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1990). The CAPS is a structured PTSD diagnostic interview and the most widely used PTSD measure (Elhai, Gray, Kashdan, & Franklin, 2005). It assesses the frequency and intensity of the 17 DSM-IV PTSD symptoms (plus eight associated symptoms). Frequency items are rated from 0 (never or none/not at all) to 4 (daily or almost every day or more than 80%). Intensity items are rated from 0 (none) to 4 (extreme). The CAPS has adequate

interrater reliability (.92–.99), internal consistency (.73–.85), and convergent validity with the Structured Clinical Interview for DSM-IV Axis I disorders (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996) and other established measures of PTSD (Weathers et al., 2001). In addition, the robust psychometric properties of the CAPS have been supported in a variety of combat and civilian samples, including substance dependent patients (e.g., Blake et al., 1990; Brown et al., 1996; Shalev, Freedman, Peri, Brandes, & Sahar, 1997; Weathers et al., 2001).

Participants were also interviewed using the SCID-IV (First et al., 1996) to provide an assessment of current Axis I disorders (other than PTSD), and the borderline personality disorder (BPD) module of the Diagnostic Interview for DSM-IV Personality Disorders (DIPD-IV; Zanarini, Frankenburg, Sickel, & Young, 1996) to assess the presence of current BPD symptoms (Zanarini et al., 2000). Finally, given the relevance of antisocial personality features to negative clinical outcomes among SUD patients (see Daughters, Sargeant, Bornovalova, Gratz, & Lejuez, 2008), the legal status subscale of the Addiction Severity Index – 5th Edition (ASI; McLellan et al., 1992) was administered to assess frequency of criminal behavior (one of the key features of antisocial personality pathology in the DSM-IV [APA, 2000] and among SUD patients in particular [Brooner et al., 2010]). Interviews were conducted by bachelors- or masters-level clinical assessors trained to reliability with the principal investigator (MTT) and co-investigator (KLG). All interviews were reviewed by the principal investigator, with diagnoses confirmed in consensus meetings.

Assessment of DT—The Paced Auditory Serial Addition Task – Computerized Version (PASAT-C; Lejuez, Kahler, & Brown, 2003) was used to assess DT. During this task, numbers are sequentially flashed on a computer screen, and participants are instructed to sum the most recent number with the previous number (using the computer mouse to click on the correct answer). After providing each sum, the participant must ignore the sum and add the following number to the most recently presented number. When a correct answer is provided, a point is obtained. If an incorrect answer is provided, or if the participant fails to provide an answer before the next number is presented, an “explosion” sound is played and the score does not change.

The version of the PASAT-C used in this study consisted of 3 levels with increasingly shorter latencies between number presentations. Because the correct answer must be provided before the presentation of the next number to obtain a point, difficulty increases as latencies decrease. Level 1 (low difficulty) had a 3-second latency between number presentations, Level 2 (medium difficulty) had a 2-second latency, and Level 3 (high difficulty) had a 1-second latency. The first level lasted 3 minutes, the second level lasted 5 minutes, and the third level lasted 7 minutes and included an option to terminate the task at any time. To determine whether DT is best represented as a continuous or dichotomous variable, we examined whether latency in seconds to task termination was normally distributed. According to the Shapiro-Wilk test (Shapiro & Wilk, 1965), latency to terminate the PASAT-C was not normally distributed ($z_{\text{skew}} = 5.18, p < .05$; $z_{\text{kurtosis}} = 3.85, p < .05$), supporting dichotomization of this variable (see MacCallum, Zhang, Preacher, & Rucker, 2002). Providing further support for the use of a dichotomous DT variable, the vast majority (86%) of participants who terminated the PASAT-C did so within the first 2 minutes of the final level, and the mean latency to terminate the PASAT-C among participants who quit the PASAT-C was 57.48 sec ($SD = 84.65$). Consequently, and consistent with previous studies (e.g., Anestis, Gratz, Bagge, & Tull, in press; Gorka, Ali, & Daughters, in press; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Schloss & Haaga, 2011), DT was indexed by quit status, with individuals who persisted until the end of the task categorized as having high DT and those who quit the task categorized as having low DT.

As a manipulation check to ensure that the task induced emotional distress, participants rated their level of anxiety, frustration, and irritation both before the task (pre-task) and immediately prior to receiving the option to terminate the task (post-task). Each item was rated from 0 to 100, with the average rating across all forms of distress used to examine changes in distress in response to the task (see Manipulation Check below).

The PASAT-C has been used extensively with patients in residential SUD treatment (e.g., Anestis, Tull, Bagge, & Gratz, in press; Bornovalova et al., 2008; Daughters, Sargeant, et al., 2008; Daughters, Lejuez, Bornovalova et al., 2005; Gratz, Bornovalova, Delany-Brumsey, Nick, & Lejuez, 2007). In support of the construct validity of the PASAT-C, this task has been shown to induce emotional distress in the form of anxiety, anger, frustration, and irritability among clinical and non-clinical samples (e.g., Bornovalova et al., 2008; Gratz et al., 2011; Lejuez et al., 2003), and to be significantly correlated with self-report measures of emotion dysregulation and the unwillingness to experience emotional distress (Gratz et al., 2006). Further, providing evidence for its convergent and predictive validity, substance users with (vs. without) both BPD (Bornovalova et al., 2008) and antisocial personality disorder (Daughters, Sargeant et al., 2008) have been found to exhibit low DT, and low DT has been found to predict early treatment dropout among substance users in residential SUD treatment (Daughters, Lejuez, Bornovalova et al., 2005). Finally, providing evidence that persistence on this task is not simply a measure of skill level or emotional distress in response to the task, neither emotional distress in response to the task nor task performance has been found to be significantly associated with task termination (Bornovalova et al., 2008; Daughters, Sargeant et al., 2008; Gratz et al., 2007).

Assessment of treatment completion—To assess treatment completion, we calculated the proportion of actual days in treatment to treatment contract length. To increase the likelihood that we were capturing treatment non-completion with this variable, participants who left treatment early upon the advice of treatment staff for non-disciplinary reasons (i.e., they successfully completed the residential SUD treatment program) were considered to have completed the full length of their treatment contract. This ensured that participants who were classified as not completing the full-length of their treatment contract either: (a) left treatment prematurely against medical advice, or (b) were required to leave treatment due to breaking rules of the residential treatment program (e.g., using or selling substances, acting aggressively towards other patients or staff, or engaging in sexual relations with other patients). Although previous studies examining treatment completion have generally classified patients as treatment completers versus non-completers (e.g., Daughters, Lejuez, Bornovalova et al., 2005; Daughters, Stipelman et al., 2008; Ford et al., 2007; Lejuez et al., 2008; Martínez-Raga, Marshall, Keaney, Ball, & Strang, 2002), evidence suggests a positive association between treatment retention and clinical outcomes, with longer durations of residential SUD treatment associated with better outcomes (e.g., Dale et al., 2011; Simpson, Joe, & Brown, 1997). Thus, it is likely that treatment non-completers who remain in treatment longer experience some benefit from treatment (compared to those who drop out of treatment sooner). Consequently, we examined treatment retention as a continuous variable in order to better examine the effect of PTSD, gender, and DT on the length of time patients remain in treatment prior to dropping out or being prematurely discharged.

Procedure

All procedures were reviewed and approved by the University of Mississippi Medical Center's Institutional Review Board. To be eligible for inclusion in the study, participants were required to have: 1) obtained a Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975) score of ≥ 24 ; and 2) exhibited no current psychotic disorders (as determined by the SCID-IV). Eligible participants were recruited for this study no sooner

than 72 hours after entry in the facility (to limit the possible interference of withdrawal symptoms on study engagement). Those who met inclusion criteria were provided with information about study procedures (including the collection of treatment completion data from treatment facility administrative staff) and associated risks, following which written informed consent was obtained. All participants took part in this study within their first two weeks of treatment. To reduce participant burden, the study protocol was conducted across two different sessions and participants were paid \$15 per session. Treatment completion data were collected from administrative staff once the patient was discharged from the treatment facility. Specifically, information regarding length of stay, contract length, and reason for discharge (e.g., center-initiated due to breaking of facility rules, patient-initiated against medical advice, or successful completion of treatment) was provided by administrative staff.

Results

Preliminary Analyses

Descriptive data for all participants is presented in Table 1. Based on the CAPS, 29% ($n = 61$) of participants met criteria for a current diagnosis of PTSD, and 70% ($n = 149$) were classified as having low DT on the PASAT-C. There was not a significant difference in DT across participants with vs. without PTSD, $\chi^2(2) = 0.02, p = .88$. Approximately 12% of participants dropped out of treatment against medical advice, and the average percentage of treatment completed across all participants was 95%. Finally, given that our dependent variable was represented as a proportion (i.e., proportion of treatment completed), we transformed this variable using an arcsine transformation (the suggested method when using proportion data; Sheskin, 2004).

Manipulation check—Providing support for the use of quit status on the PASAT-C as a measure of the willingness to tolerate distress (DT), results of a 2 (PTSD vs. no current PTSD) $\times$ 2 (female vs. male) $\times$ 2 (pre- vs. post-task) repeated measures analysis of variance (ANOVA) for emotional distress revealed a significant main effect of time, $F(1, 209) = 83.91, p < 0.001, \eta^2 = 0.29$, with all participants reporting an increase in distress in response to the PASAT-C. Further, the PTSD $\times$ gender $\times$ time interaction was not significant, $F(1, 209) = 1.98, p = 0.16, \eta^2 = 0.01$, indicating that the task resulted in a comparable increase in distress across PTSD status and gender.

Identification of covariates—Prior to conducting primary analyses, in order to identify potential covariates (see Tabachnick & Fidell, 2007), a series of Pearson product-moment and point-biserial correlation analyses was conducted to explore associations between the dependent variable (proportion of treatment contract completed) and demographic factors (i.e., age, racial/ethnic background, income, education level, marital status, and employment), diagnostic variables (mood and anxiety disorders, specific substance use disorders, and BPD), psychotropic medication use (yes vs. no), criminal behavior, court-ordered treatment status (yes vs. no), and treatment contract length. Given the small number of participants in many of the demographic categories, these variables were collapsed into dichotomous variables of: (1) White (55%) versus non-White (45%); (2) past year income of $< \$10,000$ (47%) versus $\geq \$10,000$ (53%); (3) a high school education or less (61%) versus some post-high school education (39%); (4) single (70%) versus in a committed relationship (30%); and (5) unemployed (70%) versus employed (30%). Age was found to be significantly positively associated with the proportion of treatment completed (transformed; $r = 0.14, p = .048$). No other variables were found to be significantly associated with the dependent variable ($r \leq |0.13|, p > 0.05$). Consequently, only age was included in subsequent analyses as a covariate.

Primary Analyses

To test hypotheses, we conducted a 2 (current PTSD vs. no PTSD) $\times$ 2 (female vs. male) $\times$ 2 (high-DT vs. low-DT) analysis of covariance (ANCOVA; controlling for age), with proportion of treatment completed (arcsine transformed) serving as the dependent variable (see Table 2 for mean treatment completion proportions across all groups). Although no significant main effects were found, results did reveal a significant gender $\times$ DT interaction, $F(1, 205) = 4.99, p = 0.03, \eta^2 = 0.02$, as well as a significant PTSD $\times$ gender $\times$ DT interaction, $F(1, 205) = 6.17, p = 0.01, \eta^2 = 0.03$ (see Table 3).²

Despite evidence of a significant gender $\times$ DT interaction, post-hoc analyses revealed no significant differences in the proportion of treatment completed across male and female participants with high versus low DT. With regard to the PTSD $\times$ gender $\times$ DT interaction, post-hoc analyses indicated that, among men, those with a current diagnosis of PTSD and low DT completed a significantly lower proportion of residential SUD treatment compared to all other groups ($t[\text{dfs} = 23\text{--}88] > 2.30, ps < 0.02$; see Table 2). Of note, the PTSD $\times$ gender $\times$ DT interaction also remained significant when no covariates were included in the model, $F(1, 203) = 4.50, p = 0.04, \eta^2 = 0.02$.

Given the theoretical relevance of contract length and court-ordered treatment status to SUD treatment completion (Daughters, Lejuez, Bornoalova et al., 2005; Lejuez et al., 2008), we reran the primary analyses controlling for these two variables. Evidence of a significant PTSD $\times$ gender $\times$ DT interaction remained, $F(1, 203) = 5.91, p = 0.046, \eta^2 = 0.03$. Finally, given the relevance of antisocial personality pathology to both PTSD (e.g., Goodwin & Hamilton, 2003) and SUD treatment non-completion (e.g., Daughters, Stipelman et al., 2008; Greenberg, Otero, & Villanueva, 1994; Martínez-Raga et al., 2002), the primary analyses were also conducted controlling for court-ordered treatment status, criminal behavior, and number of impulsive behaviors (e.g., aggressive behavior, spending sprees, risky sexual behavior, and other antisocial behaviors) as assessed by the BPD module of the DIPD-IV (to provide a proxy for the presence of antisocial personality features). The significant PTSD $\times$ gender $\times$ DT interaction remained, $F(1, 200) = 5.02, p = 0.03, \eta^2 = 0.02$.

Discussion

The purpose of this study was to examine the main and interactive effects of current PTSD, DT, and gender on completion of residential SUD treatment. Hypotheses were partially supported. Contrary to past research (e.g., Daughters, Lejuez, Bornoalova et al., 2005; Ford et al., 2007; King & Canada, 2004; Maglione et al., 2000), we did not find the expected main effects of PTSD, DT, and gender on SUD treatment non-completion. However, consistent with hypotheses, we did find evidence that DT and gender moderated the effect of PTSD on SUD treatment non-completion. Specifically, male SUD patients with a current diagnosis of PTSD and low DT completed a lower proportion of treatment than all other male SUD patients. These results suggest that, at least among men, DT may play an important role in residential SUD treatment completion among SUD patients with PTSD.

PTSD has been found to be associated with the experience of more intense and frequent negative affective states (Newton & Ho, 2008; Orsillo, Batten, Plumb, Luterek, & Roessner, 2004; Tull, Jakupcak, McFadden, & Roemer, 2007), and studies have found that SUD patients with PTSD are most likely to relapse in the context of negative affective states (Ouimette, Coolhart, Funderburk, Wade, & Brown, 2007; Tate, Brown, Unrod, & Ramo,

²A significant PTSD $\times$ gender $\times$ DT interaction was also found when using a continuous measure of DT (i.e., latency to terminate the PASAT-C), $\eta^2 = 0.28, R^2 = .07, p = .02$, overall model $F(8, 205) = 1.99, p = .049$.

2004). Consequently, SUD patients with PTSD and low DT may experience difficulties in withstanding intense and frequent emotional distress that may occur in the context of residential SUD treatment. As a result, they may be more likely to leave treatment prematurely to seek out substances as a way of escaping their distress, or engage in other maladaptive behaviors (e.g., aggression) that violate residential SUD treatment center rules as a way of regulating their distress.

It is also possible that the experience of emotional distress and the inability to tolerate that distress may increase the risk for impulsive behaviors among SUD patients with PTSD, consistent with an ego-depletion model of self-regulation (Baumeister, Bratslavsky, Muraven, & Tice, 1998). According to this model, the capacity for self-regulation is a limited resource (similar to energy or strength). Thus, exposure to any situation or activity that requires self-regulation or self-control will deplete this resource, temporarily limiting one's capacity for self-regulation (Baumeister et al., 1998; Muraven, Tice, & Baumeister, 1998). The high levels of negative emotional arousal that accompany a PTSD diagnosis may rapidly deplete an individual's self-regulatory resources (Baumeister et al., 1998; Muraven et al., 1998), limiting the resources available for managing behavior in other situations that may be encountered. Consequently, such individuals may be more likely to make rash or impulsive decisions or exhibit difficulties controlling maladaptive behaviors, increasing the risk that they will violate residential SUD treatment rules and be prematurely discharged from treatment.

The absence of significant main effects of PTSD and DT on treatment non-completion suggest that the interrelations of PTSD, DT, and SUD treatment completion are more complex than expected, and highlight the importance of exploring the different contexts in which patients with PTSD or low DT may be at heightened risk for negative clinical outcomes. For example, although Gorka et al. (in press) found that DT was not significantly associated with problematic alcohol use at a zero-order level, the combination of low DT and more severe depressive symptoms was predictive of problematic alcohol use. Likewise, Tull, McDermott, Gratz, Coffey, and Lejuez (2011) found that co-occurring PTSD among cocaine dependent inpatients was associated with an attentional bias toward cocaine cues only in the context of trauma-related distress. Finally, whereas Anestis, Tull et al. (in press) found no evidence of a unique association between DT or PTSD and medically-attended suicide attempts, PTSD was found to interact with high DT in predicting such attempts. Together with the results of the present study, these findings demonstrate the importance of examining the specific contexts in which PTSD and DT may affect a variety of negative clinical outcomes, including SUD treatment completion.

It is also important to note that findings demonstrating the relevance of DT to SUD treatment completion among SUD patients with PTSD were obtained only among men. A growing body of research indicates that the manifestation of PTSD may be influenced by individual differences in the extent to which individuals externalize or internalize their distress (e.g., Forbes, Elhai, Miller, & Creamer, 2010; Miller, Greif, & Smith, 2003; Miller, Kaloupek, Dillon, & Keane, 2004; Rielage, Hoyt, & Renshaw, 2010), with the externalizing subtype of PTSD characterized by greater emotional lability, substance misuse, aggressiveness, impulsivity, and distrust of others (Miller et al., 2003). Importantly, Miller et al. (2003) have suggested that men may be more likely to exhibit the externalizing subtype of PTSD than women. Consequently, it is possible that male (vs. female) patients with PTSD in our sample were more likely to exhibit behaviors consistent with an externalizing subtype of PTSD, thereby increasing their risk for violating treatment center rules and being prematurely discharged from SUD treatment. Providing further support for this interpretation of our findings (as well as the relevance of PTSD to SUD treatment completion), the interactive effect of PTSD, DT, and remained significant even when

controlling for antisocial personality features, including court-ordered treatment status, criminal behavior, and impulsive behaviors. Nonetheless, although we were able to account for the influence of several key features of antisocial personality disorder, we did not actually assess for the presence of an antisocial personality disorder diagnosis. Thus, future studies would benefit from the assessment of antisocial personality disorder and consideration of this diagnosis in the relations between PTSD, low DT, and SUD treatment completion.

Although the results of this study provide preliminary evidence for the relevance of low DT to residential SUD treatment non-completion among male SUD patients with PTSD, these findings must be evaluated in light of the study's limitations. First, we examined only whether or not participants were prematurely discharged from residential SUD treatment. As a result, it remains unclear if the patients who did not complete treatment eventually relapsed or experienced some other negative clinical outcome (e.g., incarceration). Consequently, it will be important for future studies to utilize longer follow-up periods to examine whether PTSD-SUD patients who drop-out of residential SUD treatment are at risk for experiencing other negative clinical outcomes in the long-term. Future studies may also benefit from examining larger samples of patients with SUDs. Such investigations may bring attention to additional factors that contribute to treatment non-completion that we were unable to identify due to low power. For example, treatment non-completers were found to exhibit a higher rate of major depression (36%) than treatment completers (19%) in the present study. Although not statistically significant, the difference between these two groups in major depression is notable and suggests the need to further examine the role of this variable in SUD treatment retention in future studies.

In addition, we examined treatment non-completion within a residential SUD treatment program where contract lengths are restricted to 30–45 days. Therefore, the extent to which our findings would generalize to other SUD treatment programs (such as outpatient SUD treatment programs or residential SUD treatment programs with longer stays) remains unclear. Indeed, our rate of treatment non-completion (12%) was lower than the rates reported in other studies (e.g., 25.3%) that examined SUD patients with longer contract lengths (e.g., 30 to 180 days; Lejuez et al., 2008). Likewise, we did not recruit participants within the first 72 hours of their admission to the treatment center in order to limit the potential interference of withdrawal symptoms on study engagement and task performance (see also Coffey, Dansky, Carrigan, & Brady, 2000; West & Gossop, 1994). Although we believe this decision provides us with a more accurate and stable index of participants' DT (and, thus, the impact of DT on treatment retention), it may also have influenced our assessment of treatment retention. Specifically, by waiting three days to recruit participants, it is possible that some participants with particularly low DT (who could not tolerate the discomfort of acute withdrawal) may have left the treatment facility prior to the study recruitment period. Together, the relatively short contract lengths within the treatment center examined here, combined with the standard procedure in laboratory-based SUD studies of waiting 72 hrs before enrolling participants, may have inflated the SUD treatment retention rate obtained here.

Furthermore, although the use of a laboratory-based DT task is a strength of this study (as it assesses DT in the context of actual distress and is not susceptible to some of the limitations of self-report measures of DT), future research would benefit from the multimodal assessment of DT. Indeed, a growing body of research suggests that self-report and behavioral measures of DT are often not significantly intercorrelated (Anestis, Lavender et al., in press; Bernstein, Marshall, & Zvolensky, 2011; McHugh et al., 2011) and are differentially associated with a variety of clinical outcomes (Anestis, Lavender et al., in press; Bernstein et al., 2011; see also Zvolensky, Leyro, Bernstein, & Vujanovic, 2011).

Consequently, it is possible that self-report and behavioral DT measures are capturing different (unique) aspects of a single construct or assessing two separate constructs. Future research exploring the unique effects of perceived and actual DT on the negative clinical outcomes observed among PTSD-SUD patients may help inform the development of more comprehensive and effective treatment programs for PTSD-SUD patients.

Likewise, although the PASAT-C is an empirically supported laboratory stressor (see Zvolensky et al., 2011) and resulted in a significant increase in emotional distress among the participants in this sample, it is a general stressor. Thus, it may not induce distress comparable to that experienced in real world contexts among individuals with PTSD. As such, studies that utilize more personally-relevant or PTSD-relevant stressors (e.g., examination of the willingness to tolerate trauma-related distress in particular, or the assessment of DT following trauma cue exposure) may produce results with greater generalizability, as well as findings with larger effect sizes than what was obtained here. In addition, future studies would benefit from exploring whether the tolerance of specific emotional states (e.g., anxiety, anger, shame) improves our understanding of the effect of PTSD on SUD treatment completion.

Finally, although not necessarily a limitation, we only found evidence for the moderating role of low DT among male SUD patients with PTSD, suggesting the need to identify and evaluate other psychological variables that may influence treatment completion among female SUD patients with PTSD. One variable worth exploring may be anxiety sensitivity, given evidence that anxiety sensitivity is elevated among individuals with PTSD (Cox, Borger, & Enns, 1999) and has been found to predict residential SUD treatment drop-out (Lejuez et al., 2008). Further, although related to DT, anxiety sensitivity and DT have been found to be uniquely associated with SUD-relevant outcomes (e.g., alcohol use problems; Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010).

Despite limitations, results suggest that male SUD patients with both PTSD and low DT may be at heightened risk for SUD treatment non-completion. These results suggest that PTSDSUD patients (particularly men) may benefit from learning DT skills while in residential SUD treatment. One intervention that may be particularly useful in this regard is Skills for Improving Distress Intolerance, a six-session individual treatment for low DT that has been found to significantly improve DT among patients in residential SUD treatment (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, in press). Likewise, literature suggests that the incorporation of skills from Dialectical Behavior Therapy (DBT; Linehan, 1993) into SUD treatment may improve treatment retention (Coffey, Schumacher, Brimo, & Brady, 2005). Incorporating DBT DT skills training into residential SUD treatment programs may increase the ability of male SUD patients with PTSD to control their behaviors and act effectively in the context of intense and unpleasant emotional experiences. Likewise, research examining the utility of PTSD-specific treatments that increase tolerance of trauma-specific distress (e.g., Prolonged Exposure; Foa, Hembree, & Rothbaum, 2007; see also Vujanovic, Bernstein, & Litz, 2011) within SUD populations is also needed. Finally, although there are available treatments for individuals with a combined PTSDSUD diagnosis (see Riggs & Foa, 2008), the extent to which these treatments actually improve DT is unclear. Consequently, future research is needed to determine whether and how these treatments improve residential SUD treatment retention within this population.

Acknowledgments

Support for this study was provided in part by R21 DA022383 from the National Institute on Drug Abuse of the National Institutes of Health awarded to the first author (MTT). The authors would like to thank Dr. Carl W. Lejuez, Bettye Van Norman, Melissa Soenke, Sarah Anne Moore, Rachel Brooks, and Jessica Fulton for their assistance with this project.

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed., Text Revision. Author; Washington, DC: 2000.
- Anestis MD, Gratz KL, Bagge CL, Tull MT. The interactive role of distress tolerance and borderline personality disorder in suicide attempts among substance users in residential treatment. *Comprehensive Psychiatry*. in press.
- Anestis MD, Tull MT, Bagge CL, Gratz KL. The moderating role of distress tolerance in the relationship between posttraumatic stress disorder symptom clusters and suicidal behavior among trauma-exposed substance users in residential treatment. *Archives of Suicide Research*. in press.
- Arfken CL, Klein C, di Menza S, Schuster CR. Gender differences in problem severity at assessment and treatment retention. *Journal of Substance Abuse Treatment*. 2001; 20:53–57. [PubMed: 11239728]
- Back SE, Dansky BS, Carroll KM, Foa EB, Brady KT. Exposure therapy in the treatment of PTSD among cocaine-dependent individuals: Description of procedures. *Journal of Substance Abuse Treatment*. 2001; 21:35–45. [PubMed: 11516925]
- Back S, Dansky BS, Coffey SF, Saladin ME, Sonne S, Brady KT. Cocaine dependence with and without posttraumatic stress disorder: A comparison of substance use, trauma history and psychiatric comorbidity. *The American Journal on Addictions*. 2000; 9:51–62. [PubMed: 10914293]
- Baumeister RF, Bratslavsky E, Muraven M, Tice DM. Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*. 1998; 74:1252–1265. [PubMed: 9599441]
- Berenz EC, Vujanovic AA, Coffey SF, Zvolensky MJ. Anxiety sensitivity and breath-holding duration in relation to PTSD symptom severity among trauma exposed adults. *Journal of Anxiety Disorders*. 2012; 26:134–139. [PubMed: 22047652]
- Bernstein A, Marshall EC, Zvolensky MJ. Multi-method evaluation of distress tolerance measures and construct(s): Concurrent relations to mood and anxiety psychopathology and quality of life. *Journal of Experimental Psychopathology*. 2011; 2:386–399.
- Blake, DD.; Weathers, FW.; Nagy, L.; Kaloupek, DG.; Klauminzer, G.; Charney, DS.; Keane, TM. *The Clinician Administered PTSD Scale*. National Center for PTSD- Behavioral Science Division; Boston: 1990.
- Bornoalova MA, Gratz KL, Daughters SB, Hunt ED, Lejuez CW. Initial RCT of a distress tolerance treatment for individuals with substance use disorders. *Drug and Alcohol Dependence*. in press.
- Bornoalova MA, Gratz KL, Daughters SB, Nick B, Delany-Brumsey A, Lynch TR, Lejuez CW. A multimodal assessment of the relationship between emotion dysregulation and borderline personality disorder among inner-city substance users in residential treatment. *Journal of Psychiatric Research*. 2008; 42:717–726. [PubMed: 17868698]
- Brady KT, Back SE, Coffey SF. Substance abuse and posttraumatic stress disorder. *Current Directions in Psychological Science*. 2004; 13:206–209.
- Brady KT, Dansky BS, Back SE, Foa EB, Carroll KM. Exposure therapy in the treatment of PTSD among cocaine-dependent individuals: Preliminary findings. *Journal of Substance Abuse Treatment*. 2001; 21:47–54. [PubMed: 11516926]
- Brooner, RK.; Disney, ER.; Neufeld, KJ.; King, VL.; Kidorf, J.; Stoller, KB. Antisocial personality disorder in patients with substance use disorders. In: Nunes, EV.; Selzer, J.; Levounis, P.; Davies, CA., editors. *Substance dependence and co-occurring psychiatric disorders: Best practices for diagnosis and treatment*. Civic Research Institute; Kingston, NJ: 2010. p. 1-26.
- Brown PJ, Stout RL, Mueller T. Posttraumatic stress disorder and substance abuse relapse among women: A pilot study. *Psychology of Addictive Behaviors*. 1996; 10:124–128.
- Brown PJ, Stout RL, Mueller T. Substance use disorder and posttraumatic stress disorder comorbidity: Addiction and psychiatric treatment rates. *Psychology of Addictive Behaviors*. 1999; 13:115–122.
- Chen KW, Banducci AN, Guller L, Macatee RJ, Lavelle A, Daughters SB, Lejuez CW. An examination of psychiatric comorbidities as a function of gender and substance type within an inpatient substance use treatment program. *Drug and Alcohol Dependence*. 2011; 118:92–99. [PubMed: 21514751]

- Coffey SF, Dansky BS, Carrigan M, Brady KT. Acute and protracted cocaine abstinence in an outpatient population: A prospective study of mood, sleep, and withdrawal symptoms. *Drug and Alcohol Dependence*. 2000; 59:277–286. [PubMed: 10812287]
- Coffey SF, Schumacher JA, Brimo ML, Brady KT. Exposure therapy for substance abusers with PTSD: Translating research to practice. *Behavior Modification*. 2005; 29:10–38. [PubMed: 15557477]
- Coffey SF, Stasiewicz PR, Hughes PM, Brimo ML. Trauma-focused imaginal exposure for individuals with comorbid posttraumatic stress disorder and alcohol dependence: Revealing mechanisms of alcohol craving in a cue reactivity paradigm. *Psychology of Addictive Behaviors*. 2006; 20:425–435. [PubMed: 17176177]
- Condelli WS, Koch MA, Fletcher B. Treatment refusal/attrition among adults randomly assigned to programs at a drug treatment campus: The New Jersey Substance Abuse Treatment Campus, Seacaucus, NJ. *Journal of Substance Abuse Treatment*. 2000; 18:395–407. [PubMed: 10812314]
- Cox, BJ.; Borger, SC.; Enns, MW. Anxiety sensitivity and emotional disorders: Psychometric studies and their theoretical implications. In: Taylor, S.; Taylor, S., editors. *Anxiety sensitivity: Theory, research, and treatment of the fear of anxiety*. Lawrence Erlbaum Associates Publishers; Mahwah, NJ US: 1999. p. 115-148.
- Dale V, Coulton S, Godfrey C, Copello A, Hodgson R, Heather N, Tober G. Exploring treatment attendance and its relationship to outcome in a randomized controlled trial of treatment for alcohol problems: Secondary analysis of the UK Alcohol Treatment Trial (UKATT). *Alcohol and Alcoholism*. 2011; 46:592–599. [PubMed: 21733833]
- Daughters SB, Lejuez CW, Bornoalova MA, Kahler CW, Strong DR, Brown RA. Distress tolerance as a predictor of early treatment dropout in a residential substance abuse treatment facility. *Journal of Abnormal Psychology*. 2005; 114:729–734. [PubMed: 16351393]
- Daughters SB, Lejuez CW, Kahler CW, Strong DR, Brown RA. Psychological distress tolerance and duration of most recent abstinence attempt among residential treatment-seeking substance abusers. *Psychology of Addictive Behaviors*. 2005; 19:208–211. [PubMed: 16011392]
- Daughters SB, Sargeant MN, Bornoalova MA, Gratz KL, Lejuez CW. The relationship between distress tolerance and antisocial personality disorder among male inner-city treatment seeking substance users. *Journal of Personality Disorders*. 2008; 22:509–524. [PubMed: 18834298]
- Daughters SB, Stipelman BA, Sargeant MN, Schuster R, Bornoalova MA, Lejuez CW. The interactive effects of antisocial personality disorder and court-mandated status on substance abuse treatment dropout. *Journal of Substance Abuse Treatment*. 2008; 34:157–164. [PubMed: 17869050]
- Deane FP, Wootton DJ, Hsu C, Kelly PJ. Predicting dropout in the first 3 months of 12-step residential drug and alcohol treatment in an Australian sample. *Journal of Studies on Alcohol and Drugs*. 2012; 73:216–225. [PubMed: 22333329]
- Elhai JD, Gray MJ, Kashdan TB, Franklin C. Which instruments are most commonly used to assess traumatic event exposure and posttraumatic effects?: A survey of traumatic stress professionals. *Journal of Traumatic Stress*. 2005; 18:541–545. [PubMed: 16281252]
- Fenton MC, Keyes K, Geier T, Greenstein E, Skodol A, Krueger B, Grant BF, Hasin DS. Psychiatric comorbidity and the persistence of drug use disorders in the United States. *Addiction*. 2012; 107:599–609. [PubMed: 21883607]
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. *Structured Clinical Interview for DSM-IV Axis I Disorders. Patient Edition (SCID-I/P, Version 2.0)*. New York State Psychiatric Institute; New York, NY: 1996. Unpublished measure
- Foa, EB.; Hembree, EA.; Rothbaum, B. *Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences: Therapist guide*. Oxford University Press; New York, NY US: 2007.
- Folstein MF, Folstein SE, McHugh PR. Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*. 1975; 12:189–198. [PubMed: 1202204]
- Forbes D, Elhai JD, Miller MW, Creamer M. Internalizing and externalizing classes in posttraumatic stress disorder: A latent class analysis. *Journal of Traumatic Stress*. 2010; 23:340–349. [PubMed: 20564366]

- Ford JD, Hawke J, Alessi S, Ledgerwood D, Petry N. Psychological trauma and PTSD symptoms as predictors of substance dependence treatment outcomes. *Behaviour Research and Therapy*. 2007; 45:2417–2431. [PubMed: 17531193]
- Gratz KL, Bornovalova MA, Delany-Brumsey A, Nick B, Lejuez CW. A laboratory-based study of the relationship between childhood abuse and experiential avoidance among inner-city substance users: The role of emotional nonacceptance. *Behavior Therapy*. 2007; 38:256–268. [PubMed: 17697851]
- Gratz KL, Hepworth C, Tull MT, Paulson A, Clarke S, Remington B, Lejuez CW. An experimental investigation of emotional willingness and physical pain tolerance in deliberate self-harm: The moderating role of interpersonal distress. *Comprehensive Psychiatry*. 2011; 52:63–74. [PubMed: 21220067]
- Gratz KL, Rosenthal M, Tull MT, Lejuez CW, Gunderson JG. An experimental investigation of emotion dysregulation in borderline personality disorder. *Journal of Abnormal Psychology*. 2006; 115:850–855. [PubMed: 17100543]
- Greenberg WM, Otero J, Villanueva L. Irregular discharge from a dual diagnosis unit. *American Journal of Drug and Alcohol Abuse*. 1994; 20:355–371. [PubMed: 7977220]
- Goodwin RD, Hamilton SP. Lifetime comorbidity of antisocial personality disorder and anxiety disorders among adults in the community. *Psychiatry Research*. 2003; 117:159–166. [PubMed: 12606017]
- Gorka SM, Ali B, Daughters SB. The role of distress tolerance in the relationship between depressive symptoms and problematic alcohol use. *Psychology of Addictive Behaviors*. in press.
- Hien DA, Nunes E, Levin F, Fraser D. Posttraumatic stress disorder and short-term outcome in early methadone maintenance treatment. *Journal of Substance Abuse Treatment*. 2000; 19:31–37. [PubMed: 10867298]
- Hien DA, Wells EA, Jiang H, Suarez-Morales L, Campbell AC, Cohen LR, Nunes EV. Multisite randomized trial of behavioral interventions for women with co-occurring PTSD and substance use disorders. *Journal of Consulting and Clinical Psychology*. 2009; 77:607–619. [PubMed: 19634955]
- Howell AN, Leyro TM, Hogan J, Buckner JD, Zvolensky MJ. Anxiety sensitivity, distress tolerance, and discomfort tolerance in relation to coping and conformity motives for alcohol use and alcohol use problems among young adult drinkers. *Addictive Behaviors*. 2010; 35:1144–1147. [PubMed: 20719435]
- Kessler RC, Chiu W, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 62:617–627. [PubMed: 15939839]
- King AC, Canada SA. Client-related predictors of early treatment drop-out in a substance abuse clinic exclusively employing individual therapy. *Journal of Substance Abuse Treatment*. 2004; 26:189–195. [PubMed: 15063912]
- Lejuez CW, Kahler CW, Brown RA. A modified computer version of the Paced Auditory Serial Addition Task (PASAT) as a laboratory-based stressor. *The Behavior Therapist*. 2003; 26:290–293.
- Lejuez CW, Zvolensky MJ, Daughters SB, Bornovalova MA, Paulson A, Tull MT, Otto MW. Anxiety sensitivity: A unique predictor of dropout among inner-city heroin and crack/cocaine users in residential substance use treatment. *Behaviour Research and Therapy*. 2008; 46:811–818. [PubMed: 18466878]
- Linehan, MM. *Cognitive Behavioral Treatment of Borderline Personality Disorder*. Guilford Press; New York: 1993.
- MacCallum RC, Zhang S, Preacher KJ, Rucker DD. On the practice of dichotomization of quantitative variables. *Psychological Methods*. 2002; 7:19–40. [PubMed: 11928888]
- Maglione M, Chao B, Anglin M. Correlates of outpatient drug treatment drop-out among methamphetamine users. *Journal of Psychoactive Drugs*. 2000; 32:221–228. [PubMed: 10908011]
- Marshall-Berenz EC, Vujanovic AA, Bonn-Miller MO, Bernstein A, Zvolensky MJ. Multimethod study of distress tolerance and PTSD symptom severity in a trauma-exposed community sample. *Journal of Traumatic Stress*. 2010; 23:623–630. [PubMed: 20848616]

- Martínez-Raga J, Marshall EJ, Keaney F, Ball D, Strang J. Unplanned versus planned discharged from in-patient alcohol detoxification: Retrospective analysis of 470 first-episode admissions. *Alcohol & Alcoholism*. 2002; 37:277–281. [PubMed: 12003918]
- McDermott MJ, Tull MT, Gratz KL, Daughters SB, Lejuez CW. The role of anxiety sensitivity and difficulties in emotion regulation in posttraumatic stress disorder among crack/cocaine dependent patients in residential substance abuse treatment. *Journal of Anxiety Disorders*. 2009; 23:591–599. [PubMed: 19233609]
- McHugh RK, Daughters SB, Lejuez CW, Murray HW, Hearon BA, Gorka SM, Otto MW. Shared variance among self-report and behavioral measures of distress intolerance. *Cognitive Therapy and Research*. 2011; 35:266–275. [PubMed: 23894216]
- McLellan T, Kushner H, Metzger D, Peters R, Smith I, Grissom G, Pettinati H, Argeriou M. The fifth edition of the Addiction Severity Index. *Journal of Substance Treatment*. 1992; 9:199–213.
- Miller MW, Greif JL, Smith AA. Multidimensional Personality Questionnaire profiles of veterans with traumatic combat exposure: Externalizing and internalizing subtypes. *Psychological Assessment*. 2003; 15:205–215. [PubMed: 12847781]
- Miller MW, Kaloupek DG, Dillon AL, Keane TM. Externalizing and internalizing subtypes of combat-related PTSD: A replication and extension using the PSY-5 scales. *Journal of Abnormal Psychology*. 2004; 113:636–645. [PubMed: 15535795]
- Mills KL, Teesson M, Ross J, Darke S. The impact of post-traumatic stress disorder on treatment outcomes for heroin dependence. *Addiction*. 2007; 102:447–454. [PubMed: 17298653]
- Mills KL, Teesson M, Ross J, Peters L. Trauma, PTSD, and substance use disorders: Findings from the Australian National Survey of Mental Health and Well-Being. *The American Journal of Psychiatry*. 2006; 163:651–658.
- Muraven M, Tice DM, Baumeister RF. Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*. 1998; 74:774–789. [PubMed: 9523419]
- Najavits LM, Gastfriend DR, Barber J, Reif S, Muenz LR, Blaine J, Weiss RD. Cocaine dependence with and without PTSD among subjects in the National Institute on Drug Abuse Collaborative Cocaine Treatment Study. *American Journal of Psychiatry*. 1998; 155:214–219. [PubMed: 9464200]
- Najavits LM, Harned MS, Gallop RJ, Butler SF, Barber JP, Thase ME, Crits-Christoph P. Six-month treatment outcomes of cocaine-dependent patients with and without PTSD in a multisite national trial. *Journal of Studies on Alcohol and Drugs*. 2007; 68:353–361. [PubMed: 17446974]
- Najavits LM, Weiss RD, Liese BS. Group cognitive-behavioral therapy for women with PTSD and substance use disorder. *Journal of Substance Abuse Treatment*. 1996; 13:13–22. [PubMed: 8699538]
- Najavits LM, Weiss RD, Reif S, Gastfriend DR, Siqueland L, Barber JP, Thase M. The Addiction Severity Index as a screen for trauma and posttraumatic stress disorder. *Journal of Studies on Alcohol*. 1998; 59:56–62. [PubMed: 9498316]
- Najavits LM, Weiss RD, Shaw SR. A clinical profile of women with posttraumatic stress disorder and substance dependence. *Psychology of Addictive Behaviors*. 1999; 13:98–104.
- Najavits LM, Weiss RD, Shaw SR, Muenz LR. 'Seeking safety': Outcome of a new cognitive-behavioral psychotherapy for women with posttraumatic stress disorder and substance dependence. *Journal of Traumatic Stress*. 1998; 11:437–456. [PubMed: 9690186]
- Newton TL, Ho IK. Posttraumatic stress symptoms and emotion experience in women: Emotion occurrence, intensity, and variability in the natural environment. *Journal of Psychological Trauma*. 2008; 7:276–297.
- Orsillo SM, Batten SV, Plumb JC, Luterek JA, Roessner BM. An experimental study of emotional responding in women with posttraumatic stress disorder related to interpersonal violence. *Journal of Traumatic Stress*. 2004; 17:241–248. [PubMed: 15253096]
- Ouimette P, Brown PJ, Najavits LM. Course and treatment of patients with both substance use and posttraumatic stress disorders. *Addictive Behaviors*. 1998; 23:785–796. [PubMed: 9801716]
- Ouimette P, Coolhart D, Funderburk J, Wade M, Brown PJ. Precipitants of first substance use in recently abstinent substance use disorder patients with PTSD. *Addictive Behaviors*. 2007; 32:1719–1727. [PubMed: 17188816]

- Ouimette P, Finney JW, Moos RH. Two-year posttreatment functioning and coping of substance abuse patients with posttraumatic stress disorder. *Psychology of Addictive Behaviors*. 1999; 13:105–114.
- Potter CM, Vujanovic AA, Marshall-Berenz EC, Bernstein A, Bonn-Miller MO. Posttraumatic stress and marijuana use coping motives: The mediating role of distress tolerance. *Journal of Anxiety Disorders*. 2011; 25:437–443. [PubMed: 21146357]
- Pulford J, Adams P, Sheridan J. Responding to treatment dropout: A review of controlled trials and suggested future directions. *Addiction Research and Theory*. 2010; 18:298–315.
- Read JP, Brown PJ, Kahler CW. Substance use and posttraumatic stress disorders: Symptom interplay and effects on outcome. *Addictive Behaviors*. 2004; 29:1665–1672. [PubMed: 15451135]
- Rielage J, Hoyt T, Renshaw K. Internalizing and externalizing personality styles and psychopathology in OEF-OIF veterans. *Journal of Traumatic Stress*. 2010; 23:350–357. [PubMed: 20564367]
- Riggs, DS.; Foa, EB. Treatment for co-morbid posttraumatic stress disorder and substance use disorders. In: Stewart, SH.; Conrod, PJ., editors. *Anxiety and substance use disorders: The vicious cycle of comorbidity*. Springer; New York: 2008. p. 119-137.
- Sayre SL, Schmitz JM, Stotts AL, Averill PM, Rhoades HM, Grabowski JJ. Determining predictors of attrition in an outpatient substance abuse program. *The American Journal of Drug and Alcohol Abuse*. 2002; 28:55–72. [PubMed: 11853135]
- Schloss HM, Haaga DAF. Interrelating behavioral measures of distress tolerance with self-reported experiential avoidance. *Journal of Rational-Emotive Cognitive-Behavioral Therapy*. 2011; 29:53–63.
- Shalev AY, Freedman S, Peri T, Brandes D, Sahar T. Predicting PTSD in trauma survivors: Prospective evaluation of self-report and clinician-administered instruments. *British Journal of Psychiatry*. 1997; 170:558–564. [PubMed: 9330024]
- Shapiro SS, Wilk MB. An analysis of variance test for normality (complete samples). *Biometrika*. 1965; 52:591–611.
- Sheskin, DJ. *Handbook of parametric and non-parametric statistical procedures*. 3rd edition. Chapman & Hall/CRC Press; Boca Raton, FL: 2004.
- Simons JS, Gaher RM. The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and Emotion*. 2005; 29:83–102.
- Simpson DD, Joe GW, Brown BS. Treatment retention and follow-up outcomes in the drug abuse treatment outcome study (DATOS). *Psychology of Addictive Behaviors*. 1997; 11:294–307.
- Sonne SC, Back SE, Zuniga C, Randall CL, Brady KT. Gender differences in individuals with comorbid alcohol dependence and post-traumatic stress disorder. *The American Journal on Addictions*. 2003; 12:412–423. [PubMed: 14660155]
- Stark MJ. Dropping out of substance abuse treatment: A clinically oriented review. *Clinical Psychology Review*. 1992; 12:93–116.
- Substance Abuse and Mental Health Services Administration. Office of Applied Studies. National Survey of Substance Abuse Treatment Services (N-SSATS): 2009. Data on Substance Abuse Treatment Facilities. US Department of Health and Human Services; Rockville, MD: 2009. DASIS Series: S-54HHS Publication No. (SMA) 10-4579
- Tabachnick, BG.; Fidell, LS. *Using multivariate statistics*. 5th ed.. Allyn & Bacon/Pearson Education; Boston, MA: 2007.
- Tate SR, Brown SA, Unrod M, Ramo DE. Context of relapse for substance-dependent adults with and without comorbid psychiatric disorders. *Addictive Behaviors*. 2004; 29:1707–1724. [PubMed: 15530716]
- Tull, MT.; Bornovalova, MA.; Patterson, R.; Hopko, DR.; Lejuez, CW. Analogue research. In: McKay, D., editor. *Handbook research methods in abnormal and clinical psychology*. Sage Publications; Thousand Oaks, CA: 2008. p. 61-78.
- Tull MT, Jakupcak M, McFadden ME, Roemer L. The role of negative affect intensity and the fear of emotions in posttraumatic stress symptom severity among victims of childhood interpersonal violence. *Journal of Nervous and Mental Disease*. 2007; 195:580–587. [PubMed: 17632248]
- Tull MT, McDermott MJ, Gratz KL, Coffey SF, Lejuez CW. Cocaine-related attentional bias following trauma cue exposure among cocaine dependent inpatients with and without post-traumatic stress disorder. *Addiction*. 2011; 106:1810–1818. [PubMed: 21615582]

- Vujanovic, AA.; Bernstein, A.; Litz, BT. Distress tolerance and traumatic stress. In: Zvolensky, MJ.; Bernstein, A.; Vujanovic, AA., editors. *Distress Tolerance*. Guilford Press; New York, NY: 2011. p. 126-148. p. 126-148.
- Vujanovic AA, Bonn-Miller MO, Potter CM, Marshall EC, Zvolensky MJ. An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. *Journal of Psychopathology and Behavioral Assessment*. 2011; 33:129–135. [PubMed: 22039316]
- Vujanovic AA, Marshall-Berenz EC, Zvolensky MJ. Posttraumatic stress and alcohol use motives: A test of the incremental and mediating role of distress tolerance. *Journal of Cognitive Psychotherapy*. 2011; 25:130–141. [PubMed: 22072844]
- Weathers FW, Keane TM, Davidson JT. Clinician-Administered PTSD Scale: A review of the first ten years of research. *Depression and Anxiety*. 2001; 13:132–156. [PubMed: 11387733]
- West R, Gossop M. Overview: A comparison of withdrawal symptoms from different drug classes. *Addiction*. 1994; 89:1483–1489. [PubMed: 7841860]
- Zanarini, MC.; Frankenburg, FR.; Sickel, AE.; Young, L. Diagnostic interview for DSM-IV personality disorders. McLean Hospital; Boston, MA: 1996. Unpublished measure
- Zanarini MC, Skodol AE, Bender D, Dolan R, Sanislow C, Schaefer E, Gunderson JG. The Collaborative Longitudinal Personality Disorders Study: Reliability of Axis I and II diagnoses. *Journal of Personality Disorders*. 2000; 14:291–299. [PubMed: 11213787]
- Zlotnick C, Zimmerman M, Wolfsdorf BA, Mattia JI. Gender differences in patients with posttraumatic stress disorder in a general psychiatric practice. *The American Journal of Psychiatry*. 2001; 158:1923–1925. [PubMed: 11691704]
- Zvolensky, MJ.; Leyro, TM.; Bernstein, A.; Vujanovic, AA. Historical perspectives, theory, and measurement of distress tolerance. In: Zvolensky, MJ.; Bernstein, A.; Vujanovic, AA., editors. *Distress Tolerance*. Guilford Press; New York, NY: 2011. p. 3-27.

Table 1

Clinical data as a function of treatment completion status

	Treatment Completers (n = 189)	Treatment Non-Completers (n = 25)
	Mean (SD)/% Present	Mean (SD)/% Present
Posttraumatic Stress Disorder	29.1%	24%
Major Depressive Disorder	19%	36%
Panic Disorder with/without Agoraphobia	19%	20%
Social Anxiety Disorder	11.6%	4%
Specific Phobia	12.2%	12%
Obsessive-Compulsive Disorder	2.6%	4%
Generalized Anxiety Disorder	32.8%	32%
Alcohol Dependence	36%	40%
Cocaine Dependence	32.3%	36%
Opioid Dependence	11.6%	12%
Marijuana Dependence	18.5%	6%
Sedative Dependence	9%	4%
Stimulant Dependence	12.7%	4%
Hallucinogen Dependence	0.5%	4%
Polysubstance Dependence	4.2%	8%
Borderline Personality Disorder	31.2%	44%
Court-Ordered Treatment	34.9%	24%
Psychotropic Medication Use	38.5%	52%
Frequency of Criminal Behavior	6.84 (9.70)	7.88 (8.72)
Quit PASAT-C (low DT)	70.4%	64%
Average Proportion of Treatment Completed	1.00 (0.00)	0.61 (.26)

Table 2

Means and standard deviations for proportion of treatment not completed across all groups (non-transformed and transformed data)

	Male		Female	
	PTSD	No PTSD	PTSD	No PTSD
High Distress Tolerance				
Transformed	1.57 (0.00) ^a	1.52 (0.13) ^b	1.41 (0.32) ^c	1.48 (0.31) ^d
Non-Transformed	1.00 (0.00)	0.98 (0.06)	0.91 (0.21)	0.94 (0.22)
Low Distress Tolerance				
Transformed	1.37 (0.43) ^e	1.50 (0.22) ^f	1.56 (0.72) ^g	1.47 (0.28) ^h
Non-Transformed	0.86 (0.30)	0.96 (0.14)	0.99 (0.15)	0.93 (0.19)

Note. Standard deviations are presented in parentheses. PTSD = Posttraumatic stress disorder.

^a
n = 10.

^b
n = 35.

^c
n = 9.

^d
n = 11.

^e
n = 15.

^f
n = 75.

^g
n = 27.

^h
n = 32.

Table 3

ANCOVA results examining the interactive effect of PTSD, gender, and DT on treatment completion

	F (1,205)	p	p²
Age	6.02	0.02	0.03
Gender	0.02	0.89	0.00
Distress Tolerance	1.16	0.28	0.01
PTSD	0.20	0.66	0.00
Gender × Distress Tolerance	4.99	0.03	0.02
Gender × PTSD	0.37	0.54	0.00
PTSD × Distress Tolerance	0.05	0.83	0.00
PTSD × Distress Tolerance × Gender	6.17	0.01	0.03