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ORIGINAL PAPER

Acting with Awareness and Distress Tolerance Relate to PTSD Symptoms Among Women with Substance Use Disorder

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Abstract

Objectives Women with a history of trauma exposure and substance use disorder (SUD) are more likely to report co-occurring post-traumatic stress disorder (PTSD) symptoms than the general population. However, cognitive factors such as increased distress tolerance and mindfulness disposition might be especially protective against PTSD symptoms for women with SUD.

Methods We examined the associations of distress tolerance and mindfulness disposition as potential resilience factors to PTSD symptoms in a sample of women receiving residential treatment for SUD ($N = 237$, $M_{AGE} = 32.34$, 56.96% Hispanic). PTSD symptoms were divided into the clusters of reexperiencing, avoidance, dysphoria, and arousal.

Results Regression models revealed that distress tolerance and the mindfulness facet of acting with awareness were negatively and incrementally associated with total, dysphoria, and arousal PTSD symptom severity, while nonreactivity had a significant negative relationship with avoidance PTSD symptoms. Only distress tolerance emerged to be negatively related to PTSD reexperiencing symptom severity.

Conclusions Our findings show that the ability to tolerate distress, as well as specific mindfulness skills, might protect against specific severe PTSD symptoms among women with SUD. Future research should examine whether targeting both of these facets is necessary for achieving favorable clinical outcomes on PTSD in this population.

Keywords Mindfulness · Distress tolerance · Substance use disorder · Posttraumatic stress disorder

Post-traumatic stress disorder (PTSD) and substance use disorder (SUD) often co-occur (e.g., Goldstein et al. 2016) and each disorder increases the risk for an individual to develop the other, especially among women (Berenz et al. 2017). Prevalence of PTSD, specifically, is also close to two times higher among women than men (e.g., Lehavot et al. 2018). This makes PTSD in the context of SUD an important issue for women's mental health.

Common underlying mechanisms of PTSD and SUD might explain the high rate of symptom co-occurrence. Deficits in distress tolerance (i.e., affective nonreactivity to aversive experiences; Simons and Gaher 2005) have been proposed to play a role in the etiology and maintenance of both disorders (e.g., Khantzian 1997, Vujanovic et al. 2015). High mindfulness disposition (covering nonjudgmental attending, responding with awareness, and acceptance to both internal and external signals, regardless of their affective load, e.g., Baer et al. 2006; Bishop et al. 2004), on the other hand, might serve as a resilience factor (e.g., Karyadi et al. 2014; Vujanovic et al. 2016a). Although distress tolerance and mindfulness disposition might be related (Naragon-Gainey et al. 2017), they are usually studied separately, which creates uncertainty regarding which is more relevant for PTSD symptoms among women with SUD. It is important to examine the relative contribution of these factors to PTSD symptom severity as they might serve as potential targets for both prevention and treatment of PTSD among women with SUD.

Experiencing, witnessing, or otherwise being exposed to a traumatic event, such as a close relative's sudden death, does not alone cause PTSD. For example, high distress tolerance might protect against the development of PTSD symptoms following a traumatic event (Vujanovic et al. 2015) because

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of the ability to experience and manage the event-associated distress without becoming overwhelmed, rather than avoiding any reminders of the trauma, which might exacerbate PTSD (e.g., Ehlers and Clark 2000). One essential form of distress tolerance (Leyro et al. 2010) refers to the individual capacity to experience aversive emotions without it being an unsurmountable challenge and can be measured with the Distress Tolerance Scale (DTS, Simons and Gaher 2005). Cross-sectional studies have shown that such distress tolerance is linked to reduced PTSD symptoms among individuals with a history of exposure to traumatic events (e.g., Vujanovic et al. 2011a, b), cocaine-dependent individuals (Vujanovic et al. 2016b), and psychiatric inpatients with high frequency of diagnosed SUD (Vujanovic et al. 2017). Last, changes in distress tolerance scores were related to lower PTSD symptoms at treatment completion among predominantly male veterans in residential treatment for PTSD (Banducci et al. 2017). Therefore, distress tolerance might be a potential target for treatment among individuals with both PTSD and SUD symptoms.

Although distress tolerance refers to affective nonreactivity to aversive experiences (Simons and Gaher 2005), mindfulness disposition is a multidimensional construct (e.g., Baer et al. 2006; Bishop et al. 2004). Therefore, the emotion regulation skills covered by the mindfulness concept might additionally buffer the effects of trauma (Vujanovic et al. 2016a). We are aware of only three studies (Bowen et al. 2017; Garland and Roberts-Lewis 2013; Shorey et al. 2014) that have examined the relationship of mindfulness and PTSD symptoms in samples with trauma exposure and clinically diagnosed SUD. Cumulative findings point toward a significant inverse relationship between PTSD symptom severity and mindfulness disposition, after statistically controlling for confounders.

Some studies use a composite mindfulness score in their analyses, which obstructs our ability to identify which mindfulness subfactor contributes most to PTSD symptoms. Few studies have examined specific mindfulness dimensions and their relationship to PTSD in SUD samples. Bowen et al. (2017), for example, tested the individual facets of mindfulness assessed by the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006). Acting with awareness, describing, and nonjudgmental acceptance were significantly associated with both PTSD and SUD symptom severity, whereas observing and nonreactivity were not. In their correlational analyses, Garland and Roberts-Lewis (2013) found all but the observing facet to have a negative relationship with PTSD symptom severity. Further research is needed to elucidate which key aspects of mindfulness are associated with reduced PTSD symptoms among women with SUD.

The relationship between distress tolerance and mindfulness is theoretically underspecified. Therefore, before distinguishing their specific contribution to PTSD symptoms among SUD samples, it is important to determine the magnitude of their overlap. A recent meta-analysis found a moderate correlation between distress tolerance and mindfulness across five samples ($r = .38$, Naragon-Gainey et al. 2017). Because mindfulness is an umbrella term for distinct patterns of relating to emotional, sensory, and experiential events (Baer et al. 2006), various aspects of mindfulness might have distinct relationships with distress tolerance in samples with SUD symptoms. Among smokers, only the mindfulness factors of acting with awareness and nonjudgment acceptance mindfulness factors were associated with distress tolerance after controlling for covariates (e.g., Luberto et al. 2014), whereas in a sample of heavy-drinking students, the facets of describing, nonjudgmental acceptance, and nonreactivity all emerged as significantly related to distress tolerance scores (Kraemer et al. 2017). Neither of these two studies reported a significant association between the observing facet and measures of distress tolerance. We are aware of only one study that has examined the association between those two concepts in an SUD sample (Hsu et al. 2013). The study found significant positive correlations between all five mindfulness facets and distress tolerance scores, with nonreactivity ($r = .47$) having the strongest relationship. These correlations are not high enough to preclude the simultaneous evaluation of the cognitive factors in cross-sectional studies on PTSD symptom severity.

Answering the question of whether mindfulness facets and distress tolerance uniquely contribute to PTSD resilience or largely overlap can help consolidate scientific efforts, uncover which cognitive mechanisms are of vital importance, and reduce redundancy in the literature on emotion regulation in PTSD, which mirrors the overabundance of overlapping constructs in the general emotional regulation literature (e.g., Naragon-Gainey et al. 2017). The importance of this question lies also in the need for future clinical interventions for individuals with SUD and PTSD to have a targeted approach toward the mechanisms associated with the biggest clinical change (NIMH 2013), rather than relying on nonspecific therapeutic effects.

Women might face distinct challenges when it comes to risk factors for PTSD that go beyond trauma exposure (e.g., Pineles et al. 2017). Studies that specifically investigate relationships between cognitive factors among women with SUD can bring us a step closer to understanding what underlies the increased PTSD vulnerability of women (Pineles et al. 2017). To understand how distress tolerance and mindfulness facets relate to symptoms of PTSD among women with SUD, we examined whether (a) distress tolerance is negatively associated with reduced severity by PTSD symptoms cluster, in replication of Vujanovic et al. (2016b), and (b) facets of mindfulness have a significant negative association with PTSD symptoms beyond distress tolerance.

Methods

Participants

Baseline data collected for a randomized clinical trial (Amaro and Black 2017) of Moment-by-Moment in Women's Recovery (Vallejo and Amaro 2009), a mindfulness-based relapse prevention adjunctive intervention program for women ($N = 245$) in gender-specific residential SUD treatment, were used for the present study. Participants were recruited at treatment entry. Eligibility criteria for the parent study were as follows: age in the range of 18–65, SUD diagnosis, ability to provide consent, and willingness to be audio recorded and provide broad consent for other studies using the collected data. Exclusion criteria included conditions interfering with the experimental treatment (i.e., suicidal ideation in the last 30 days, untreated psychotic disorder, or other chronic mental health problem), being currently imprisoned, or advanced pregnancy (see Amaro and Black 2017 for full study methods description).

For this study, we additionally excluded women ($n = 8$) who did not endorse exposure to a traumatic event covered by Criterion A for PTSD diagnosis from the Diagnostic and Statistical Manual of Mental Disorders—5th edition (DSM-V, American Psychiatric Association 2013). Demographic, psychosocial, and clinical characteristics of the present sample ($N = 237$, mean age = 32.34, 95% CI = [31.20, 33.49]) are reported in Table 1 and Table 2. Sixty-five women (27.42%) were diagnosed by the clinical team with PTSD according to the fourth (27%, APA 2000) or fifth edition (70.89%, APA 2013) of the Diagnostic and Statistical Manual of Mental Disorders (DSM) and 41.35% of the sample had at least one additional mental health diagnosis to SUD and PTSD.

Procedure

For the current study, we used data from clinical records and selected measures administered during a baseline structured interview prior to randomization and intervention delivery for the parent randomized clinical trial. Data were recorded with REDCap (Harris et al. 2009). All parent study procedures were approved by the affiliated university's institutional review board.

Measures

PTSD symptom severity in the last 30 days was assessed with the PTSD Symptom Scale–Self-Report for DSM-IV (Foa et al. 1997). The scale measures severity of PTSD symptoms on a 4-point Likert scale, ranging from not at all (0) to almost always (3). Participants responded to the items relative to any traumatic event experienced, not a specific traumatic event as traditional instructions recommend. Based on the factor analyses first proposed by Simms et al. (2002) and later validated by multiple groups (e.g., Boelen et al. 2008), we calculated scores for four different symptom clusters: reexperiencing (5 items), avoidance (2 items), dysphoria (8 items), and arousal (2 items). Summing all scores represents total PTSD symptom severity. All subscales showed high

Table 1 Sample characteristics ($N = 237$)

Characteristic	*n* (%)
Ethnoracial group	
Non-Hispanic White	48 (20.25)
Non-Hispanic Black	50 (21.10)
Hispanic	135 (56.96)
Other	4 (1.69)
Marital status	
Married or common law	17 (7.17)
Separated, divorced, or widowed	45 (18.99)
Never married	175 (73.84)
Education	
Less than high school	115 (48.52)
High school or equivalent	64 (27.00)
Some postsecondary education	58 (24.47)
Employment in 8 months prior to treatment entry	
Full-time	32 (13.50)
Part-time	29 (12.24)
Not working	176 (74.26)
Mandated to treatment	
Criminal justice	112 (47.26)
Department of Children and Family Services	76 (32.07)
Not mandated	49 (20.68)
SUD diagnosis[a]	
Alcohol use disorder (AUD)	24 (10.13)
Drug use disorder (DUD)	175 (73.84)
AUD and DUD	33 (13.92)
Top 5 substances used in 8 months prior to treatment entry[b]	
(Meth)amphetamines	182 (76.79)
Marijuana	133 (56.12)
Alcohol to intoxication	121 (51.05)
Alcohol	88 (37.13)
Cocaine	33 (13.92)
Top 5 life traumas reported[c]	
Observed physical violence in childhood	148 (62.44)
Physical abuse	147 (62.03)
Death of a close person	142 (59.92)
Experience stalking or threats	137 (57.81)
Witnessed a physical attack	122 (51.48)

[a] Some individuals ($n = 5$) did not receive a formal diagnosis

[b] Some individuals ($n = 127$) reported using more than one type of drug on the same day

[c] Most individuals ($n = 221$) endorsed more than one type of traumatic events

Table 2 Matrix of bivariate Pearson's correlations between variables entered in the models, as well as descriptive results (N = 237)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Trauma types		−.13	.10	.01	−.08	−.12	−.05	*.38*	*.34*	*.30*	*.29*	*.38*
2. Distress tolerance			.15	*.45*	*.47*	*.31*	*.25*	*−.31*	*−.29*	*−.49*	*−.31*	*−.44*
3. Observing				*.40*	.12	−.19	*.53*	.06	.00	−.05	−.01	.00
4. Describing					*.48*	*.23*	*.35*	−.15	*−.24*	*−.34*	−.14	*−.28*
5. Acting with awareness						*.46*	.05	*−.22*	*−.27*	*−.46*	*−.26*	*−.38*
6. Nonjudgmental acceptance							−.17	−.13	−.20	*−.21*	−.05	−.19
7. Nonreactivity								−.12	−.20	*−.21*	−.18	−.20
8. PTSD Reexperiencing									*.73*	*.66*	*.57*	*.88*
9. PTSD Avoidance										*.65*	*.45*	*.80*
10. PTSD Dysphoria											*.65*	*.92*
11. PTSD Arousal												*.74*
12. PTSD Total												
Mean	5.87	44.12	13.80	16.50	16.78	14.60	14.99	5.47	2.04	8.43	1.97	17.89
Lower 95% CI	5.48	42.39	13.29	15.94	16.18	14.03	14.49	4.88	1.77	7.65	1.72	16.26
Upper 95% CI	6.27	45.85	14.31	17.06	17.39	15.17	15.50	6.05	2.30	9.22	2.23	19.52

Correlation coefficients with Holm adjusted for multiple tests p values < .05 are in italics. All bivariate correlations for reexperiencing symptoms had a sample size of 236 due to missing responses from one participant. Distress tolerance was measured with the Distress Tolerance Scale (Simons and Gaher 2005). Observing, describing, acting with awareness, nonjudgmental acceptance, and nonreactivity were assessed with the short Five-Facet Mindfulness Questionnaire (Bohlmeijer et al. 2011). PTSD symptoms were evaluated through the PTSD Symptom Scale–Self-Report for DSM-IV (Foa et al. 1997)

psychometric properties (Cronbach's alphas > .86 and McDonald's ω_t > .89 for PTSD reexperiencing, dysphoria, and total; Spearman-Brown coefficients > .78 for PTSD avoidance and arousal).

Distress tolerance was measured by the Distress Tolerance Scale (DTS, Simons and Gaher 2005), a 15-item self-report questionnaire containing items related to attitudes and responses during experiences of distress. Participants rated the items on a scale ranging from strongly agree (1) to strongly disagree (5). The total score was used as measure of distress tolerance, in accordance with Vujanovic et al. (2016b). Cronbach's alpha of DTS in the present sample was .88 and the McDonald's omega total equaled .92.

Dispositional mindfulness was measured using the short 24-item version of the FFMQ (Bohlmeijer et al. 2011), which assesses an individual's tendency to be mindful in everyday life. Items are rated on a 5-point Likert scale, ranging never true (1) to very often true (5). It provides scores for the following mindfulness dimensions: observing (4 items), describing (5 items), acting with awareness (5 item), nonjudgmental acceptance (5 items), and nonreactivity (5 items). All subscales had adequate internal consistency in this sample (Cronbach's alphas: observing = .73, describing = .73, acting with awareness = .81, nonjudgmental acceptance = .74, nonreactivity = .66, McDonald's omega total: observing = .74, describing = .82, acting with awareness = .85, nonjudgmental acceptance = .80, nonreactivity = .72).

Number of trauma types endorsed was measured as the sum of event types endorsed in the modified Life Stressors Checklist–Revised (LSC-R, Wolfe and Kimerling 1997) that meet Criterion A of the diagnostic criteria for PTSD in DSM-V (APA 2013).

Data Analyses

Data analyses procedures were modeled after those reported in Vujanovic et al. (2016b). Binary associations between variables were assessed with Pearson's correlations in order to determine the appropriateness of entering the independent variables simultaneously in subsequent models. p values were adjusted for inflated family-wise error using Holm's method.

PTSD total and symptom cluster scores were entered as criterion variables in five hierarchical linear regression models. In each model, the control variable of total trauma types was entered in Step 1 because more extensive trauma history has been linked to more severe PTSD (e.g., Johnson and Thompson 2008). In Step 2, the first predictor of interest, DTS Sum, was entered. In Step 3, we added each of the facets of mindfulness to the model.

Missing values in this study were excluded in the calculation of summary variables. We applied Bonferroni correction for the number of regression models in the present paper (i.e., 5) and used alpha level of .01 to determine significance. Analyses were conducted using R (Version 3.5.1, R Core Team 2017) in R Studio (Version 1.0.143 for Macintosh, R Studio Team 2016).

Results

Binary Associations Between Variables of Interest

The bivariate correlations and descriptive statistics of study variables can be found in Table 2. The facet of observing was not significantly correlated with any PTSD scores, therefore not considered in subsequent analyses.

Relationships Between DTS, FFMQ, and PTSD Clustered Symptoms

We examined the relationships between distress tolerance and dispositional mindfulness and each of the measured PTSD symptom clusters (reexperience, avoidance, dysphoria, and arousal), as well as PTSD total, in separate analyses. Details about these analyses can be found in Table 3. When

Table 3 Step 3 of regression models ($N = 237$)

PTSD criterion variable	Variable	B [95% CIs]	β	t	p
Reexperiencing ($n = 236$)	Step 3 Statistics:	$R^2 = .22$, $F(6, 229) = 10.72$, $p < .001$			
	Constant	7.87 [4.49, 11.25]		4.58	.000
	Trauma types	*.50 [.32, .67]*	*.34*	*5.69*	*.000*
	Distress tolerance	*− .07 [− .12, − .02]*	*− .21*	*− 2.97*	*.003*
	Describing	− .00 [− .16, .15]	− .00	− .04	.971
	Acting with awareness	− .09 [− .24, .05]	− .10	− 1.28	.200
	Nonjudgmental acceptance	.01 [− .13, .15]	.01	.19	.853
	Nonreactivity	− .05 [− .20, .10]	− .04	− .66	.512
Avoidance	Step 3 Statistics:	$R^2 = .23$, $F(6, 230) = 11.24$, $p < .001$			
	Constant	4.62 [3.09, 6.14]		5.97	.000
	Trauma types	*.20 [.12, .28]*	*.30*	*5.14*	*.000*
	Distress tolerance	− .01 [− .04, .01]	− .10	− 1.38	.170
	Describing	− .03 [− .10, .04]	− .07	− .93	.355
	Acting with awareness	− .05 [− .12, .01]	− .12	− 1.63	.104
	Nonjudgmental acceptance	− .04 [− .10, .02]	− .09	− 1.25	.215
	Nonreactivity	*− .07 [− .14, − .01]*	*− .14*	*− 2.13*	*.034*
Dysphoria	Step 3 Statistics:	$R^2 = .38$, $F(6, 230) = 23.09$, $p < .001$			
	Constant	20.01 [15.95, 24.07]		9.71	.000
	Trauma types	*.48 [.27, .68]*	*.24*	*4.56*	*.000*
	Distress tolerance	*− .13 [− .19, − .07]*	*− .29*	*− 4.55*	*.000*
	Describing	− .06 [− .25, .12]	− .05	− .68	.496
	Acting with awareness	*− .38 [− .56, − .21]*	*− .30*	*− 4.42*	*.000*
	Nonjudgmental acceptance	.06 [− .11,.23]	.04	.73	.469
	Nonreactivity	− .13 [− .32,.05]	− .09	− 1.46	.145
Arousal	Step 3 Statistics:	$R^2 = .20$, $F(6, 230) = 9.71$, $p < .001$			
	Constant	3.50 [2.00, 5.00]		4.60	.000
	Trauma types	*.16 [.09, .24]*	*.25*	*4.23*	*.000*
	Distress tolerance	*− .03 [− .05, − .01]*	*− .21*	*− 2.90*	*.004*
	Describing	.03 [− .03, .10]	.07	1.00	.318
	Acting with awareness	*− .10 [− .16, − .03]*	*− .23*	*− 3.02*	*.003*
	Nonjudgmental acceptance	.05 [-.01, .11]	.11	1.64	.102
	Nonreactivity	− .05 [− .12, .01]	− .11	− 1.61	.109
Total	Step 3 Statistics:	$R^2 = .35$, $F(6, 230) = 20.65$, $p < .001$			
	Constant	36.05 [27.40, 44.70]		8.21	.000
	Trauma types	*1.34 [.90, 1.78]*	*.32*	*5.98*	*.000*
	Distress tolerance	*− .25 [− .37, − .13]*	*− .27*	*− 4.09*	*.000*
	Describing	− .06 [− .45, .32]	− .02	− .33	.744
	Acting with awareness	*− .63 [− .99, − .26]*	*− .23*	*− 3.40*	*.001*
	Nonjudgmental acceptance	.09 [− .27, .45]	.03	.49	.623
	Nonreactivity	− .31 [− .69, .08]	− .10	− 1.57	.118

Scores of significant independent variables ($p < .05$) are in italics for emphasis. One participant did not respond to any items pertaining to the reexperiencing cluster. Measurement scales used Distress Tolerance Scale (Simons and Gaher 2005), Five-Facet Mindfulness Questionnaire (Bohlmeijer et al. 2011), and PTSD Symptom Scale–Self-Report for DSM-IV (Foa et al. 1997)

examining PTSD reexperiencing symptom severity, adding distress tolerance scores to the model increased the variance explained by the overall model at both Step 2 ($\Delta R^2 = .07$, $F(1, 233) = 20.35$, $p < .001$) and Step 3. Adding the mindfulness facets did not improve the model at Step 3. The largest percentage of the variance was explained number of trauma types endorsed ($R^2 = .14$, $F(1, 234) = 38.69$, $p < .001$).

Similarly, when adding distress tolerance scores in Step 2, the variance of PTSD avoidance symptom severity explained by the model increased significantly ($\Delta R^2 = .06$, $F(1, 234) = 16.92$, $p < .001$). Step 1 explained some of the variance of PTSD avoidance symptoms ($R^2 = .12$, $F(1, 235) = 31.46$, $p < .001$). Last, Step 3 variables improved the model significantly. Nonreactivity emerged as an additional significant independent variable, above and beyond distress tolerance.

Analyses of the dysphoria symptom cluster showed that distress tolerance scores improved the model significantly ($\Delta R^2 = .20$, $F(1, 234) = 68.22$, $p < .001$) over the variance explained by number of trauma types endorsed ($R^2 = .09$, $F(1, 235) = 23.79$, $p < .001$). At Step 3, both acting with awareness and distress tolerance were significantly related to dysphoria severity.

Number of endorsed trauma types explained some of the variance of PTSD arousal symptom severity ($R^2 = .09$, $F(1, 235) = 21.97$, $p < .001$). Distress tolerance scores in Step 2 improved the model ($\Delta R^2 = .07$, $F(1, 234) = 20.34$, $p < .001$). In Step 3, significant negative associations were additionally found with acting with awareness and distress tolerance scores; however, the improvement of the overall model was minimal between Step 2 and Step 3 ($\Delta R^2 = .04$, $F(1, 230) = 3.13$, $p = .016$).

Finally, a similar pattern emerged when using PTSD total scores as a criterion variable. When added, distress tolerance doubled the variance explained by the overall model ($\Delta R^2 = .16$, $F(1, 234) = 52.08$, $p < .001$, Step 1: $R^2 = .14$, $F(1, 235) = 39.5$, $p < .001$). In Step 3, both distress tolerance and acting with awareness scores were significantly negatively correlated with PTSD severity scores.

Discussion

The analyses reported suggest that both distress tolerance and acting with awareness may be specific resilience factors for some PTSD symptoms. Distress tolerance was significantly negatively association with PTSD severity in all models except the model for avoidance symptoms. Acting with awareness scores were negatively associated with total, dysphoria, and arousal symptoms, while the mindfulness facet of nonreactivity was negatively associated with avoidance symptoms.

Distress tolerance seems to contribute to most models in this sample in replication of Vujanovic et al. (2016b), even when mindfulness facets are added to the models. This supports theories that have highlighted distress intolerance as an underlying risk factor for PTSD (Vujanovic et al. 2015). Previous research has shown significant gender differences in distress tolerance, with women's self-report being lower than that of men (e.g., Vujanovic et al. 2017). To our knowledge, ours is the first study examining the contribution of distress tolerance to PTSD exclusively among women with SUD. DTS scores in the present study are similar to those reported by cocaine-dependent women in the Vujanovic et al. (2016b) study ($M = 42.92$, $SD = 12.82$), which were significantly lower than those reported by the male participants in their study. Therefore, we echo the suggestion by Vujanovic et al. (2015) and others that more studies need to examine gender differences in this cognitive factor and gender's contribution to PTSD symptomatology and other psychopathology. Particularly, the present findings suggest that increasing distress tolerance should be evaluated as a specific target for women with SUD and PTSD.

In this study, mindfulness facets explained an additional 4 to 8% of the PTSD symptom variance in some models. Specifically, the facet of acting with awareness, referring to the ability of responding to action triggers with increased attention rather than habitually (Baer et al. 2006), stood out as important factor for the dysphoria and arousal PTSD symptoms clusters. Overall, the findings regarding the acting with awareness facet of mindfulness and PTSD have been mixed. This facet has shown significant negative association with PTSD symptoms among a sample in after care program for SUD (Bowen et al. 2017), adults with exposure to trauma (Vujanovic et al. 2009), individuals with past exposure to trauma receiving inpatient psychiatric treatment (Martin et al. 2018), soldiers following their deployment (Shipherd and Salters-Pedneault 2018), and trauma-exposed online participants (Boughner et al. 2016), but not trauma-exposed students (Kalill et al. 2014), police officers (Chopko and Schwartz 2013), and Dutch participants with PTSD (Schoorl et al. 2015). A recent study by Stephenson et al. (2017) further showed that increases in acting with awareness predicted a reduction of PTSD symptom severity among veterans who received mindfulness-based stress reduction. Although the findings of the present study suggest that acting with awareness might be the most important mindfulness facet among women with SUD and PTSD symptoms, the mixed findings across studies point toward the need for continued research on the topic. The heterogeneity of results might be due to many factors, such as the different characteristics of study samples (e.g., gender), severity of psychopathology, measurement tools, and analytic methods employed, or the influence of other dispositional or demographic factors included in the analyses. Meta-analytic approaches might be utilized to uncover the true contribution of this specific mindfulness facet to explaining PTSD symptom variance. Further, the significant associations were observed with measures of the nonspecific

PTSD symptoms of dysphoria and arousal, rather than the most prominent PTSD symptom of re-experiencing. The model of arousal was also just minimally improved by adding the facets of mindfulness. Therefore, the importance of acting with awareness for PTSD among women with SUD should be studied further before being able to unequivocally conclude that increasing acting with awareness is a worthwhile intervention target among women with SUD and PTSD symptoms.

The nonreactivity scale reached significance in the model for avoidance. However, the nonreactivity subscale showed somewhat lower internal consistency in the present sample, and thus interpretation of these results should be done with caution. Future research should develop a scale that captures more accurately the aspect of remaining nonreactive to internal experiences among women with SUD. The mindfulness facets of describing and nonjudgmental acceptance did not emerge as significant in any of the models. Nevertheless, the present study highlights the importance of studying facets of mindfulness separately.

The findings reported here suggest that distress tolerance and acting with awareness need to receive further attention when examining PTSD symptom severity among women with SUD. It is interesting to highlight that while distress tolerance and acting with awareness scores had the strongest bivariate correlations, they contributed distinctly to PTSD symptom severity. Future research should unpack these findings and understand better both the convergent and divergent validity of the specific measures of distress tolerance and acting with awareness.

It is notable that in the current study, we observed a significant negative correlation between distress tolerance measure and severity of the reexperiencing symptoms of PTSD in replication of previous results (Vujanovic et al. 2016b). Arguably, intrusions, nightmares, and flashbacks are the most upsetting and impairing PTSD symptoms (e.g., Holmes et al. 2004) and result from disturbed autobiographical memory processes of both encoding and recalling the traumatic event (Ehlers and Clark 2000). Previous studies on PTSD symptomatology have found a significant relationship between some mindfulness facets (e.g., act aware and nonjudgment; Vujanovic et al. 2009) and PTSD reexperiencing severity. Usually in previous studies, participants reported PTSD symptoms regarding a specific past traumatic event, whereas participants in this study reported symptoms associated with any traumatic event in their life. This might explain the contradictory finding of the present study. Therefore, it is also not surprising that in our analyses, the number of trauma types endorsed was found to be most closely related to PTSD reexperiencing symptom severity. Further, the women in our study reported high rates of exposure to stressors, and the cumulative effect of these events might obscure some effects of cognitive factors on the severity of involuntary distressing memory events. Last, women in the present sample were in the early stages of residential treatment, and thus they had only recently discontinued substance use. Based on the self-medication hypotheses, substances might be used for the purpose of ameliorating PTSD symptoms (e.g., Khantzian 1997). Consequently, if substance use diminishes PTSD symptoms, use discontinuation might be related to perceived increases in PTSD and reexperiencing symptoms. Such increases might have obfuscated the effects of some protective cognitive factors.

Limitations and Future Research

The study presented here is not without limitations. First, this was a cross-sectional examination of the contribution of cognitive factors to PTSD symptomatology, which limited analyses to testing simple associations. Therefore, no temporal or causal relationships can be inferred from the present study. A next important step is to evaluate how these factors change during treatment and whether their changes serve as a working mechanism behind the efficacy of PTSD treatments, as evidenced in the Stephenson et al. (2017) study. An additional limitation for this study is that we relied on self-reported PTSD symptoms about traumatic events in general, rather than a clinical assessment of PTSD symptoms. Also, the study relied solely on self-report scales in this study, and by using the same measurement method, this study might suffer from common method bias. While some suggestions exist in the literature (Podsakoff et al. 2003) about statistically correcting for this, these techniques might lead to faulty conclusions and are not recommended. Further, the scale we used to assess PTSD symptoms does not reflect the recognition of numbing symptoms as a separate symptom category, which occurred with the publishing of DSM-V (APA 2013). Future research should use scales such as the PTSD Checklist for DSM-V (Weathers et al. 2013), where severity scores can be calculated for the DSM-V PTSD symptom clusters.

Additional research on the role of distress tolerance and acting with awareness is needed among women with SUD. It is crucial that successful prevention and treatment interventions for PTSD are developed for this population. Interventions specifically increasing distress tolerance and acting with awareness should be evaluated in the future. Although there is little evidence for the effectiveness of PTSD interventions not directly addressing trauma, positive findings about the benefit of mindfulness-based interventions for PTSD have started to emerge (e.g., Talkovsky and Lang 2017). An important next step is to evaluate whether mindfulness-based interventions produce reductions in PTSD symptomatology through changes in distress tolerance and acting with awareness.

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Author Contributions IA designed the study, analyzed the data and wrote the manuscript. HA was PI of parent grant from which data were drawn, collaborated in the design of the study, provided input in data analyses and collaborated in writing the manuscript.

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Compliance with Ethical Standards

Disclaimer The ideas and opinions expressed herein are those of the authors and endorsement of those opinions by funders is not intended nor inferred.

Conflict of Interest The authors declare that they have no conflict of interest.

Ethics The Institutional Review Board of the University of Southern California approved all procedures of the parent study.

Informed Consent All study participants provided informed consent prior to participation in the parent study.

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