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Substance Use Disorders and PTSD: Examining Substance Use, PTSD Symptoms, and Dropout Following Imaginal Exposure

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Abstract

Integrated exposure-based interventions to treat substance use disorders (SUD) and posttraumatic stress disorder (PTSD) may not be widely utilized, in part, because of clinician concerns that such interventions will worsen symptomatology and lead to treatment dropout. In order to address this question, the current pilot study examined whether participants' ratings of craving and distress following imaginal exposure predicted increased substance use, PTSD severity, and treatment dropout. Participants (N=46) were U.S. military Veterans who met criteria for current SUD and PTSD. Subjective ratings of craving and distress, and past-week substance use and PTSD symptom severity were assessed at each treatment session. Multilevel modeling tested whether lagged ratings of craving and distress predicted the following week's frequency of substance use and PTSD severity. Discrete time survival analysis, using proportional odds Cox ratio, examined whether craving and distress ratings predicted treatment dropout. The findings revealed that neither craving nor distress following imaginal exposure were associated with the following week's substance use or PTSD severity. However, participants with higher craving and distress were more likely to drop out before completing treatment. Future research is needed to develop strategies to increase treatment retention for individuals at-risk for treatment dropout and identify mechanisms that account for the association between in-session ratings of craving and distress and dropout.

Keywords

addiction; substance use; posttraumatic stress disorder; imaginal exposure; treatment retention

Substance use disorders (SUD) frequently co-occur with posttraumatic stress disorder (PTSD). Individuals seeking SUD treatment are at greater risk for meeting lifetime criteria for PTSD and many individuals diagnosed with PTSD report misusing substances to self-medicate PTSD symptoms (Debell et al., 2014; Grant et al., 2015; Leeies, Pagura, Sareen, &

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Bolton, 2010). Veterans are at particularly high risk for this psychiatric comorbidity; approximately 41.4% of Veterans diagnosed with PTSD have a co-occurring substance use disorder (Petrakis, Rosenheck, & Desai, 2011).

Comorbid SUD and PTSD is associated with numerous negative sequelae (e.g., medical illness, homelessness, violence victimization, suicidality) and a challenging treatment course (Anderson et al., 2017; Mills et al., 2014; Ouimette, Goodwin, & Brown, 2006; Young, Rosen, & Finney, 2005). In practice, behavioral treatment for comorbid SUD and PTSD typically follows a sequential model (i.e., patients are treated for SUD before PTSD) (Schumm & Gore, 2016); however, recent years have seen increased development of integrated treatments for comorbid SUD and PTSD (e.g., Back et al., 2014; McGovern, Lambert-Harris, Alterman, Xie, & Meier, 2011; Najavits, 2003). Integrated treatments seek to acknowledge the interplay between SUD and PTSD symptoms, targeting both disorders simultaneously with one clinician. The integrated model has pulled support from research finding that improvement in PTSD impacts subsequent improvement in substance use, though improvement in substance use has little impact on subsequent improvement in PTSD (Back, Brady, Jaanimägi, & Jackson, 2006; Badour et al., 2017; Hien et al., 2010).

Integrated treatments have demonstrated efficacy, safety, and feasibility, and many patients report a preference for the integrated approach (Flanagan, Korte, Killeen, & Back, 2016; Schumm & Gore, 2016). Nevertheless, integrated treatments are not commonly utilized in substance use treatment centers (Back, Waldrop, & Brady, 2009; Schumm & Gore, 2016). This may be attributed to a variety of causes, including clinician concerns that addressing the trauma may worsen cravings and negatively impact treatment dropout and efficacy (Gielen, Krumeich, Havermans, Smeets, & Jansen, 2014; Norman & Hamblen, 2017). Indeed, prior research using laboratory-based tasks suggests that subjective craving and distress can be elicited by exposure to a stress or trauma-cue (Coffey et al., 2010; Coffey, Stasiewicz, Hughes, & Brimo, 2006; Sinha et al., 2008). However, repeated exposure to a trauma cue is associated with decreased craving and distress over time (Coffey et al., 2006); in turn, habituation of distress and craving is associated with PTSD symptom improvement and less frequent substance use, respectively (Badour et al., 2017; Foa & McLean, 2016). Research has also shown that, conditions comorbid with PTSD, such as SUD, depression, anxiety, and psychotic disorders, commonly decrease in severity or do not change as a function of PTSD treatments such as Prolonged Exposure (PE; Foa, Hembree, & Rothbaum, 2007; van Minnen, Zoellner, Harned, & Mills, 2015).

To directly examine whether imaginal exposure is associated with an increase in subsequent substance use, PTSD severity, or treatment dropout, the current pilot study took an exploratory approach to examine if ratings of craving and distress following imaginal exposures, delivered in the context of an integrated treatment (i.e., Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure, or COPE; Back et al., 2014), are associated with 1) increased substance use during the following week, 2) increased PTSD symptom severity over the following week, or 3) treatment dropout.

Methods

Participants.

Participants were U.S. military Veterans enrolled in a clinical trial examining the efficacy of COPE. Eligible individuals: 1) were a Veteran, reservist, or member of the National Guard, 2) fluent in English, 3)18–65 years old, 4) met DSM-IV criteria for SUD based on the Mini International Neuropsychiatric Interview (Sheehan et al., 1998) 4), used substances within the past 90 days, 5) met DSM-IV criteria for PTSD 6) had a score of 50 or higher on the Clinician Administered PTSD Scale (Blake et al., 1995). Individuals were excluded if they: 1) reported current suicidal or homicidal ideation with intent, 2) had conditions requiring advanced levels of care such as psychotic or bipolar affective disorders, 3) endorsed a current eating disorder, 4) were receiving ongoing treatment for PTSD or SUD, or 5) demonstrated severe cognitive impairment as evidenced by the Mini Mental Status Exam (Folstein, Folstein, & McHugh, 1975). Participants stabilized on psychotropic medications at baseline were permitted to participate.

Only participants randomized to the COPE intervention were included in the current analyses (N=55; 90.9% male). Most participants identified as White/Caucasian (69.1%); the remainder identified as Black/African American (29.1%) or Multiracial/Other (1.8%). The average age of the sample was 39.49 (SD = 11.01). Most participants indicated alcohol was their primary substance (34.5%). One individual was found ineligible after completing the baseline assessment and 8 participants dropped out of treatment prior to session 4 (when imaginal exposures began). Thus, data was analyzed for 46 participants.

Procedures

Potential participants were screened and individuals meeting eligibility criteria were invited to partake in a more thorough baseline assessment. At the assessment visit, participants provided informed consent and completed semi-structured clinical interviews and self-report measures. Participants were then randomized to receive 12 weekly individual sessions of COPE or Relapse Prevention (Kadden et al., 1992). The COPE treatment integrates Relapse Prevention with PE. Abstinence was encouraged during treatment but not required of participants. Before each treatment session, participants completed assessments measuring substance use and PTSD symptoms. Consistent with the COPE manual, imaginal exposures occurred during sessions 4–11. As part of homework assignments, participants were instructed to listen to audio-recorded imaginal exposures daily.

Measures

Subjective ratings of distress and craving.—During sessions 4–11, participants rated their level of craving for their substance of choice on a 0–100 scale (0 = no craving to 100 = highest craving) immediately before and after in-session imaginal exposures. Before, after, and every 5 minutes throughout the imaginal exposure participants rated their level of distress on a scale of 0 (no distress) to 100 (the worst distress experienced).

Substance use.—The Timeline Followback (Sobell & Sobell, 1992), which uses a calendar based method for collecting self-reports, assessed drug and alcohol use. Percent

days used (PDU) for alcohol or any substance was assessed two months prior to baseline and weekly, immediately prior to the therapy session, during treatment.

PTSD severity.—The PTSD Checklist–Military Version (Weathers, Litz, Herman, Huska, & Keane, 1994) assessed DSM-IV PTSD symptoms at baseline and weekly, immediately prior to, the therapy session. At each weekly assessment, participants were asked about their PTSD symptoms over the previous week. In the current sample, internal consistency ranged from good to excellent between sessions 4–12 (αs = 0.86 to 0.97).

Data analytic plan

Multilevel modeling (MLM) was conducted in Mplus version 8 (Muthén & Muthén, 1998–2017) to examine whether subjective ratings of cravings and distress following in-session imaginal exposures predicted substance use frequency or PTSD severity the following week. Intercepts and slopes were allowed to vary. Time, for which the first session analyzed in the data (i.e., session 4) was coded 0, was entered as a fixed effect. Group-mean centered lagged ratings of craving and distress were modeled as fixed effects as well. Lagged rating by time interactions examined how subjective ratings predicted substance use frequency and PTSD severity across sessions 4–12. Prior week's frequency of substance use and PTSD severity were group mean-centered and included as covariates in the respective MLMs[1]. Two-part modeling was used to examine substance use outcomes due to the presence of zero-inflated data (Olsen & Schafer, 2001). In this approach, data are modeled in separate parts within the same model. One part of the model captures the likelihood of using (dichotomous, 0 = no use, 1 = use) and the other part models severity of use, conditional upon substance use (PDU).

Survival analysis, using a Cox proportional hazard model, as described by (Singer & Willett, 1993), was fit to the data in Mplus to examine the effects of craving and distress on treatment dropout. This model was compared to a model with the proportional hazard assumption relaxed to ensure best fit. A significant likelihood ratio test (LRT) and a lower Bayesian Information Criterion (BIC) would indicate better fit for the Cox proportional hazard model. Continuing in treatment was coded as 0, dropout as 1, and time after a participant discontinued treatment was coded as missing. Lagged ratings of craving and distress were group mean-centered and entered together as predictors of dropout.

Results

Descriptive statistics.

Mean ratings of craving and distress before and after each session's imaginal exposures are represented in Table 1. Participants tended to indicate a relative increase in subjective ratings of craving and distress from pre- to post-imaginal exposure across sessions. Post-imaginal exposure ratings of craving and distress, averaged across sessions 4–11, were not significantly associated with baseline levels of PDU (craving: $r = 0.20$, $p = 0.196$; distress: $r = -0.05$, $p = 0.721$) or PTSD severity (craving: $r = 0.05$, $p = 0.735$; distress: $r = 0.06$, $p =$

[1]MLMs also included pre-imaginal ratings of craving and distress as covariates. These covariates were not significant in either model nor did they impact the interpretation of the findings described below. Thus, they were subsequently removed.

0.717). Participants reported using substances 19.85% (*SD* = 26.68) of the days during an average week.

MLM analyses.

Results of MLM are reported in Table 2. Prior week's post-imaginal craving and the interaction of craving by time was not associated with probability of any substance use, PDU, or PTSD severity. Similarly, distress and the interaction of distress by time were not associated with substance use, PDU, or PTSD severity. There was a significant effect of time on PTSD such that as time progressed, PTSD severity decreased.

Survival analysis.

Prior to survival analysis, a life table was constructed to quantify the number of participants who dropped out at each session, with corresponding survival and hazard proportions (Table 3). Results of the life table indicated most participants who attended session 4 completed treatment (63%). Dropout rates did not fluctuate greatly (i.e., hazard probability ranged from .00 to .11 across sessions), although the highest hazard probability of dropping out (11%) occurred between sessions 9 and 10 and all participants who attended session 7 returned for session 8. The Cox proportional hazard model provided better fit than the unrestricted hazard model (LRT = 39.29, $df = 14$, $p < .001$; ΔBIC = 63.53). Results of the survival analysis indicate that changes in post-imaginal craving ratings predicted treatment dropout ($B = 0.02$, $p = .004$), with an odds ratio of 1.02 (95% confidence interval [CI; 1.01, 1.02]). Participants whose prior-week post-imaginal cravings increased from earlier sessions had greater odds of dropping out during their next session compared to participants whose prior-week craving ratings did not increase. Additionally, changes in post-imaginal distress ratings predicted treatment dropout ($B = 0.03$, $p < .001$), with an odds ratio of 1.03 (95% CI [1.02, 1.04]), indicating that participants whose prior-week distress ratings increased from earlier sessions had greater odds of dropping out during their next session compared to participants whose prior-week distress ratings did not increase.

Discussion

This pilot study is the first to examine whether in-session ratings of craving and distress following imaginal exposure are associated with subsquent substance use, PTSD symptom exacerbation, or drop out in a comorbid sample. The findings revealed ratings of craving and distress were not associated with the following week's substance use or PTSD severity. This finding is consistent with research suggesting exposure-based PTSD treatments as well as nonexposure-based PTSD treatments do not increase SUD symptomatology (Kaysen et al., 2014; van Minnen et al., 2015). It is also consistent with findings that most indivdiuals treated for PTSD do not experience symptom exacerbation (Larsen, Wiltsey Stirman, Smith, & Resick, 2016). The results from the current study may be attributed to the fact that craving and distress habituate within and between therapy sessions, and thus SUD and PTSD symptomatology is reduced (Badour et al., 2017; Foa & McLean, 2016). It may also be that post-imaginal exposure ratings of craving and distress are not appropriate indicators of who will experience symptom exacerbations over the course of treatment.

As our group showed in a previous study using data from the same trial, the results from the current study suggest the largest number of dropouts in this sample occurred between sessions 9 and 10 (Szafranski et al., 2017). This differs from research on PE in Veterans that demonstrates most participants drop out of treatment prior to session four (Garcia, Kelley, Rentz, & Lee, 2011; Mott et al., 2014). This discrepancy may be because exposures were implemented later in the COPE treatment following implementation of coping skills training (i.e., at session 4 versus session 3). Thus, particpants presumably had rapport built with the therapist and the coping skills needed to better tolerate the imaginal exposures. Alternatively, participants may have dropped out later because symptoms had improved (Szafranski et al., 2017; Zandberg, Rosenfield, Alpert, McLean, & Foa, 2016).

The current pilot study builds upon this work and found that craving and distress following imaginal exposures are predictive of treatment dropout. That is, individuals who showed between-session increases in craving and distress following imaginal exposures were less likely to complete treatment compared to those who experienced between-session craving/distress improvement, as well as those who reported no change. Upon post-hoc analysis, it was revealed that a minority of participants reported increases in post-imaginal exposure ratings of craving (0.00 – 30.00% of participants between sessions 4–11) and distress (11.80 – 40.00% of participants between sessions 4–11) relative to the week prior. Although findings from the surivival analysis were statistically signficant they were small in magnitude.

Although post-imaginal ratings of craving and distress were not predictive of subsequent substance use or PTSD severity, it is possible that some of the individuals who dropped out of the study did so due to substance use relapse or an increase in PTSD symptom severity after their last completed session. Because we could not collect data from individuals who dropped out of the study, the effect of craving and distress on symptomatology may not have been fully captured in the results. Mechanisms other than SUD and PTSD symptomatology could account for the associations between craving, distress, and treatment retention as well. For instance, individuals who consistently rate higher levels of craving and distress may be more likely to present with characteristics or circumstances that make it difficult to adhere to treatment (e.g., poor distress tolerance, homelessness). Future research should identify specific mechanisms that explain the link between post-imaginal exposure ratings of craving and distress and treatment dropout.

Limitations.

This pilot study included a small sample of primarily male Veterans; participation did not require abstinence from substances. Thus, results may not generalize to other treatment-seeking samples and findings need to be replicated using larger samples. Ratings of post-imaginal craving and distress were only collected in the COPE arm of the study and participants in the Relapse Prevention condition did not provide ratings of in-session craving and distress. It is possible that associations between craving, distress, and dropout are not unique to exposure-based therapies, and would have been observed in participants receiving substance use only treatment. Future research should collect these data in the context of substance use only treatment in order to assess the impact of in-session craving and distress

on therapy outcome across treatments. We were unable to obtain substance use and PTSD severity data from partipants who dropped out of the study, thus findings from the MLM should be interpreted with this in mind. Finally, our data collection methods may have also impacted our findings and interpretation of the data. For instance, collecting self-report ratings of substance use and PTSD symptoms daily or multiple times daily through the use of ecological monetary assessment (EMA) may have generated different results.

Conclusions.

Craving and distress did not impact the subsequent week's substance use or PTSD symptom severity in this sample; however, individuals reporting higher levels of post-imaginal craving and distress were at increased risk for treatment dropout. Research is needed to help identify mechanisms that account for the association between in-session ratings of craving and distress and subsequent dropout. In addition, future research is needed to develop strategies to enhance treatment retention for individuals with comorbid SUD and PTSD.

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Table 1.

Mean Ratings of Pre- and Post-imaginal Craving and Distress by Session

	Craving		Distress	
Session	**Pre-imaginal M (SD)**	**Post-imaginal M (SD)**	**Pre-imaginal M (SD)**	**Post-imaginal M (SD)**
4	18.11 (25.99)	23.31 (32.04)	52.05 (24.03)	58.13 (27.10)
5	22.08 (30.36)	24.57 (31.61)	41.35 (28.12)	50.22 (26.51)
6	16.05 (25.63)	19.05 (25.73)	41.03 (26.88)	42.44 (25.54)
7	8.91 (15.95)	10.03 (19.94)	35.30 (24.97)	38.64 (24.73)
8	8.44 (16.34)	12.37 (22.87)	28.59 (23.29)	36.72 (26.32)
9	10.21 (17.93)	13.75 (25.41)	33.83 (24.94)	35.70 (27.65)
10	8.62 (14.69)	6.496 (19.50)	21.38 (19.77)	28.28 (24.50)
11	7.78 (16.25)	7.67 (17.33)	25.37 (22.31)	27.78 (19.18)

Note. Means calculated with missing data excluded.

Table 2.

Lagged Ratings of Craving and Distress Predicting Substance Use and PTSD severity

Estimate	*B*	*SE*	*t*	*p*	*B*	*SE*	*t*	*p*
Substance Use	Continuous				Categorical			
Fixed Effects								
Intercept/Threshold	3.40	0.18	18.72	<0.001	−3.20	2.99	−1.07	0.285
Time	−0.10	0.03	−0.40	0.688	−0.36	0.31	−1.16	0.246
Prior Week Substance Use	−0.003	0.002	−1.10	0.270	0.03	0.03	0.93	0.351
Craving	−0.001	0.01	−0.08	0.939	−0.02	0.04	−0.36	0.720
Distress	0.002	0.004	0.37	0.711	−0.05	0.06	−0.88	0.377
Time × Craving	0.00	0.002	−0.12	0.908	0.004	0.02	0.26	0.797
Time × Distress	0.00	0.001	−0.05	0.957	0.02	0.01	1.22	0.224
Random Effects								
Intercept/Threshold	0.69	0.26	-	-	44.24	49.35	-	-
Time	0.01	0.01	-	-	0.67	1.31	-	-
PTSD Severity	*B*	*SE*	*t*	*p*				
Fixed Effects								
Intercept	47.89	2.76	17.36	<0.001				
Time	−1.04	0.32	−3.25	0.001				
Prior Week's PCL	0.09	0.08	1.15	0.250				
Craving	−0.07	0.06	−1.16	0.246				
Distress	0.03	0.05	0.66	0.506				
Time × Craving	0.02	0.01	1.62	0.105				
Time × Distress	−0.002	0.01	−0.19	0.854				
Random Effects								
Intercept	234.16	54.36	-	-				
Time	1.40	0.52	-	-				

Note. PCL = PTSD Checklist. Statistically significant at $p < 0.05$ level.

Table 3.

Life Table Displaying Treatment Dropout and Corresponding Survival and Hazard Probabilities

Session	In Treatment	Dropped Out	Survivor Probability	Hazard Probability
4	46	-	1.00	0.00
5	43	3	0.93	0.07
6	41	2	0.89	0.05
7	38	3	0.83	0.07
8	36	2	0.78	0.05
9	35	1	0.76	0.03
10	31	4	0.67	0.11
11	29	2	0.63	0.06
12	29	0	0.63	0.00

Note. Participants are considered to have dropped out of treatment if they failed to return for the indicated session. For example, three participants who showed for session 4 did not return for session 5.