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Interactive Effects of Anxiety Sensitivity and Difficulties in Emotion Regulation: An Examination among Individuals in Residential Substance Use Treatment with Comorbid Posttraumatic Stress Disorder

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Abstract

Individuals with posttraumatic stress disorder (PTSD) exhibit deficits in cognitive and emotional processes. PTSD severity is positively associated with anxiety sensitivity (AS) and difficulties in emotion regulation, and difficulties in emotion regulation mediate the relation between AS and PTSD. However, previous research has not examined the interactive nature of these variables. Associations between PTSD, AS, and difficulties in emotion regulation were examined in patients with PTSD in a residential substance treatment program (N = 120). Conditional process analyses indicated an interactive effect of difficulties in emotion regulation and AS for predicting PTSD symptom severity. For individuals high in emotion regulation difficulties, PTSD symptom severity was high regardless of level of AS; conversely, for individuals high in AS, increased PTSD severity was observed regardless of level of emotion regulation difficulties. Results suggest directions for future research, including targeting patient specific cognitive-affective processes to enhance PTSD treatment response among substance dependent individuals.

Keywords

anxiety sensitivity; emotion regulation; posttraumatic stress disorder; trauma

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Conflict of Interest

All authors declare that they have no conflict of interest.

Informed Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Posttraumatic stress disorder (PTSD), a psychological disorder that results from exposure to trauma, is characterized by specific symptom clusters, including avoidance, hyperarousal, negative cognitions and mood, and re-experiencing (American Psychiatric Association [APA], 2013). Individuals suffering from PTSD often encounter a variety of problems, such as psychological comorbidities, occupational impairment, elevated health care costs, and increased levels of substance use (Brady, Back, & Coffey, 2004; Hofmann, Litz, & Weathers, 2002; Kessler, 2000; Walker et al., 2003). Lifetime prevalence of PTSD in community samples is 6.8% (Kessler, Chiu, Demler, & Walters, 2005); however, higher prevalence rates have been observed among substance use disorder (SUD) samples (i.e., 36-50%; Brady et al., 2004). In addition, individuals in treatment for SUDs with comorbid PTSD have poorer prognoses compared to those without PTSD (Brady et al., 2004). Clearer understanding of individual differences in PTSD-related processes is warranted given that such findings may contribute to improved treatment outcomes for individuals with comorbid PTSD and SUDs.

Accumulating evidence suggests that anxiety sensitivity (AS) is an important cognitive vulnerability factor that contributes to the development and maintenance of PTSD (Elwood, Hahn, Olatunji, & Williams, 2009; Fedoroff, Taylor, Asmundson, & Koch, 2000; Taylor, 2003). AS is conceptualized as the fear of anxiety-related sensations based on beliefs about their harmful physical, social, or cognitive consequences (Reiss & McNally, 1985). Interoceptive cues associated with AS and panic attacks are posited to exacerbate PTSD symptomatology (Hinton, Hofmann, Pitman, Pollack, & Barlow, 2008), and in fact there is strong evidence for an association between AS and severity of concurrent and prospective PTSD symptoms (Asmundson, Norton, Allardings, Norton, & Larsen, 1998; Feldner, Lewis, Leen-Feldner, Schnurr, & Zvolensky, 2006; Feldner, Zvolensky, Schmidt, & Smith, 2008). Furthermore, PTSD treatment has been shown to reduce AS severity (Gutner, Nillni, Suvak, Wiltsey-Stirman, & Resick, 2013). Notably, more severe AS is related to increased substance use among individuals with PTSD (Gillihan, Farris, & Foa, 2011).

While AS, a largely cognitive construct, appears to be integral to PTSD symptomatology, emotional processes are also theorized to be central to PTSD (Foa & Kozak, 1986; Foa & Rothbaum, 1998). PTSD has been associated with a variety of difficulties in emotion regulation, defined as deficits in responding adaptively to emotions (Gratz & Roemer, 2004). PTSD-related difficulties include emotional suppression, lack of acceptance, limited access to effective regulation strategies, and lack of emotional clarity (Ehring & Quack, 2010; Moore, Zoellner, & Mollenholt, 2008; Tull, Barrett, McMillan, & Roemer, 2007). Notably, PTSD has demonstrated significant associations with heightened emotional intensity and reactivity (Orsillo, Batten, Plumb, Luterek, & Roessner, 2004; Tull, Jakupcak, McFadden, & Roemer, 2007), thus requiring increased regulation efforts. For example, in a laboratory study, Badour and Feldner (2013) found a significant, positive association between increased emotional reactivity to trauma narratives and posttraumatic stress symptom severity in individuals with high, but not low, emotion regulation difficulties. Moreover, in an effort to regulate emotions, individuals with PTSD often engage in maladaptive behavioral strategies, such as substance use (Khantzian, 1997; Simpson, Stappenbeck, Varra, Moore, & Kaysen, 2012).

In order to more clearly delineate the functional relationship between AS and emotional vulnerability factors among trauma-exposed populations, researchers have evaluated these factors in individuals undergoing residential treatment for crack/cocaine dependence. In one study, probable PTSD participants demonstrated higher levels of emotion regulation difficulties and increased AS specific to social concerns (McDermott, Tull, Gratz, Daughters, & Lejuez, 2009). Emotion regulation problems were uniquely predictive of PTSD status even when accounting for anxiety severity and the social concerns dimension of AS, which did not demonstrate unique variance in the model.

Similarly, a more recent study found that emotional avoidance and AS were uniquely predictive of PTSD symptom severity in substance dependent patients even when accounting for anxiety severity and participant sex (Naifeh, Tull, & Gratz, 2012). When emotional avoidance and AS were considered simultaneously, AS no longer significantly predicted PTSD severity, suggesting that the relationship between AS and PTSD was indirect through emotional avoidance. However, reverse mediation (i.e., the relationship between emotional avoidance and PTSD was indirect through AS) was also demonstrated. These findings lend further support for the roles of both AS and emotion regulation in PTSD status and symptom severity.

In previous studies, researchers' empirical questions have examined the relative influence of AS *versus* emotion regulation in predicting PTSD. However, there is also substantial evidence supporting an interactive relation between cognitive and emotional processes in PTSD (Hayes, VanElzaker, & Shin, 2012). Given this evidence, it may be that both AS and emotion regulation operate together to influence the development and/or maintenance of PTSD. PTSD is characterized by threat-relevant interpretations of innocuous stimuli (Ehlers & Clark, 2000), including anxiety-related bodily sensations (Hinton et al., 2008; Wald & Taylor, 2008); such appraisals elicit negative emotions (Tomaka, Blascovich, Kibler, & Ernst, 1997), which individuals with PTSD often have difficulty managing (van der Kolk et al., 1996). Similarly, dysregulated emotions may activate anxiety sensitivity by influencing the way that arousal is evaluated (Tull, 2006). For example, elevated fear can initiate threat-related cognitions related to danger (e.g., emotional reasoning; "I feel scared, so these sensations must be dangerous") and negative consequences of fear (e.g., "I might have a heart attack").

Accordingly, the purpose of the current study was to examine the potential interaction of AS and difficulties in emotion regulation in predicting PTSD symptom severity among a residential SUD treatment sample. We expected that: 1) AS and difficulties in emotion regulation would be positively correlated; 2) AS and difficulties in emotion regulation would both positively correlate with PTSD symptom severity; and 3) AS and difficulties in emotion regulation would both contribute to each other in predicting PTSD severity. To test these hypotheses, we examined the interaction of AS and difficulties in emotion regulation in predicting PTSD symptom severity. Such an examination allows for the potential detection of: 1) a conditional effect of AS in predicting PTSD symptom severity based on levels of difficulties in emotion regulation; and 2) a conditional effect of difficulties in emotion regulation in predicting PTSD symptom severity based on levels of AS.

Method

Participants

Participants were recruited from an unlocked residential SUD treatment facility between 2008 and 2011. Inclusion criteria included diagnosis of current alcohol dependence and current PTSD related to a non-combat trauma according to DSM-IV-TR (APA, 2000) criteria, and age between 18-60 years. Exclusion criteria included the presence of an acute psychotic disorder, bipolar disorder with an active manic episode, imminent risk for suicide, prescription medications that reduce cravings (e.g., naltrexone) or medications that reduce alcohol use (e.g., disulfiram), use of a benzodiazepine as determined by self-report or urine drug screen, a medical condition that might compromise the integrity of the data or limit cooperation (e.g., organic brain syndrome, dementia, head injury, neuropathy), illiteracy in English, and being involved in an ongoing abusive relationship that resulted in a DSM-IV-TR PTSD Criterion A event. A total of 700 individuals completed a brief pre-screening of alcohol misuse and PTSD symptoms; 462 individuals did not meet screening criteria for inclusion in the study. Of the 238 individuals deemed eligible for the initial assessment, 222 completed the initial assessment. Of these, a total of 102 participants did not qualify for inclusion in the study because they did not meet criteria for PTSD and alcohol dependence or refused to participate.

The final sample included 120 participants (53.3% male). Average age was 33.72 years ($SD = 10.25$). Participants self-identified as White (80%), African-American (18.3%), or "Other" (1.3%). Alcohol and drug abuse or dependence was assessed using the Computerized Diagnostic Interview Schedule for DSM-IV (C-DIS-IV; Robins et al., 2000) and included marijuana (38.3%), amphetamines (22.5%), sedatives (35.8%), cocaine/crack (58%), and opiates (40.0%). Current alcohol dependence was present in 100% of the sample and 98.3% of the sample met current dependence criteria for at least one illicit substance. A total of 84 participants (70% of the sample) met criteria for at least one non-PTSD DSM-IV anxiety disorder (range = 1 – 4 additional diagnoses; e.g., generalized anxiety disorder, panic disorder, social anxiety). Ninety-seven participants (80.8%) met criteria for a current major depressive episode. Participants reported experiencing an average of 9.58 DSM-IV Criterion A traumatic events ($SD = 5.00$). The majority of participants endorsed the following Criterion A traumatic events: being attacked with a weapon (63.3%); accidents (60.8%); lifetime sexual assault (59.2%); and being attacked without a weapon (55.0%). Additionally, 40.0% of participants reported childhood physical abuse and 36.7% reported experiencing a natural disaster.

This study was part of a larger, Institutional Review Board -approved treatment study. The goal of the larger study was to examine whether individuals with comorbid PTSD and SUDs exhibit improved outcomes if PTSD is treated during SUD treatment. Participants provided written informed consent and were compensated for their participation.

Measures

Screening measures—The *PTSD Checklist-Civilian Version* (PCL-C; Weathers, Litz, Huska, & Keane, 1994), a 17-item self-report measure of DSM-IV PTSD symptoms, was

used as a screening measure to assess the likelihood for meeting diagnostic criteria for PTSD. Participants are asked how bothered they have been by each symptom over the past month. Items are rated on a 5-point scale (1 = *not at all* to 5 = *extremely*). The PCL-C exhibits high diagnostic efficiency (Buckley, Blanchard, & Hickling, 1996) and strong convergent validity with other measures of trauma-related problems (e.g., Weathers, Litz, Herman, Huska, & Keane, 1993). Participants were eligible to participate if they met screening criteria established for civilians (i.e., 44, Blanchard, Jones-Alexander, Buckley, & Forneris, 1996).

The *Alcohol Use Disorders Identification Test* (AUDIT; Saunders, Aasland, Babor, De la Fuente, & Grant, 1993), a 10-item measure assessing amount and frequency of drinking, symptoms of alcohol dependence, and negative consequences of alcohol use, was used to screen for likely alcohol dependence. Total scores range from 0 to 40; scores of 8 or above are indicative of likely hazardous or harmful alcohol use (Saunders et al., 1993). The AUDIT has previously demonstrated validity and efficiency in identification of harmful alcohol use (de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009).

Diagnostic measures—The *Clinician Administered PTSD Scale* (CAPS; Blake, Weathers, Nagy, & Kaloupek, 1995), a gold-standard structured clinical interview for DSM-IV PTSD symptoms, was used to diagnose current PTSD. The CAPS measures the frequency and severity of symptoms on a 4-point scale. A symptom was considered to be present when the past month frequency and severity ratings were at least 1 and 2, respectively (Weathers, Keane, & Davidson, 2001). A total severity score is calculated by summing the frequency and severity ratings of the 17 symptoms of PTSD (possible range = 0-136). Internal consistency in the current study was good ($\alpha = .85$) and interrater reliability for PTSD diagnosis was very good (kappa = .94). The *National Women's Study PTSD Module* (Resnick, 1996), a structured interview, was used to assess participants' trauma histories and establish PTSD Criterion A (APA, 2000) event exposure.

The *Computerized Diagnostic Interview Schedule* (C-DIS-IV; Robins et al., 2000), a fully structured, computerized diagnostic interview for DSM-IV Axis I psychiatric disorders, was used to establish substance use disorder diagnostic status. Participants were assigned diagnoses (i.e., no diagnosis, past or current abuse, past or current dependence) related to use of alcohol, marijuana, amphetamines, sedatives, cocaine/crack, opiates, PCP, hallucinogens, inhalants, and "other" drugs.

Self-report questionnaires—The *Difficulties in Emotion Regulation Scale* (DERS; Gratz & Roemer, 2004), a 36-item self-report measure, was used to assess six dimensions of emotion regulation difficulties. Participants endorse applicability of each item to themselves using a 5-point Likert scale (1 = *almost never* to 5 = *almost always*). Higher overall and subscale scores indicate more difficulty regulating emotions. For the current study, we used the revised 30-item five-factor model due to its improved psychometric properties (see Bardeen, Fergus, & Orcutt, 2012). The internal consistency of the 30-item DERS in the current sample was excellent ($\alpha = .93$). The total score was highly correlated with the original 36-item version of the measure ($r = .98, p < .001$).

The *Anxiety Sensitivity Index* (ASI; Reiss, Peterson, Gursky, & McNally, 1986), a 16-item measure of anxiety about the negative consequences of arousal symptoms, was used to measure anxiety sensitivity. ASI items are rated on a five-point scale (0 = “very little” to 4 = “very much”). The ASI is a widely used, valid, and reliable measure (Peterson & Plehn, 1999). In the current sample internal consistency was good ($\alpha = .89$).

Procedure

After hearing a brief description of the study, individuals expressing interest in the trial were administered the PCL-C and the AUDIT. Individuals whose scores on the PCL-C and AUDIT equaled or exceeded 44 and 8, respectively, were scheduled for an in-person clinical assessment to provide informed consent and determine study eligibility via structured diagnostic interviews. Upon giving informed consent, participants completed a comprehensive assessment battery, which included the CAPS, C-DIS-IV, DERS, and ASI.

Data Analysis

Analyses were conducted using SPSS version 20. Zero-order correlation coefficients were used to assess relationships between study variables prior to analysis. PROCESS version 2.04 (Hayes, 2013) was used to test the interaction of AS and DERS in predicting PTSD symptom severity. DERS and ASI scores were mean centered prior to analysis to allow for meaningful interpretation of conditional effects. The Johnson-Neyman regions of significance analysis (Johnson & Neyman, 1936) was used to probe the interaction. In addition, the pick-a-point technique (Rogosa, 1980) was used to further explore the interaction at the DERS mean, one standard deviation below the mean, and one standard deviation above the mean.

Results

Means, standard deviations, and correlations between study variables are presented in Table 1. The ASI and DERS were significantly positively associated and each was positively associated with PTSD symptom severity. Conditional process analysis results are presented in Table 2. Conditional effects for both the ASI and DERS were not significant, while the interaction term (ASI X DERS) was a significant predictor of PTSD symptom severity (small effect, $R^2 = .04$). These findings indicate that AS and difficulties in emotion regulation interacted to predict PTSD symptom severity. That is, the association between AS and PTSD was conditional upon the severity of difficulties regulation emotion, and the association between difficulties in emotion regulation and PTSD was conditional upon AS severity.

The Johnson-Neyman analysis of the interactive effect indicated that the ASI significantly predicted PTSD symptom severity when DERS scores were less than or equal to 86.18 (i.e., -0.27 standard deviations below the DERS mean). The pick-a-point follow-up analysis revealed a significant conditional relationship between the ASI and PTSD symptom severity when DERS scores were held to one standard deviation below the mean (71.33), $B = -.47$, $t(116) = 2.69$, $p = .008$. The conditional relationship between ASI and CAPS was non-significant when DERS scores were held at the mean (91.72) and one standard deviation

above the mean (112.11), $B = -0.20$, $t(116) = 1.46$, $p = .147$ and $B = -.07$, $t(116) = -.034$, $p = .732$, respectively. Predicted PTSD symptom severity scores as estimated by the pick-a-point follow-up analysis are presented in Figure 1.

Discussion

Consistent with previous research, the current results demonstrated that AS and difficulties in emotion regulation are both associated with PTSD severity. As predicted, both AS and difficulties in emotion regulation had independent linear effects in predicting PTSD symptom severity (i.e., increased AS and difficulties in emotion regulation each predicted CAPS scores). Together, however, the effect was interactive, in that the relative effect of each predictor diminished as risk on the other predictor increased. For individuals with the highest levels of difficulties in emotion regulation, PTSD symptom severity was high regardless of level of AS. Conversely, for individuals with the highest levels of AS, increased PTSD symptom severity was observed regardless of level of difficulties in emotion regulation.

The current findings are partially consistent with our expectations, in that AS and difficulties in emotion regulation were operating in conjunction to predict PTSD symptom severity. However, this association only held in the context of low-to-moderate levels of AS and low-to-moderate difficulties in emotion regulation. The interaction finding suggests that, at heightened levels of severity, AS and difficulties in emotion regulation each exhibited influence on PTSD symptom severity in this sample of treatment-seeking, drug and alcohol dependent individuals.

Results of this study provide evidence for both cognitive and emotional conceptualizations of PTSD. The association between AS and PTSD symptom severity supports Ehlers and Clark's (2000) cognitive model of PTSD, wherein PTSD is characterized by negative cognitions about physical symptoms and emotional experiences. The finding that emotion regulation difficulties are associated with PTSD symptomatology is also consistent with emotional processing theories, which posit that individuals with PTSD limit and avoid exposure to trauma-related cues in an effort to reduce emotional reactivity (Foa & Kozak, 1986; Foa & Rothbaum, 1998). Thus, we replicated previous research showing that both AS and difficulties in emotion regulation are relevant to PTSD, and provided an extension of this research through an integrated examination of how these cognitive and emotional factors operate together. Our findings suggest the possibility that extreme AS or difficulties in emotion regulation may differentially affect the clinical presentation of PTSD symptoms.

When interpreting these results, it is important to consider the limitations and strengths of the current study. The primary limitation of this study is the cross-sectional, correlational design, which precludes our ability to detect directionality of effects; future research should utilize longitudinal designs to enhance understanding of the precise influences of AS and difficulties in emotion regulation on PTSD development and maintenance. Additionally, the current study used the ASI to measure AS rather than the updated Anxiety Sensitivity Index – 3 (ASI-3; Taylor et al., 2007). The psychometric properties of the two scales are generally comparable for assessment of global AS; however, the ASI-3 is superior for assessment of

the AS subscales. As such, investigation of AS dimensions in the current study was not feasible. Given this limitation, examination of potential differential associations among AS social, cognitive, and physical concerns, difficulties in emotion regulation, and PTSD symptom severity is an important direction for future studies. One strength of the current study is that a clinical interview was administered to assess PTSD status, which represents an improvement over related studies (McDermott et al., 2009). Finally, previous investigations focused on a narrower population (i.e., predominantly African American, male crack/cocaine users; McDermott et al., 2009). Therefore, the current results may be more widely generalizable than previous studies.

Both AS and emotional avoidance have been associated with poor SUD treatment outcomes. For example, AS was found to be prospectively associated with SUD residential treatment dropout among heroin and crack/cocaine users (Lejeuz et al., 2008). Similarly, avoidance of emotional distress during behavioral tasks was retrospectively associated with self-reported duration of abstinence (Daughters, Lejeuz, Bornovaloa, et al., 2005) and prospectively associated with early treatment dropout (Daughters, Lejeuz, Kahler, Strong, & Brown, 2005). Future research could examine whether these findings generalize to individuals with comorbid SUDs and PTSD, in that individuals with high levels of AS and/or difficulties in emotion regulation may exhibit more severe SUD symptomatology or poorer SUD treatment outcomes.

While cross-sectional in nature, our findings suggest that AS and difficulties in emotion regulation may interact mechanistically to predict and/or maintain PTSD. Considered in the context of previous research, results from this study provide additional, albeit preliminary, support for the potential benefit of interventions targeting AS and/or difficulties in emotion regulation (particularly emotional avoidance) among individuals with PTSD, depending on the manifestations of these difficulties in a particular client. The effectiveness of cognitive-behavioral interventions for PTSD is likely due to their targeting both cognitive and affective mechanisms of PTSD. However, patients with PTSD are quite heterogeneous. Within the context of established treatments, clinicians may consider measuring AS and emotion regulation difficulties during pre-treatment and emphasizing techniques that directly target the patient's most salient difficulties (e.g., emphasizing emotion regulation skills among individuals high in emotion regulation difficulties but lower in AS). As such, examination of the clinical utility of targeting specific cognitive-affective processes in treatment-seeking individuals with comorbid PTSD and SUDs may be warranted. Future research could examine, for example, whether emphasizing specific treatment techniques based on patients' cognitive-affective profiles improves treatment outcomes.

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Figure 1.

Predicted PTSD symptom severity, measured with the Clinician Administered PTSD Scale (CAPS), as a function of scores falling at the mean, one standard deviation above the mean, and one standard deviation below the mean on the Anxiety Sensitivity Index (ASI) and Difficulties in Emotion Regulation Scale (DERS), respectively. Please note that the ASI and DERS scores are interchangeable on the axes, as this analysis focused on the interactive nature of both variables in predicting PTSD symptom severity.

Table 1

Means, Standard Deviations, and Correlations Among Study Variables

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. PTSD Symptom Severity (CAPS)	79.03	18.07	--		
2. Anxiety Sensitivity (ASI)	34.92	12.80	.27*	--	
3. Emotion Regulation (DERS)	91.72	20.39	.30*	.47*	--

Note: PTSD = posttraumatic stress disorder; CAPS = Clinician Administered PTSD Scale; ASI = Anxiety Sensitivity Index; DERS = Difficulties in Emotion Regulation Scale.

* $p < .01$, two-tailed.

Table 2

Overall Model, Conditional Effects, and Interaction Effect Estimating PTSD Symptom Severity

	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Overall Model				
F(3,116) = 6.60, $p < .001$, $R^2 = .15$				
Intercept	80.64	1.71	47.12	<.001
Anxiety Sensitivity (ASI)	0.20	0.14	1.46	.147
Emotion Regulation (DERS)	0.16	0.09	1.80	.074
ASI X DERS	-0.01	0.01	-2.19	.031

Note: PTSD = posttraumatic stress disorder; ASI = Anxiety Sensitivity Index; DERS = Difficulties in Emotion Regulation Scale.