



## Differential roles of thought suppression and dispositional mindfulness in posttraumatic stress symptoms and craving

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### ABSTRACT

Exposure to traumatic events often results in severe distress which may elicit self-medication behaviors. Yet, some individuals exposed to trauma do not develop post-traumatic stress symptoms and comorbid addictive impulses. In the wake of traumatic events, psychological processes like thought suppression and mindfulness may modulate post-traumatic stress and craving for substances. We examined the differential roles of mindfulness and suppression in comorbid post-traumatic stress and craving among a sample of 125 persons with extensive trauma histories and psychiatric symptoms in residential treatment for substance dependence. Results indicated that thought suppression, rather than extent of trauma history, significantly predicted post-traumatic stress symptom severity while dispositional mindfulness significantly predicted both post-traumatic stress symptoms and craving. In multiple regression models, mindfulness and thought suppression combined explained nearly half of the variance in post-traumatic stress symptoms and one-quarter of the variance in substance craving. Moreover, multivariate path analysis indicated that prior traumatic experience was associated with greater thought suppression, which in turn was correlated with increased post-traumatic stress symptoms and drug craving, whereas dispositional mindfulness was associated with decreased suppression, post-traumatic stress, and craving. The maladaptive strategy of thought suppression appears to be linked with adverse psychological consequences of traumatic life events. In contrast, dispositional mindfulness appears to be a protective factor that buffers individuals from experiencing more severe post-traumatic stress symptoms and craving.

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### 1. Introduction

Exposure to traumatic life events often results in adverse psychological and behavioral consequences. Yet, not all individuals exposed to severe adversities develop clinical symptoms (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). How is it that people facing similar stressors can have such markedly different outcomes and resiliencies? Transactional models (c.f., Lazarus & Folkman, 1984) propose that the stress reaction is mediated by appraisal and coping processes. According to this theoretical perspective, the emotional response to the stressor is modulated by cognitive responses, which, in turn, modify the stress appraisal and influence subsequent affective and behavioral reactions. Thus, cognitive coping processes may be conceptualized as being situated in a feedback circuit which may attenuate, sustain, or exacerbate the stress reaction and its consequences over time.

Many individuals exposed to traumatic life events cope with trauma through the use of psychoactive substances. Indeed, data from the National Epidemiologic Survey on Alcohol and Related Conditions indicate that approximately 20% of individuals with post-traumatic stress disorder (PTSD) use substances to relieve their symptoms (Leeies, Pagura, Sareen, & Bolton, 2010). Trauma exposure is associated with heightened risk for developing substance use disorders (Jacobsen, Southwick, & Kosten, 2001). Moreover, men and women with post-traumatic stress disorder (PTSD) exhibit more than twice the rate of substance abuse and dependence than persons without PTSD (Breslau, Davis, & Schultz, 2003; Mills, Teesson, Ross, & Peters, 2006). Furthermore, clinical anecdotes point to the likelihood that traumatized individuals use psychoactive substances as means of self-medicating the dysphoric mood, intrusive cognitions, and psychophysiological sequelae of trauma (Khantzian, 1997). Situations that evoke and involve negative emotion are the most commonly cited precipitants of relapse (Lowman, Allen, & Stout, 1996). The temporary relief obtained via the anxiolytic properties of select psychoactive agents may become a powerful negative reinforcer (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), leading to entrenchment of this coping pattern as an addictive response that may be reactivated by subsequent stressors (Garland, Boettiger, & Howard, 2011).

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Thus, when persons with histories of using substances to cope with stress and negative affect are confronted with a stressor, this encounter may elicit a powerful conditioned response, subjectively experienced as craving (Ludwig & Wikler, 1974; Poulos, Hinson, & Siegel, 1981; Skinner & Aubin, 2010; Stewart, De Wit, & Eikelboom, 1984). The craving experience is characterized as involving a sense of dysphoria or anxiety coupled with distressing somatic sensations (Bergquist, Fox, & Sinha, 2010), and is marked by intrusive images and thoughts about the desired substance (Merikle, 1999). In response to such intrusions, persons may initiate substance use, or they may attempt to inhibit or ignore the drive to use. Tiffany (1990) posited that when addicts attempt to suppress the automatic, conditioned appetitive response, they experience an upwelling of craving that may become so unpleasant that the individual consumes the substance in an effort to relieve craving-induced distress.

The suppression of unwanted thoughts and feelings is a cognitive strategy that may also be used to cope with trauma. Exposure to traumatic events may trigger post-traumatic stress disorder (PTSD), characterized by recurrent, distressing symptoms, including intrusive cognitions, images, memories, and emotions associated with the original trauma (Dunmore, Clark, & Ehlers, 2001; Ehlers et al., 2002; Greenberg, 1995; Holmes, Grey, & Young, 2005). In an attempt to cope with such intrusions, individuals may engage in attempts to suppress the unwanted thoughts or feelings. Ironically, suppression may foster the intrusive trauma-related cognitions that are the hallmark of PTSD (Tull, Gratz, Salters, & Roemer, 2004) by interfering with the emotional processing of the traumatic memory and preventing its successful integration into long-term memory (Elzinga & Bremner, 2002; Foa & Kozak, 1986), as well as by mediating the influence of negative moods on PTSD symptoms (Rosenthal, Cheavens, Lynch, & Follette, 2006). In this respect, thought suppression significantly predicts the occurrence of PTSD one and even three years after a motor vehicle accident (Ehlers, Mayou, & Bryant, 1998; Mayou, Ehlers, & Bryant, 2002). Deliberate thought suppression in laboratory settings has also been shown to exacerbate intrusive thoughts related to the original trauma; for instance, experimental induction of suppression of thoughts related to a motor vehicle accident resulted in a transient decrease in thoughts about the trauma, followed by a resurgence of twice as many thoughts related to the accident than the pre-suppression level (Beck, Gudmundsdottir, Palyo, Miller, & Grant, 2006).

Thus, suppression inadvertently results in a “rebound effect,” i.e., an increased rate of the thoughts and emotions it is directed against (Wegner, Schneider, Carter, & White, 1987; Wenzlaff & Wegner, 2000). This effect may be explained by Wegner’s ironic process theory (Wegner, 1994), which asserts that suppression involves two processes: a) a conscious search for cognitive contents consistent with the desired mental state, and b) an implicit monitoring process that searches continually for cognitions that are inconsistent with the desired state. When attention is automatically deployed in search of undesirable mental content to be replaced, the ensuing positive feedback loop leads to hyperaccessibility of unwanted cognitions (Wegner & Erber, 1992), amplifying their frequency and intensity under conditions of stress (Nixon, Cain, Nehmy, & Seymour, 2009). As a result, the intrusive and distressing nature of the target thoughts is magnified by the very process employed to avoid them (Abramowitz, Tolin, & Street, 2001).

When sustained over time, suppression may exhaust the capacity for self-regulation, which Baumeister and colleagues have characterized as a limited resource that is depleted through repeated acts of self-control (Baumeister, 2003; Muraven & Baumeister, 2000). Thus prolonged suppression of unwanted trauma-related thoughts may undermine subsequent cognitive control efforts (Pu, Schmeichel, & Demaree, 2010). Insofar as trauma and stress may trigger appetitive impulses, post-suppression rebound of trauma-related thoughts may reactivate the drive to use psychoactive substances while

exhausting the resources to regulate it, resulting in impaired regulation of urges manifested in increased subjective craving.

In contrast, the adaptive psychological tendency of dispositional mindfulness, a mindset characterized by nonreactive awareness and acceptance (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Garland, Fredrickson, Kring, Johnson, Meyer, & Penn, 2010), may serve as a protective factor and mitigate the pathogenic cycle underpinning the co-occurrence of trauma and addiction. Indeed, in a recent study of undergraduates who had been exposed to traumatic events, Thompson and Waltz (2010) found that mindfulness was significantly inversely associated with post-traumatic stress avoidance symptoms. Other research has identified a robust negative correlation between dispositional mindfulness and thought suppression (Baer et al., 2006). Thus, rather than attempting to avoid or deny experience by suppressing unwanted cognitions or feelings, dispositionally mindful individuals tend to cope with stressful life events by adopting an attitude of nonjudgment, openness, and self-compassion towards their own thoughts and emotions. By coping with stress in this manner, dispositionally mindful persons are better able to extricate themselves from cognitive perseveration (Evans & Segerstrom, 2010), to regulate negative affective states (Coffey & Hartman, 2008), and to disengage attention from addictive cues (Garland, Boettiger, Gaylord, West Channon, & Howard, 2012). Conversely, persons with low levels of mindfulness (i.e., mindlessness) may tend to engage in habitual and counterproductive reactions (Langer, 1992) such as self-medicating traumatic intrusions with alcohol and drugs. Although of potentially considerable clinical importance, associations between dispositional mindfulness, thought suppression, post-traumatic stress symptoms, and craving remain understudied.

Given evidence for the roles of thought suppression and dispositional mindfulness in the cognitive mediation of traumatic stress and appetitive responses, we hypothesized that among substance dependent individuals with extensive trauma histories a) thought suppression will be associated with elevated symptoms of post-traumatic stress and craving whereas b) dispositional mindfulness will be associated with lower levels of post-traumatic stress symptoms and craving. Furthermore, we hypothesized that c) thought suppression and dispositional mindfulness would statistically mediate the relationship between trauma history, post-traumatic stress symptoms, and craving. We expected that persons with extensive trauma histories would tend toward thought suppression which would partially account for their comparatively more severe post-traumatic stress symptoms and craving. In contrast, we expected individuals with higher levels of dispositional mindfulness to engage in less thought suppression which would partially account for their comparatively lower post-traumatic stress symptoms and craving. The present study provides an empirical test of these hypotheses by examining the proposed associations among a sample of persons with extensive trauma histories in residential treatment for substance dependence.

## 2. Materials and methods

### 2.1. Procedure

Participants were recruited from a residential treatment facility in the Southeastern U.S. serving persons with co-occurring substance dependence and psychiatric disorders. Prior to participating in the research assessment, participants had resided in a therapeutic milieu for six weeks, during which time they were offered vocational training, given peer support, and provided with psychoeducation on biopsychosocial factors in addiction. No other interventions were administered at this time. The research team met with potential participants to explain the purpose of the study, and to assure them that confidentiality would be maintained throughout the research process. Participation in the study was completely voluntary, and participants gave informed consent prior to engaging in research. After consenting, participants

completed a set of validated assessment instruments (see Section 2.3). Upon completing the research assessment detailed in the present study, participants were engaged in formal, evidence-based interventions for substance use disorders and trauma treatment. However, the present study focused on a cross-sectional analysis of data obtained prior to the start of these interventions. This study was conducted in accordance with the Declaration of Helsinki.

To satisfy study inclusion criteria, potential participants had to meet DSM-IV criteria for one or more substance dependence diagnoses. Substance dependence and other Axis I disorders were diagnosed by licensed and trained clinicians with experience making psychiatric and addiction diagnoses. Clinicians conducted semi-structured psychiatric interviews based on the Mini-International Neuropsychiatric Interview (Sheehan et al., 1998). Potential participants were excluded from the study if they were actively psychotic or homicidal. All participants had abstained from using drugs or alcohol for six weeks prior to the research assessment.

## 2.2. Participants

A total of 125 individuals who met criteria for one or more substance dependence diagnoses (mean age 38.7,  $SD = 10.0$ ; 51.5% African American, 39.6% Caucasian; 92% male) agreed to participate in the study, while 13 individuals who met study criteria declined to participate due to lack of interest or scheduling conflicts. The majority of study participants met DSM-IV criteria for cocaine ( $n = 69$ , 55.2%) and/or alcohol dependence ( $n = 66$ , 52.8%); comparatively fewer participants could be diagnosed with dependence on marijuana ( $n = 46$ , 36.8%), heroin ( $n = 14$ , 11.2%), and opioids ( $n = 8$ , 6.4%), benzodiazepines ( $n = 6$ , 4.8%), or amphetamines ( $n = 5$ , 4.0%). Many participants met criteria for psychiatric disorders: 35 (28%) participants were diagnosed with major depressive disorder, 11 were diagnosed with generalized anxiety disorder, 6 (4.8%) were diagnosed with bipolar disorder, 1 (0.8%) was diagnosed with a simple phobia, 1 (0.8%) was diagnosed with social anxiety disorder ( $n = 1$ , 0.8%), and 14 (11.2%) were diagnosed with another Axis I or II disorder (e.g., personality disorders, attention-deficit-and-hyperactivity disorder). Furthermore, 23 (18.4%) met full diagnostic criteria for PTSD, as established by clinical interview and corroborated with scores from the PTSD Checklist-Civilian Version (see the Measures section below; Weathers et al., 1993). The PTSD Checklist-Civilian Version was used to provide a quantitative estimate of PTSD symptoms.

## 2.3. Measures

### 2.3.1. Trauma history

Participants were asked whether or not they had ever experienced each of 10 traumatic events in their lifetime, including: “witnessed someone severely injured or killed in person”; “having been badly hurt or in danger of being badly hurt”; “had something very bad or terrifying happen to you”; “hit by someone who was trying to hurt you”; “been mugged by a weapon or by force”; “attacked with a weapon or by someone trying to hurt or kill you”; “witnessed someone be severely beaten”; “been sexually touched against your will”; “forced to watch sex acts done by another person”; and “forced to do sex acts against your will.” A variable measuring extent of trauma history was calculated by summing the number of affirmative responses to ever having experienced a given category of lifetime trauma ( $\alpha = .660$ ). For example, if a participant had responded “yes” to having ever “witnessed someone severely injured or killed in person,” “having been badly hurt or in danger of being badly hurt,” and “had something very bad or terrifying happen to you,” they would score a 3 on the trauma history variable.

### 2.3.2. Post-traumatic stress symptoms

Post-traumatic stress symptoms were assessed with the 17-item PTSD Checklist-Civilian version (PCL-C; Weathers et al., 1993).

Participants rated how much they had been bothered by PTSD criterion symptoms as outlined by the DSM-IV over the past month on a Likert scale (1 = not at all, 5 = extremely). A total post-traumatic stress symptom score was calculated by summing responses to each item ( $\alpha = .915$ ). Responses on the PCL-C reflected post-traumatic stress symptoms resulting from the experience of traumatic events endorsed on the abovementioned measure of trauma history. According to the cutoffs established by Harrington and Newman (2007) via receiver-operator characteristic curve (ROC) analysis, a score of 44 or higher on the PCL-C may be considered to be diagnostic for PTSD among treatment-seeking individuals with substance use disorders. In the present study, all participants who were diagnosed with PTSD according to the clinical interview evidenced PCL-C scores  $\geq 44$ .

### 2.3.3. Thought suppression

Chronic thought suppression, the counterproductive tendency to avoid or suppress undesirable cognitions and emotions, was assessed with the 15-item White Bear Suppression Inventory (Wegner & Zanakos, 1994) ( $\alpha = .895$ ). Participants indicated their level of agreement (1 = strongly disagree, 5 = strongly agree) with items such as “I always try to put problems out of mind” and “I often do things to distract myself from my thoughts.” Items were summed to produce a total score, with higher scores indicative of greater trait thought suppression.

### 2.3.4. Dispositional mindfulness

The *Five Facet Mindfulness Questionnaire* was used to measure dispositional mindfulness. This scale is comprised of 39 Likert-type items tapping various facets of mindfulness: nonreactivity to inner experience (tapped by items such as “I watch my feelings without getting lost in them”), observing and attending to experience (“I pay attention to sensations, such as the wind in my hair or the sun on my face”), describing and discriminating emotional experiences (“I’m good at finding words to describe my feelings”), nonjudging of experience (“I tell myself I shouldn’t be feeling the way that I am feeling”), and acting with awareness (“I find myself doing things without paying attention”) (Baer et al., 2006). Items are summed to produce a total dispositional mindfulness score ( $\alpha = .924$ ).

### 2.3.5. Craving

Substance craving was assessed with an adapted version of the *Penn Alcohol Craving Scale* (Flannery et al., 2001), modified to assess craving for alcohol and other psychoactive substances. The original *Penn Alcohol Craving Scale* includes five question items that assess the duration, frequency and intensity of craving for alcohol on a 7-point scale (in the present study,  $\alpha = .894$ ). In the version adapted for this study the item structure was maintained for the original five items but five additional items were rephrased to inquire about craving for drugs other than alcohol. For Example item 1 of PACS “How often have you thought about drinking or how good a drink would make you feel?” was modified to “How often have you thought getting high, or about how good getting high would make you feel?” These adapted items were summed to create a total drug craving score ( $\alpha = .895$ ). Then the adapted drug craving items were summed with the alcohol craving items to compute a total substance craving score across all 10 items ( $\alpha = .910$ ).

## 2.4. Statistical analyses

Pearson product-moment correlations were used to examine zero-order correlations between study variables. Multiple linear regression analyses were used to test our first and second hypotheses by examining the differential roles of dispositional mindfulness and thought suppression as predictors of post-traumatic stress symptoms and substance craving. In both the regression model predicting post-traumatic stress symptoms and the model predicting craving, number

of traumatic events was entered as a covariate in step one. Thought suppression and dispositional mindfulness were entered in step two. Collinearity diagnostics were assessed using conventional cut-offs (tolerance  $> .20$ , variance inflation factor  $< 5.0$ ) to ensure that no multicollinearity was present. In addition, student's *t*-tests were used to compare participants who met diagnostic criteria for PTSD (according to established PCL-C cutoffs) to those who did not across trauma history, thought suppression, dispositional mindfulness, and craving variables.

Multivariate path analysis within a structural equation modeling framework, which provides simultaneous estimation of multiple linear equations, was conducted to examine the relationships proposed in our third hypothesis linking trauma history, thought suppression, dispositional mindfulness, post-traumatic stress symptoms, and substance craving. Path analysis has advantages over multiple regression analysis in that it allows the researcher to simultaneously estimate specific associations between multiple independent and dependent variables. In path analysis a variable can be represented as both a predictor and a criterion variable in the same model – unlike regression analysis where in any given model a variable must be either a predictor or criterion variable (Kline, 1998). Conducting separate regression analyses may also omit or ignore important intercorrelations among the criterion variables. AMOS 17.0 was used to calculate model parameters, and missing data were handled using full-information maximum likelihood estimation. Model fit was determined comparing fit indices to widely accepted cut-offs (Kline, 1998), including nonsignificant  $\chi^2$  ( $p > .05$ ), comparative fit index (CFI)  $> 0.90$ , and the root-mean square error of approximation (RMSEA)  $< 0.08$ .

### 3. Results

#### 3.1. Prevalence of trauma in the sample

Participants reported having experienced a wide range of traumatic incidents (see Fig. 1 for the lifetime prevalence of various traumatic experiences). Approximately 80% of participants reported having been struck by someone who had attempted to hurt them, having witnessed someone else being severely beaten, having been in danger of getting badly injured or killed, or experiencing a terrifying event. Nearly two thirds of participants had been mugged or attacked with a weapon. Fewer participants reported experiencing

sexual abuse or rape. On average, participants had experienced 5.3 (SD = 2.1) different categories of traumatic life events.

#### 3.2. Bivariate correlations between trauma history, post-traumatic stress symptoms, thought suppression, dispositional mindfulness, and substance craving

Correlation coefficients for variables of interest are reported in Table 1. Extent of trauma history was significantly positively associated with thought suppression and significantly negatively associated with the dispositional mindfulness facets of nonreactivity and nonjudging, but was not correlated with post-traumatic stress symptoms or craving. Post-traumatic stress symptom level was significantly positively associated with thought suppression and craving, and significantly negatively associated with the total dispositional mindfulness score and the mindfulness facets of nonreactivity, nonjudging, describing emotional experience, and acting with awareness. Craving and thought suppression were also significantly negatively associated with dispositional mindfulness and these four mindfulness facets.

#### 3.3. Relationship of trauma history, thought suppression, and dispositional mindfulness to post-traumatic stress symptoms

Multiple linear regression indicated that thought suppression and dispositional mindfulness significantly predicted post-traumatic stress symptom severity after controlling for extent of trauma history (see Table 2). Overall, the model explained nearly half of the variance in post-traumatic stress symptoms (Model  $R^2 = .49$ ).

#### 3.4. Relationship of trauma history, thought suppression, and dispositional mindfulness to craving

Multiple linear regression indicated that dispositional mindfulness, rather than thought suppression or extent of trauma history, significantly predicted craving (see Table 2). Overall, the model explained one quarter of the variance in craving (Model  $R^2 = .25$ ).

#### 3.5. Multivariate path analysis

Our multivariate path model (see Fig. 2) exhibited excellent empirical fit,  $\chi^2/df = .05$ ,  $p = .82$ ; CFI = 1.00; RMSEA = .00 (.00, .15). Participants with more extensive trauma histories had a greater

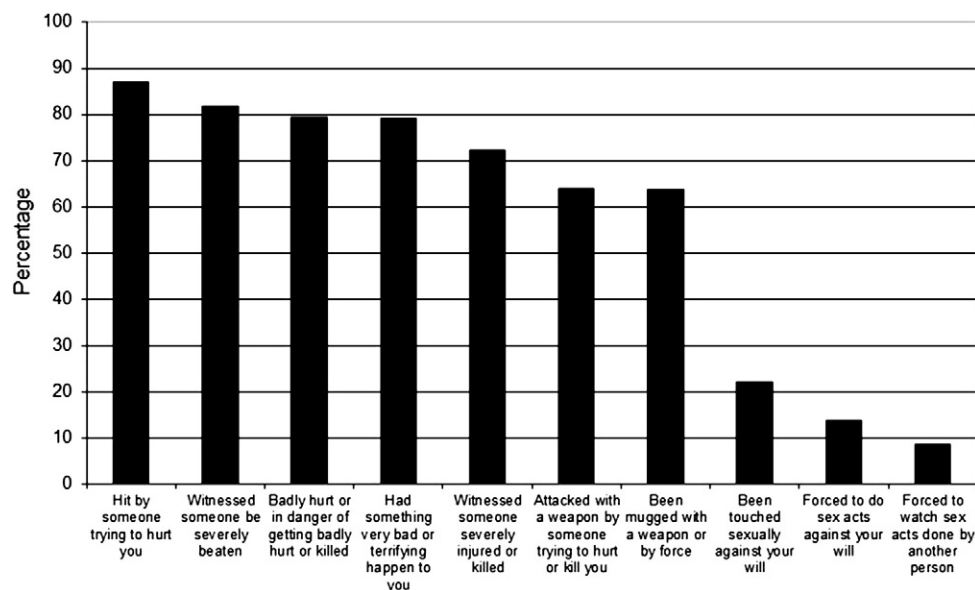


Fig. 1. Lifetime prevalence of various traumatic experiences among study participants.

**Table 1**

Bivariate correlations between trauma history, post-traumatic stress symptoms, thought suppression, dispositional mindfulness, mindfulness facets, and substance craving in adults with substance dependence disorders.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Trauma history	1									
2. Post-traumatic stress symptoms	.142	1								
3. Thought suppression	.284**	.605***	1							
4. Dispositional mindfulness (total score)	-.16	-.584***	-.640***	1						
5. Nonreactivity to inner experience	-.250*	-.540***	-.490***	.718***	1					
6. Observing/attending to experience	.008	-.130	-.064	.569**	.322**	1				
7. Describing emotional experience	-.158	-.426***	-.471***	.860***	.484***	.504***	1			
8. Nonjudging of experience	-.303**	-.417***	-.546***	.576***	.403***	-.100	.355**	1		
9. Acting with awareness	-.019	-.523***	-.497***	.829***	-.559***	.264*	.616***	.397***	1	
10. Substance craving	.125	.351**	.382**	-.489***	-.425***	-.078	-.435***	-.387***	-.401***	1

N = 125.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p \leq .001$ .

tendency to engage in thought suppression, which in turn was correlated with more severe post-traumatic stress symptoms. In contrast, the association between extent of trauma history and dispositional mindfulness was non-significant. Yet, participants reporting higher levels of dispositional mindfulness tended to engage in less thought suppression, which in turn was associated with less severe post-traumatic stress symptoms. Similarly, persons with higher levels of dispositional mindfulness tended to report less craving, although this association was not accounted for by thought suppression.

### 3.6. Differences in trauma history, thought suppression, dispositional mindfulness, and craving between individuals with and without PTSD

We compared the 23 participants who met diagnostic criteria for PTSD (as determined by clinical interview and corroborated by PCL-C scores above the cutoff score of 44 previously established by ROC analysis (Harrington & Newman, 2007) to those who did not ( $n = 102$ ) across trauma history, thought suppression, dispositional mindfulness, and craving variables. Due to the unequal subsample size, we used Levene's test to assess the homogeneity of variances between the PTSD and non-PTSD groups, and used adjusted  $t$ -test calculations when equal variances could not be assumed. Participants who met diagnostic criteria for PTSD evidenced significantly higher levels of thought suppression ( $p < .001$ ,  $d = 1.38$ ) and craving ( $p = .001$ ,  $d = .81$ ), and significantly lower levels of dispositional mindfulness ( $p < .001$ ,  $d = 1.43$ ), than participants who did not meet criteria for PTSD. In contrast, there were no significant differences in trauma history between participants who did and did not meet criteria for PTSD ( $p = .95$ ,  $d = .43$ ).

**Table 2**

Regression models of thought suppression and dispositional mindfulness on PTSD symptoms and craving.

	B	S.E.	Beta	t
Outcome: post-traumatic stress symptoms <sup>a</sup>				
Trauma history	-1.206	.612	-.173	-1.970
Thought suppression	.618	.135	.518	4.578***
Dispositional mindfulness	-.182	.069	-.282	-2.625*
Outcome: craving <sup>b</sup>				
Trauma history	-.152	.611	-.026	-.249
Thought suppression	.234	.135	.234	1.738
Dispositional mindfulness	.185	.069	.344	2.683**

<sup>a</sup>  $R^2 = .49$ .

<sup>b</sup>  $R^2 = .25$ . ( $N = 125$ ).

\*  $p < .05$ .

\*\*  $p < .10$ .

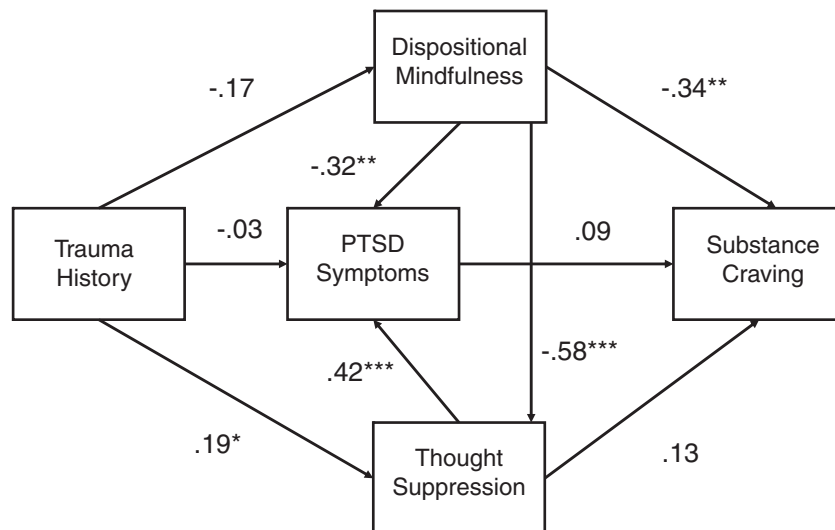
\*\*\*  $p < .001$ .

## 4. Discussion

Current study findings revealed that among a sample of treatment-seeking individuals with comorbid substance dependence, psychiatric disorders, and extensive trauma histories, thought suppression was significantly associated with post-traumatic stress symptoms, whereas lifetime exposure to traumatic events was not. In contrast, dispositional mindfulness was significantly inversely associated with post-traumatic stress symptoms and craving. Although the present data is cross-sectional and cannot be used to establish causal relations, study findings are consistent with the notion that the manner in which one cognitively copes with traumatic events is robustly associated with the co-occurrence of post-traumatic stress and addictive urges.

Indeed, while nearly 61% of men and 51% of women in the U.S. report having experienced at least one traumatic event during their lives, the lifetime occurrence of PTSD ranges between 6% and 9% (Kessler et al., 1995). Hence, the majority of people who experience trauma do not develop PTSD, in spite of having been exposed to severely adverse and often life-threatening events. Our own data support these observations; in the present sample, substance dependent individuals who met diagnostic criteria for PTSD had similar trauma histories to those who did not meet criteria for PTSD. Conversely, study participants with PTSD could be distinguished from their counterparts with regard to their greater tendency toward engaging in thought suppression, their lower levels of dispositional mindfulness, and their more severe craving for drugs and alcohol. Such findings point to a central proposition of transactional stress and coping theory (Lazarus & Folkman, 1984): it is not the stressor event itself, but rather the way in which the event is appraised and coped with, that determines the magnitude and quality of the stress reaction. In line with this proposition, among victims of childhood sexual abuse, variation in post-traumatic stress symptom severity is better accounted for by the use of avoidance than by the severity of the original trauma (Batten, Follette, & Aban, 2001; Polusny & Follette, 1995; Rosenthal, Rasmussen Hall, Palm, Batten, & Follette, 2005).

Our path analytic findings highlight the potential importance of cognitive factors in the mediation of post-traumatic stress symptoms and craving for psychoactive substances. Study results indicate that among substance dependent individuals exposed to traumatic life events, the association between trauma exposure and post-traumatic stress symptoms was statistically mediated by thought suppression. Hence, the extent to which these individuals engaged in thought suppression following trauma exposure partially accounted for the magnitude of their post-traumatic stress symptoms. Furthermore, the inverse association between dispositional mindfulness and post-traumatic stress symptoms was also statistically mediated by



**Fig. 2.** Multivariate path model depicting relationships between trauma history, post-traumatic stress symptoms, thought suppression, dispositional mindfulness, and craving among a sample of substance dependent adults ( $N = 125$ ).  $^*p < .05$ ,  $^{**}p < .01$ , and  $^{***}p < .001$ .

thought suppression. Substance dependent individuals exposed to trauma who reported higher levels of dispositional mindfulness tended to engage in less thought suppression, which in turn was related to their lower levels of post-traumatic stress symptoms. Although we identified a significant zero-order correlation between post-traumatic stress symptoms and craving, this relationship became non-significant when we accounted for potential cognitive mediating variables in our multivariate model. Contrary to our expectations, thought suppression did not statistically mediate the association between post-traumatic stress and craving. In contrast, dispositional mindfulness remained inversely associated with craving when a number of other variable relationships were controlled in the model, attesting to the robustness of the association between mindfulness and appetitive regulation.

It is possible that the maladaptive strategy of thought suppression may inadvertently amplify post-traumatic stress symptoms through ironic processes (Wegner, 1994), which have been linked with depletion of neurocognitive resources needed to regulate implicit urges towards psychoactive substances (Garland, Carter, Ropes, & Howard, 2012). Conversely, dispositionally mindful individuals who cope by adopting a nonjudgmental awareness and acceptance of trauma-related thoughts and emotions may be less likely to develop post-traumatic stress symptoms and may have greater capacity to downregulate craving. Relatedly, research suggests that mindful acceptance mediates post-traumatic stress and self-medication motives (Vujanovic, Bonn-Miller, & Marlatt, 2011), while other studies have identified associations between dispositional mindfulness, addiction-related cognitive processes, and stress-precipitated substance cue-reactivity (Garland, 2011; Garland et al., 2012). Moreover, among substance users, decreases in thought suppression have been shown to mediate the effect of mindfulness training on substance use (Bowen, Witkiewitz, Dillworth, & Marlatt, 2007), and mindfulness training appears to attenuate the relationship between negative emotion and craving (Witkiewitz & Bowen, 2010). Furthermore, mindfulness training led to significantly reduced thought suppression that was correlated with decreased alcohol attentional bias and increased autonomic recovery from stress and addictive cues (Garland, Gaylord, Boettiger, & Howard, 2010). On the contrary, lack of mindfulness (i.e., mindlessness, see Langer, 1992) may be a risk factor for persons with co-occurring disorders; indeed, study participants who scored low on the “acting with awareness” facet of the five facet mindfulness questionnaire tended to have higher levels of post-traumatic stress symptoms and craving, suggesting that habitual, reflexive responding can

confer vulnerability to individuals in recovery. To be clear, the cross-sectional nature of the present study prevents causal explanations of the relationships posited by our regression and path models, and some of these relationships may in fact be bidirectional or recursive. Longitudinal, prospective investigations, clinical trials, and experimental laboratory research are needed to test causal models linking trauma history, thought suppression, post-traumatic stress symptoms, craving, and dispositional mindfulness. Future clinical trials could examine effects of mindfulness and thought suppression on the development of PTSD symptoms and drug craving after exposure to an adverse event.

While the path model tested in this study provides a general depiction of the cognitive processes connecting adverse psychiatric and substance-related outcomes to exposure to traumatic life events, future research should further detail each stage in the process. For example, although our path analyses suggest that higher levels of thought suppression are associated with elevated substance craving, the mechanisms that mediate this association remain unspecified. Studies suggest that thought suppression leads to hyperaccessibility of substance-related cognitions (Klein, 2007; Palfai, Monti, Colby, & Rohsenow, 1997). Furthermore, thought suppression may deplete the neurocognitive resources necessary for regulating craving and disengaging attention from substance-related cues as manifested by effects on autonomic cue-reactivity (Garland, Carter, Ropes, & Howard, 2012). Future research should integrate measures of attention (e.g., dot probe task, see Field & Cox, 2008; MacLeod, Mathews, & Tata, 1986), implicit cognition (e.g., emotional Stroop task, see Cox, Hogan, Kristian, & Race, 2002; Williams, Mathews, & MacLeod, 1996), and psychophysiological cue-reactivity (Carter & Tiffany, 1999) into path models linking trauma, post-traumatic stress, and craving. In addition, we did not have access to a measure of substance use frequency and quantity. Differences in the frequency and quantity of substance use might have accounted for some of the observed relationships, and therefore, future studies should control for these variables as model covariates.

The present study was also limited by the use of a relatively “low-resolution” measure of trauma history. Participants were queried with dichotomous items about whether they had ever experienced a broad spectrum of traumatic events in their lifetime. Had we utilized a measure of the exact number of traumatic events ever experienced, our analyses may have yielded different results. It may be, for instance, that persons meeting diagnostic criteria for PTSD had a higher total number of traumatic events, despite having experienced

a near equivalent number of categories of traumatic events. Indeed, prior epidemiological studies have found that the number of traumatic events experienced is a significant predictor of PTSD (Breslau, Chilcoat, Kessler, & Davis, 1999; Perkonig et al., 2000). Conversely, certain types of traumatic events may be most strongly predictive of PTSD (Norris, 1992). As such, current study findings and path models should be replicated using a more fine-grained measure of trauma history. However, it should be noted that when trauma history and severity of the current traumatic event are statistically controlled, cognitive factors continue to predict PTSD symptoms 6 and 9 months after the occurrence of a traumatic event (Dunmore et al., 2001). Thus, in spite of the aforementioned limitations, the present findings add to a growing body of research attesting to the importance of cognitive factors in mediating the association between trauma and both post-traumatic stress and craving.

To advance treatment development efforts, it is crucial to target cognitive risk mechanisms such as thought suppression that may mediate the effects of exposure to stressful and traumatic life events on addictive behavior. In turn, identification of malleable psychological processes like mindfulness that can counter risk mechanisms implicated in co-occurring disorders is a key step towards designing targeted interventions for persons in recovery from addiction.

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#### Contributors

With regard to our respective contributions to the present manuscript, ELG and ARL designed the study. ARL managed the data collection for the study. ELG reviewed the literature and undertook the statistical analysis. ELG and ARL both contributed to the development of the manuscript.

#### Conflict of interest

All authors declare they have no conflicts of interest.

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