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## Testing Gender Effects on the Mechanisms Explaining the Association between Post-Traumatic Stress Symptoms and Substance Use Frequency

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### Abstract

The present study examines gender differences in the mechanisms that explain the association between PTSD symptoms and substance use frequency in a sample of 182 urban substance users. Specifically, the current study examined gender differences in the role of two potential explanatory variables, namely, difficulties controlling impulsive behavior when distressed (IMP), and a lack of emotional awareness and clarity (AW/CLAR). Multiple-group path modeling (across males and females) was used to examine gender differences in the path coefficients from PTSD symptoms to IMP and AW/CLAR, and from these latter variables to drug use frequency. Results indicated that PTSD symptoms were associated with IMP and AW/CLAR, and these path coefficients did not vary by gender. However, gender differences emerged when considering the path coefficients from AW/CLAR and IMP to substance use frequency. Specifically, for women, the association between PTSD and substance use was partially explained by IMP, whereas for men, the association between PTSD and substance use was partially explained by AW/CLAR. The current study is the first to examine gender differences in mechanisms accounting for the association between PTSD and substance use frequency, and these results also support the value and importance of examining gender differences in mechanisms underlying PTSD-SUD comorbidity.

### Keywords

Post-traumatic Stress Symptoms; Substance Use; Urban; Gender Differences

### 1. Introduction

The high comorbidity between substance use disorders (SUDs) and post-traumatic stress disorder (PTSD) is well documented across various samples and demographic groups (Triffleman et al, 1995 ) Brown, Recupero, & Stout, 1995; David, Woodward, Esquenazi, &

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Mellman, 2004; Kulka et al, 1990; Kulka et al., 1988; Fullilove et al, 1993). Patients presenting with PTSD experience more severe drug- and alcohol-abuse problems than those without PTSD (McFall, Mackay, & Donovan, 1992). Conversely, those presenting with the PTSD-SUD co-occurrence tend to suffer from more severe PTSD symptoms, particularly those in the avoidance and arousal symptom clusters than do patients with PTSD alone (Saladin, Brady, Dansky, & Kilpatrick, 1990). Given that during the course of treatment, individuals with the SUD-PTSD comorbidity are more likely to leave SUD treatment prematurely, relapse more readily and quicker, and are more likely to engage in SUD-related HIV risk behaviors than those presenting with SUDs alone (Brown, Stout, & Mueller, 1996, 1999; Kubiak, 2004; Ouimette, Finney, & Moos, 1999; Read, Brown, & Kahler, 2004; Stevens et al, 2003; Zweben et al, 1994), there is a clear need to understand the mechanisms underlying the link between the two disorders.

In exploring the link between PTSD and SUDs, research suggests a number of gender differences in the nature and magnitude of this relationship. First, a number of studies indicate that among individuals with substance use disorders, women and men experience different types of trauma. Women are more likely to report childhood sexual, physical emotional abuse, and adult sexual assault as their “critical” incident (i.e., the incident linked to the PTSD symptoms); in contrast, men are more likely to report combat, accidents, and exposure to crime (e.g., Grice et al, 1995; Najavits et al, 1998; Ouimette et al, 2000; see Stewart, Grant, Ouimette and Brown, 2006 for a review). Second, although men report using an overall higher variety of substances (Deykin & Buka, 1997), women with SUDs have a higher prevalence of current and lifetime PTSD (see Stewart et al, 2006). Third, research suggests different temporal ordering of the PTSD and substance use variables across men and women. Studies show that among women, PTSD either precedes or occurs simultaneously with an SUD, while in men, SUDs generally precede traumatic exposure and PTSD symptoms, or the disorders occur simultaneously (Cottler, Nishith & Compton, 2001; Deykin & Buka, 1997; Lipschitz et al., 2000; Najavits, Weiss, & Shaw, 1997; Sonne et al, 2003).

Together, these studies provide initial evidence for the different nature, strength, and temporal ordering of PTSD and SUDs across men and women. Moreover, gender differences in the PTSD-SUD clinical picture suggest that the mechanisms through which PTSD and SUD are associated differ for men and women. However, few studies explore such mechanisms. This is an important area for future inquiry as it may enhance our understanding of gender differences in the mechanisms that link the two disorders. This might lead to the development of individualized and more effective treatments for men and women experiencing this comorbidity.

In the search of underlying mechanisms that explain the relationship between PTSD and SUDs, two variables may be especially interesting to consider: (1) a lack of awareness and understanding of emotions, and (2) the inability to control behaviors when experiencing emotional distress. With regard to the first mechanism, seminal theory suggests that individuals with a history of traumatic exposure fear intense negative emotions and strive to further block emotional experiences through self-medication with drugs or alcohol (Krystal, 1984). Once blocked and/or shut down, these emotions are likely to become difficult to access and recognize as such, and may appear clinically as emotional “numbing”. With regard to second suggested mechanism of the difficulty controlling impulsive behaviors when distressed, it has been suggested that intense emotional responding associated with PTSD (Litz, Orsillo, Kaloupek, & Weathers, 2000; Orsillo, Batten, Plumb, Luterek, & Roessner, 2004) may interfere with an individual’s ability to control unhealthy behaviors, as the individual may be motivated to engage in a behavior (no matter how maladaptive) that functions to avoid or eliminate the experience of this distress in the short-term, despite a potential heightened risk for negative long-term consequences (Tull et al, 2007; Bornovalova et al, 2009).

A number of studies suggest that these two mechanisms are associated with PTSD (APA, 1994; Feeny, Zoellner, Fitzgibbons & Foa, 2000; Hyer, Woods, Summers, Boudewyns, & Harrison, 1990; Monson, Price, Rodriques, Ripley, & Warner, 2004; Tull, Barrett, McMillan, and Roemer, 2007) and SUDs (El Rasheed, 2001; Fox, Axelrod, Paliwal, Sleeper, & Sinha, 2007; Loas, Fremaux, Otmani, Lecercle, & Delahousse, 1997). For example, in a sample of substance users, Handelsman and colleagues (2000) found a relationship between difficulty recognizing and naming emotions and PTSD symptoms (see Zlotnick, Mattia, & Zimmerman, 2001 for similar results). Similarly, Stewart, Conrod, Pihl, and Dongier (1999) as well as McFall, Mackay, and Donovan (1992) found that the numbing symptoms of PTSD (i.e., the shutting down of emotions) in particular was related to drug and alcohol use severity. Similarly, supporting the role of difficulties controlling impulsive behaviors when distressed in the PTSD-SUD comorbidity link, Tull, Barrett, McMillan, and Roemer (2007) found that individuals with severe symptoms of PTSD reported significantly greater difficulties controlling impulsive behaviors when distressed, compared to individuals with traumatic exposure but subthreshold symptoms of PTSD. In a parallel line of work, (Lynam & Miller, 2004) reported that this construct is related to substance use severity.

With regard to gender, multiple studies suggest that among men, PTSD symptom severity is associated with difficulty recognizing and differentiating internal emotional states (Monson, Price, Rodriques, Ripley, & Warner, 2004). Moreover, men, compared to women, report less attention, clarity, and awareness of their emotions (Gratz & Roemer, 2004; Lane, Sechrest & Riedel, 1998; Thayer Rossy, Ruiz-Padial and Johnsen, 2003; van Middendorp et al, 2005). Similarly, although clinical lore and some empirical work (Eyesenck et al, 1985) generally suggest that men demonstrate higher impulsivity than women, Lejuez, Bornovalova, Reynolds, Daughters, and Curtin (2005) found that women substance users in a residential substance use treatment center had greater impulsivity than men. Moreover, among women, levels of impulsivity were related to frequency and severity of crack/cocaine use, and levels of impulsivity served as the explanatory mechanism between gender and crack/cocaine use. Closer to the conceptualization of impulse control used in the current paper, D'Acremont and Van Der Linden (2005) as well as Whiteside and Lynam (2003) found that females exhibited higher levels of distress-related impulsivity than males. Taken together, these findings suggest that difficulties in recognizing emotions as well as difficulties controlling impulsive behaviors when distressed may differentially explain the relationship between PTSD and substance use across gender.

## Current Study

The present study examines gender differences in the explanatory mechanisms between PTSD, and substance use frequency, an excellent proxy measure of substance use severity (Derringer et al, 2008; Kirisci et al, 2006). With regard to our explanatory mechanisms, we focused on difficulties in emotional understanding and difficulties controlling impulsive behaviors when distressed. This investigation was conducted in a sample of urban substance users. Indeed, substance-abusing individuals from poverty-stricken communities may have heightened rates of trauma-related experiences (Hien & Levin, 1994), placing them at a risk for high PTSD symptomatology and rendering the investigation of this sample especially clinically relevant. Moreover, investigating level of drug use among a sample that is already reporting substance misuse represents a more stringent test of the key relationships than the investigation of overall substance use level in the general community. Finally, it should be noted that difficulties in recognizing emotions and difficulties controlling impulsive behaviors when distressed fall under the broader rubric of emotion dysregulation, which also encompasses other definitions and types, including but not limited to the inability to withstand emotional distress and attempts to terminate said distress despite potential consequences, the inability to engage in goal-directed behaviors when distressed, and a lack of access to emotion regulation strategies (Gratz

& Roemer, 2004). However, the current study is the first to examine gender differences in mechanisms underlying the symptoms of PTSD-drug use link. And, the available literature provides support for gender differences in the mediational role of emotional awareness and difficulties controlling impulsive behaviors when distressed *in particular*. As such, the current study focused on two types of emotion dysregulation, thereby limiting the potential number of mediational analyses and reducing the likelihood of spurious findings. Based on the literature described above, we tentatively predicted that emotional non-awareness would mediate the relationship between PTSD symptom severity and substance use frequency for men, whereas difficulties controlling impulsive behaviors when distressed would mediate this relationship for women. However, the findings regarding the potentially mediating role of the two constructs are somewhat mixed (at least in the case of women). As such, we tested the mediational role of the two constructs across both genders.

## 2. Materials and Methods

### 2.1. Participants

Participants were 182 consecutively admitted inpatient residents in a drug and alcohol abuse treatment center in the greater Washington DC metropolitan area. Residents were approached for participation within one week of their arrival at the treatment center; as such, by the time the participants completed the study, they have been present at the treatment center between 48 hours and seven days. Of note, entry into the treatment center (independent of the current study) requires that individuals evidence abstinence from all drug use and complete a detoxification program if needed; thus, acute drug effects likely did not affect participants' scores on the testing battery.

Treatment at this center involves a mix of strategies adopted from Alcoholics and Narcotics Anonymous, as well as group sessions focused on relapse prevention and functional analysis. The center requires complete abstinence from drugs and alcohol (including any form of pharmacological treatment, such as methadone), with the exception of caffeine and nicotine; regular drug testing is provided and any substance use is grounds for dismissal. Typical treatment lasts between 30 and 180 days and, aside from scheduled activities (e.g., group retreats, physician visits), residents are not permitted to leave the center grounds during treatment.

Participants (72% male;  $N = 132$ ) ranged in age from 19 to 69, with a mean age of 43.05 ( $SD = 9.86$ ). The majority of participants (91.4%) were African-American. With regard to highest education level achieved, 28.5% of participants did not complete high school, 39.2% had a high school degree or equivalent, and 32.3% had some college education or above. With regard to income, 55.6% of participants reported an income of \$10,000 or less per year. Regarding marital status, 68.6% of participants were single, 9.9% were living with a partner as if married, 14.0% were married but separated, and 7.6% were married and living with their partner. Data pertaining to the type and frequency of drug use (i.e., use of a particular drug over the last year) are presented in Table 1.

### 2.2. Measures

**2.2.1. Demographics**—A brief demographics questionnaire was administered to obtain information on age, gender, race, education level, employment status, and marital status.

**2.2.2. Posttraumatic Stress Disorder Symptoms**—The *Posttraumatic Stress Disorder Checklist – Civilian Version* (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) is a 17-item self-report measure of the severity of intrusive, avoidance, and hyperarousal symptoms experienced in response to a stressful life event, as outlined by the *Diagnostic and Statistical*

*Manual of Mental Disorders, 4<sup>th</sup> Edition* (DSM-IV) diagnostic criteria for PTSD. Using a 5-point Likert scale (1 = *not at all*, 5 = *extremely*), participants rate the extent to which each symptom has bothered them in the past month. The validity of the PCL has been demonstrated in both military and civilian populations (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Weathers et al., 1993), substance users (Harrington & Newman, 2007), and urban samples (Jaycox, Narshall, & Schell, 2004). Additionally, the PCL has been found to be associated with other validated measures of PTSD (Ruggiero, Del Ben, Scotti, & Rabalais, 2003). The PCL has been found to be temporally stable over a 3-day period ( $r = .96$ ). Internal consistency in the sample was excellent ( $\alpha = .95$ ). Previous studies suggest a cutoff score of 50 for a probable PTSD diagnosis (Blanchard et al., 1996; Weathers et al., 1993).

**2.2.3. Drug Use Questionnaire**—Drug use was assessed using a self-report measure assessing frequency of drug use both in terms of past year use as well as heaviest lifetime use across the following drug classes: a) alcohol, b) marijuana, c) crack/cocaine, d) heroin, and e) PCP. Although a formal diagnostic interview was not completed, characterizing “frequent use” was based on use of the drug at least 10 times per month, a definition consistent with that used in the substance dependence section of the Structured Clinical Interview for DSM-IV (SCID-IV; First et al., 1996). The number of drugs used “frequently” was then summed to form a composite indicator termed drug use frequency. This composite index tapping frequency was used as a proxy measure of substance use severity. Indeed, recent studies suggest a high correlation of drug/alcohol use frequency with substance use disorder diagnoses as well as adjustment/social problems (Kirisci, Tarter, Vanyukov, Martin, Mezzich, & Brown, 2006). Substance use frequency has also been shown to predict a number of problems longitudinally, including risk behavior and poor social adjustment (McGee, Williams, Poulton, & Moffitt, 2000).

**2.2.4. Lack of Awareness and Clarity of Emotions and Difficulty Controlling Impulsive Behaviors When Distressed, (Difficulties in Emotion Regulation Scale, DERS Gratz & Roemer, 2004)**—Three sub-scales from the DERS were used to measure (1) lack of emotional awareness and lack of emotional clarity; and (2) difficulties controlling impulsive behaviors when distressed. The DERS uses a 5-point Likert scale (1 = *almost never*, 5 = *almost always*). The scales tapping emotional non-awareness and clarity consist of 6 and 5 items (possible scores range from 5–30 and 5–25, respectively); the scale tapping difficulties controlling impulsive behaviors when distressed consists of 6 items (range 5–30). Items were recoded so that higher scores in every case indicated greater difficulties emotional awareness/clarity and impulsivity, and a sum was calculated. Because of the high conceptual overlap between the lack of emotional awareness and lack of emotional clarity, we considered combining these scales. The correlation between the scales was moderate ( $r = .49$ ), and both scales were associated with PTSD symptoms to approximately the same degree ( $r = .49$ ). Moreover, the reliability was improved considerably from combining the individual scales ( $\alpha = .69$  and  $.72$  for AWARE and CLAR, respectively) to  $.79$ . As such, the two scales were combined for this study; this scale was named AW/CLAR (awareness/clarity), and is referred to as such throughout the rest of the manuscript. Similarly, the scale tapping difficulties controlling impulsive behaviors when distressed is referred to as IMP for the remainder of the manuscript.

The DERS subscales used in this study been found to have high internal consistency ( $\alpha = .93$ ), good test-retest reliability over a period ranging from 4 to 8 weeks ( $p = .88$ ,  $p < .01$ ), and adequate construct and predictive validity (Gratz & Roemer, 2004; Gratz et al., in press). The DERS was validated on a sample of college students; however, means and standard deviations in the current sample are only slightly higher than those found with college students (Gratz & Roemer, 2004). Internal consistency in the current study was 83 and 77, for AW/CLAR and IMP, respectively.

### 2.3. Procedures

All procedures were approved by the University of Maryland Institutional Review Board. Within the first week of their stay, all participants were approached by the first author or a trained research assistant, asking if they would be willing to participate in a study that “looks at the relationship of emotions and drug use.” Participants were told that they will be compensated \$10 for their participation. All participants who were approached agreed to participate in the study. Participants were informed verbally and in writing about the nature of the study and any potential risks. All participants were required to provide written informed consent prior to participating. Following this, all participants completed a self-report questionnaire packet including the measures described above. Measures were randomly sequenced across participants to limit the influence of order effects. All self-report instruments were completed in one classroom that was staffed by the experimenter and a research assistant; however, because of the sensitive nature of some of the questionnaires, measures were taken to ensure the anonymity of participant responding. Specifically, participants were seated at individual tables, and all measures were identified with a number only. Approximately 10–15 participants were in the classroom at any given time. Participants were actively encouraged to seek assistance regarding questions that were unclear. At least one male and one female researcher were available at each session to provide participants with a same-sex individual for queries regarding the questionnaires. Three participants stated they were unable to read and write. In these three cases (all male), a research assistant read the questions and response options to the participants. A research assistant looked over the questionnaires when the participant was ready to submit them to ensure there was no missing data.

### 2.4. Analysis Plan

In testing the role of potential underlying mechanisms between PTSD symptoms and drug use frequency across gender, we utilized a structural equation modeling (SEM; Bollen, 1989) framework. All analyses were conducted using EQS, version 6.1 (Bentler & Wu, 2005). As noted above, the current study made no specific predictions about the strength and relevance of each potential mediator for each gender. As such, we first examined structural models with both potential mechanisms included in the model.

A test of gender differences in an SEM framework is conducted as follows (see King, Orcutt, & King, 2002). First, a multiple-group model is fit without any cross-group equality constraints on the paths (in other words, this model does not specify that the path values across gender are the same, instead allowing them to vary across gender). In step two, a multiple-group model is fit as in step one. However, all structural paths of interest are now constrained to be equal across groups (i.e., modeling a hypothesis of no gender differences in any of the paths). The fit of this fully constrained model is then evaluated relative to the unconstrained model from step one. Lagrange multiplier tests are employed as criteria for suggesting cross-group equality constraints to be released (see e.g., Bollen, 1989). A model releasing one constraint is then fit and the improvement in data-model fit is examined. The process of investigating the results of the Lagrange multiplier tests and then analyzing a model releasing one constraint is repeated until these tests fail to show any significant improvement in data-model fit. Support for differential pathways for men and women will be indicated by a relatively poorer fit data-model in the constrained model, compared to the unconstrained model, the suggestion of the Lagrange multiplier tests to release constraints, and an improvement in data-model fit once this has been done.

### 3. Results

#### 3.1. Identification of Covariates

With regard to the identification of potential covariates (i.e., variables that demonstrate a significant relationship with the predictor, criterion, or intermediary variables), we examined the potential relevance of age, household income, education, employment status and marital status<sup>1</sup> separately, by gender. None of these variables were related to PTSD symptoms, substance use frequency, or difficulties in awareness/clarity of one's emotions or difficulties controlling impulsive behaviors when distressed across males or females. As such, no covariates were used in the main analyses.

#### 3.2 Primary Results

Gender differences on the variables of interest as well as demographic variables are presented in Table 2. Zero-order correlations between the variables of interest are presented in Tables 3 and 4 (correlations are shown separately by gender). The results of the SEM analyses were as follows. The results from the initial (unconstrained) multiple-group model are depicted in Figure 1. The overall data-model fit of this initial model was quite good. The null hypothesis of perfect fit was not rejected,  $\chi^2(2) = 3.06, p = .22$  and the approximate fit indices indicated solid data-model fit following conventional criteria (Hu & Bentler, 1999), CFI = .99, SRMR = .04, RMSEA = .08 with a 90% CI from 0.00 to 0.24. Finally, Akaike's Information Criterion (AIC; Akaike, 1987), to be used to facilitate model comparisons, was  $-0.94$ .

A comparison of the path significance for males and females reveals that for both groups, there was a significant effect of PTSD symptoms on both AW/CLAR and IMP (see Figure 1 for  $\beta$  weights and significance levels). In contrast, the statistical significance of the pathways from AW/CLAR to substance use frequency differed for males and females, with the pathway reaching significance for males but not for females. Similar results were observed for the pathways from IMP to substance use frequency, but in this case the female coefficient was significantly different from zero but the male coefficient was not. Due to this pattern of results, it was determined that in the subsequent model with equality constraints imposed, the paths from AW/CLAR and IMP to substance use frequency should potentially be left free.

The multiple-group model with all paths constrained to be equal between group (Figure 2) also yielded adequate data-model fit;  $\chi^2(7) = 11.05, p = .14$ , CFI = .96, SRMR = .08, RMSEA = .08 with a 90% CI from 0.00 to 0.17. The data-model fit was not significantly different than the initial (unconstrained) model,  $\chi^2(5) = 8.00, p = .16$ . Similarly, the AIC of  $-2.94$  indicates this model represents a more parsimonious account for the relationships in the data. Lagrange multiplier tests were conducted to assess the potential impact of releasing the imposed constraints. The output indicated that release of the constraint from AW/CLAR to substance use frequency would have the most significant impact ( $p = .055$ ), so this constraint was released and the model was checked again. On the second iteration, the Lagrange output indicated that release of the constraint from IMP to substance use frequency would have the most significant impact ( $p = .022$ ), so this constraint was released and the model checked again. These modifications are consistent with the findings from the results from the initial model in which group differences were suggested for the paths from the AW/CLAR and IMP to substance use frequency. No further releases of constraints were indicated to have significant impact ( $p$ 's  $\geq .41$ ).

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<sup>1</sup>The examination of race (a categorical variable indicating African-American versus White versus Other) was conducted, given that the sample consisted primarily of African-American individuals, and the analysis of race as a covariate was not meaningful.

The final multiple-group model is depicted in Figure 3. This model constrained three of the five pathways to be equal between males and females, but allowed the pathways from AW/CLAR and IMP to substance use frequency to remain free. This final model displayed the best overall fit of the models tested;  $\chi^2(5) = 3.76, p = .58, CFI = 1.00, SRMR = .05, RMSEA = .00$  with a 90% CI from 0.00 to 0.13. The fit of the final model was not significantly different than that of the unconstrained model,  $\chi^2(3) = 0.71, p = .87$ . The fit of this final model was significantly better than the fully constrained model,  $\chi^2(2) = 7.29, p = .03$ , and yielded the smallest AIC value (-6.24). As such, the statistically preferred model is one where across both males and females, symptoms of PTSD lead to AW/CLAR and IMP, and symptoms of PTSD are also associated with substance use frequency directly. However, for males, there is a significant pathway from AW/CLAR to substance use frequency, whereas this pathway is not significant for females. Moreover, for females, there is a significant pathway from IMP to substance use frequency, and for males, this pathway fails to reach significance. Conceptually, these results are similar to stating that for males, AW/CLAR mediates the relationship from PTSD symptoms to substance use frequency (and this partial mediation is not found in females); on the other hand, for females, IMP serves as a partial mediator between PTSD symptoms and substance use frequency, while in males it fails to do so.

#### 4. Discussion

The current study examined two potential explanatory factors in the association between PTSD and SUDs, with a focus on identifying gender-specific mechanisms/explanatory processes in a sample of urban, primarily minority substance users. In line with previous work (Monson et al, 2004; Feeny et al, 2000; Tull et al, 2007), the current results indicated that PTSD symptoms are associated with a lack of clarity and awareness of emotions as well as difficulty controlling impulsive behaviors when distressed. Yet, when considering the path models for these two factors and substance use frequency, the results differed by gender. Specifically, for women, the association between PTSD symptoms and substance use frequency was partially accounted for by difficulties controlling impulsive behavior when distressed, whereas for men, the relationship between PTSD symptoms and substance use frequency was partially explained by lack of emotional awareness and clarity of emotions. Results support the value and importance of examining gender differences in mechanisms underlying PTSD-SUD comorbidity (e.g., Stewart & Conrad, 2003; Stewart et al, 2006).

One contribution of this study is that it is, to our knowledge, the first to examine gender differences in the specific mechanisms that underlie the link between PTSD symptoms and substance use frequency. A second strength concerned the use of a multiple-group SEM approach to test for gender differences (King et al., 2002). This approach allowed us to test for the similarity of the proposed network of relationships (i.e., PTSD symptoms, the key mediators, and substance use) across two groups (i.e., men and women). Finally, this study was conducted using a sample of urban, primarily African-American individuals in residential substance use treatment, a rather unique population that is especially at-risk for trauma-related psychopathology (e.g., Gil-Rivas, Fiorentine, Anglin, & Taylor, 1997).

The current findings suggest clinical implications that may aid in the development and refinement of current treatments aimed at the PTSD-SUD comorbidity. Indeed, previous work has found that among women, PTSD hyperarousal symptoms are associated with the PTSD-SUD co-occurrence (Stewart et al., 2002). In the light of the current findings indicating that difficulties controlling impulsive behavior when distressed partially account for the link between PTSD symptoms and substance use frequency, the two studies taken together suggest that women with this dual diagnosis may be more vulnerable in the arousal (e.g., irritability/anger, hypervigilance) and impulse-control areas, requiring more help with arousal management and impulse control. Treatments such as Dialectical Behavior Therapy (DBT;

Linehan, 1993) may be especially useful for these types of difficulties. Indeed, DBT skills training specifically includes modules on distress tolerance and emotion regulation that address controlling impulsive behaviors in the context of distress.

Similarly, several studies have reported a relationship between difficulty recognizing and naming emotions and PTSD symptoms (e.g., Monson et al., 2004; Zlotnick et al., 2001). Extending these findings, the current results indicated that not only are the former difficulties associated with PTSD symptoms, they are also associated with substance use frequency, with this meditational relationship specific to men. In turn, these results suggest that treatments focusing on emotional awareness and education (e.g., Acceptance and Commitment Therapy, Hayes, 1999; DBT) may be useful as adjuncts to more common treatments for men with this dual diagnosis.

Although it is tempting to assume a particular temporal order from the current path models, the use of a cross-sectional design precludes any true conclusions regarding the ordering of the variables of interest. That acknowledged, it may be worthwhile to tentatively speculate about several potential competing temporal hypotheses that might explain the current results. As a first possible pathway, the temporal ordering of the variables of interest might indeed be consistent with the structure and direction of the path models; in other words, traumatic exposure and the consequent PTSD symptoms might lead to difficulties in emotional clarity and awareness for men and difficulty controlling impulsive behaviors for women. In turn, these process variables might lead to elevated substance use frequency. This first hypothesis is consistent with suggestive studies showing that emotional numbness (a construct similar to a lack of awareness/clarity), and difficulties controlling impulsive behavior when distressed follow, rather than precede the onset of PTSD (Tull et al, 1997; Foa Riggs, & Gershuny, 1995). On the other hand, it is quite possible that the two process variables, namely IMP and AWAR/CLAR serve as separate vulnerability factors for the development of this comorbidity among men and women. In other words, IMP and AW/CLAR might place an individual who is exposed to trauma at risk for the development of PTSD, which in turn is associated with substance use frequency. The third possible temporal pathway would suggest a complete reversal of the key variables in the current study. Specifically, it might be possible that variables associated with substance use frequency might lead to IMP and AW/CLAR, which may lead to traumatic exposure and the development of PTSD symptoms. This temporal ordering might be especially true for men, as previous work documents that among men, SUDs generally precede traumatic exposure and PTSD symptoms (or occur simultaneously), whereas in women, the opposite is true (Cottler et al, 2001; Deykin & Buka, 1997; Lipschitz et al., 2000; Sonne et al, 2003). The methodology of the current study does not allow us to disentangle these competing hypotheses, and future longitudinal and possibly experimental studies will benefit from testing the precise directional relationships and test the proposed directional models described above.

Although the current findings are interesting, there are also a number of limitations that must be acknowledged. As noted above, the cross-sectional design of the current study is the primary limitation. A second limitation concerned the fact that the current data were self-report in nature and, therefore, may have been influenced by participants' ability and/or willingness to report accurately on their emotional and behavioral responses. Third, limitations were evident in our measures. For instance, our measure of substance use was a self-report measure that focused on frequency of substance use across alcohol and several different drugs, but failed to measure such severity-related variables as conflict with family, financial and legal difficulties, withdrawal/tolerance symptoms, and past treatment history (APA, 1994). The current measure of substance use is also limited in the fact that there are multiple ways of obtaining a high score. In other words, an individual who drinks one glass of wine three times a week might get the same substance use score as someone who uses crack/cocaine or heroin at the same frequency.

Thus, more sophisticated measurement techniques are needed in future studies to assess the more refined construct of substance use *severity*. The third limitation concerns the relatively small sample size of women in the current study, although a path analysis is an acceptable method with ten cases per path (Kline, 1998).

Similarly, the current study failed to collect diagnostic PTSD symptom severity did not assess for a DSM-IV PTSD criterion A event(s), or examine traumas that follow or precede this event. Given the literature indicating that one traumatic experience renders individuals vulnerable to subsequent trauma exposure, it would be quite interesting to examine the interplay of multiple victimizations, PTSD symptoms, substance use, and the key intermediary variables of the current study over time. Finally, the use of a unique sample is also a limitation. Indeed, it is unclear whether findings from a sample of urban, primarily minority substance users attending residential substance use treatment will generalize to other samples, suggesting the need for cross-validation of the current model.

Despite limitations, the current findings are intriguing, and have a number of implications for future research directions and clinical applications. Future work will benefit from larger, prospective designs and the use of more sophisticated measurement techniques in order to establish temporal order and rule out extraneous variance stemming from an exclusive reliance on self-report measures. Finally, an improved understanding of the gender differences in the mechanisms underlying the associations of PTSD and substance use within urban substance users may aid in the development of targeted prevention and intervention techniques aiming to limit substance misuse in this population.

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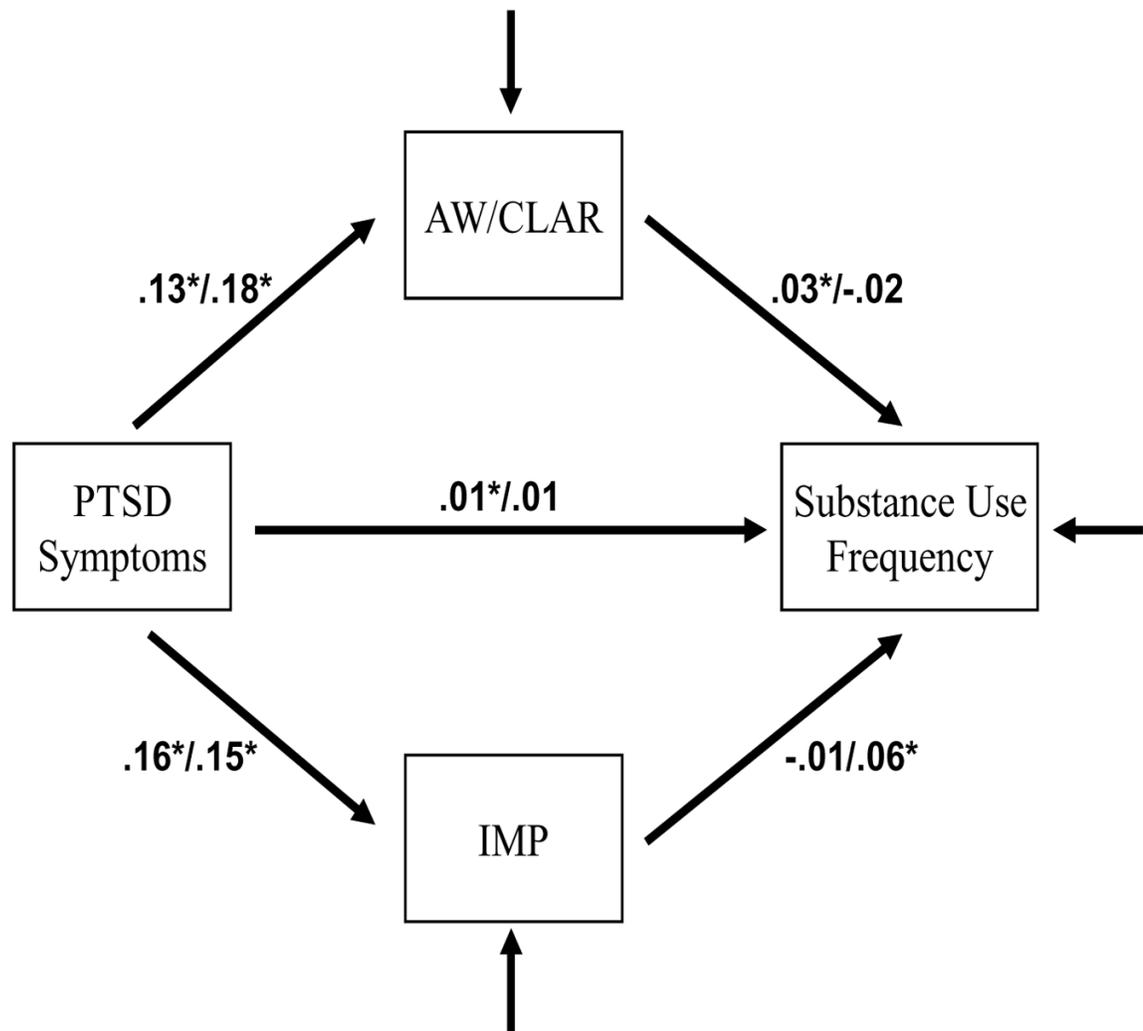
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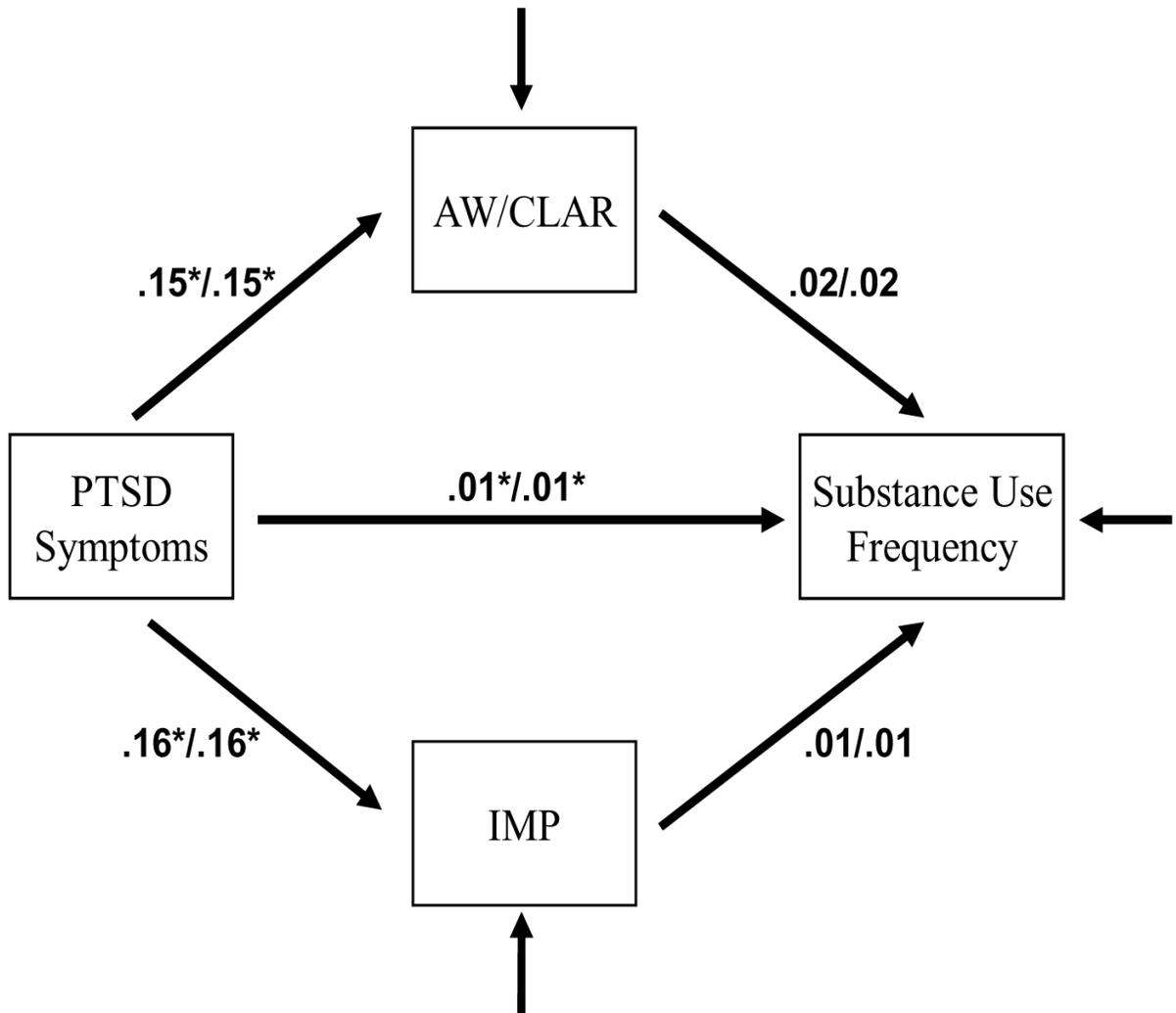
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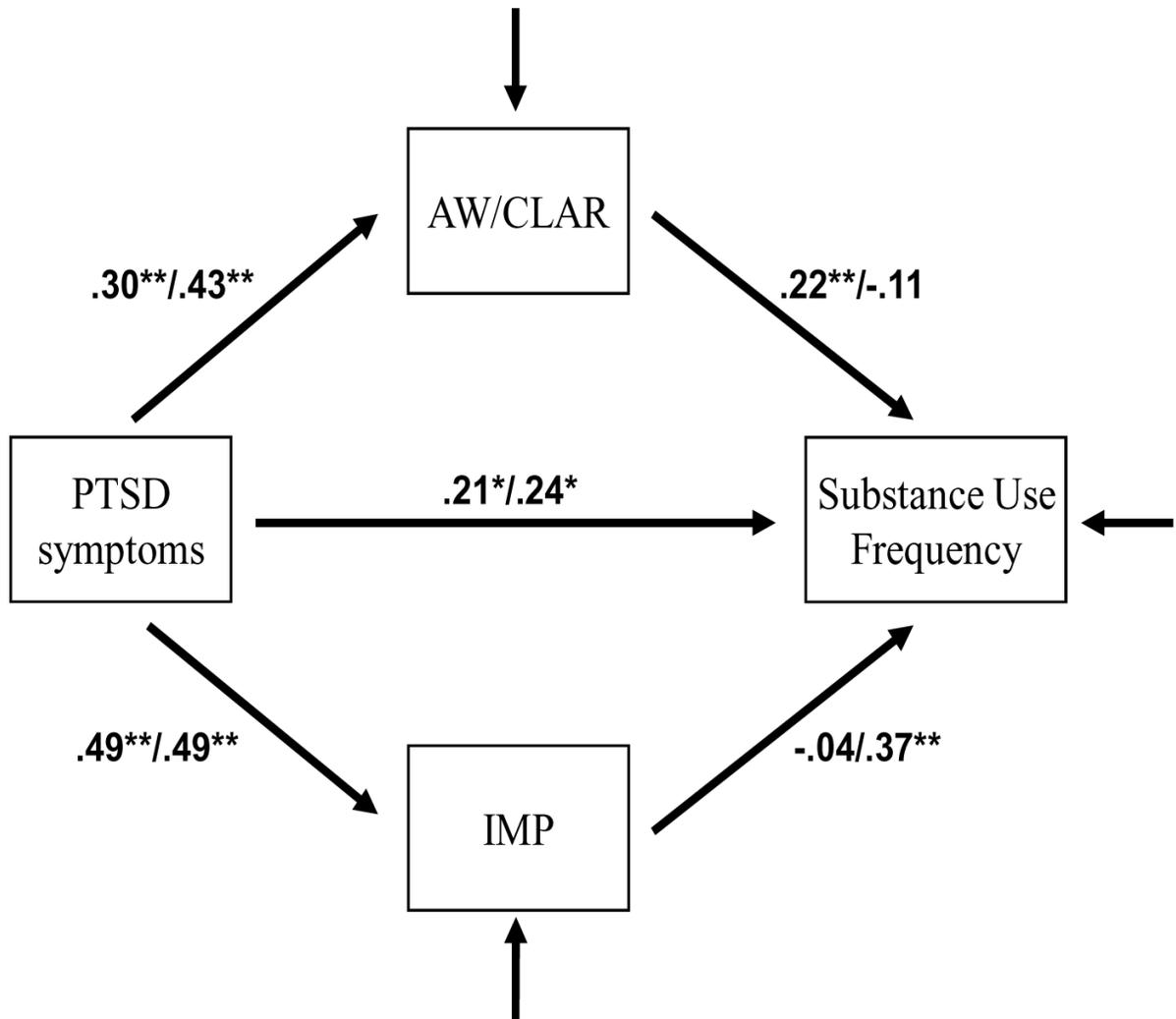


**Figure 1.** Initial unconstrained model depicting the mediated and direct effect of symptoms of PTSD on substance use frequency for males and females simultaneously. Unstandardized<sup>2</sup> regression coefficients are presented. The first regression coefficient in each path refers to males, whereas the second refers to females. \*  $p < .05$ ; \*\*  $p < .01$ .

<sup>2</sup>Unstandardized coefficients are presented as the constraints are imposed (and tested) on the unstandardized estimates.



**Figure 2.** Model with all paths constrained as equal across gender, depicting the mediated and direct effect of symptoms of PTSD on substance use frequency for males and females simultaneously. Standardized regression coefficients are presented. The first regression coefficient in each path refers to males, whereas the second refers to females. \*  $p < .05$ ; \*\*  $p < .01$ .



**Figure 3.** Initial model with three paths constrained as equal across gender (PTS to AW/CLAR, PTS to IMP, and PTS to substance use frequency), depicting the mediated and direct effect of symptoms of PTSD on substance use frequency for males and females simultaneously. Standardized regression coefficients are presented. The first regression coefficient in each path refers to males, whereas the second refers to females. \*  $p < .05$ ; \*\*  $p < .01$ .

**Table 1**

Percentage of sample acknowledging any use or frequent use (10 times per month or more) among each drug type in past year.

Drug Class	Men		Women	
	Acknowledging Any Use	Acknowledging Frequent Use	Acknowledging Any Use	Acknowledging Frequent Use
Alcohol	89.0	54.9	72.5	42.2
Marijuana	70.2	31.3	47.5	15.6
Crack/Cocaine	79.1	58.8	93.2	80.0
Opiates	47.1	33.9	36.4	28.9
PCP	32.4	9.6	7.1	2.2

**Table 2**  
Descriptive Statistics for Potential Covariates, Independent and Dependent Variables

Variable	Men			Women			Significance
	M	SD	M	M	SD	SD	
PTS	37.13	15.55	40.17	19.94			$F(1, 181) = 1.20; p = .28$
Impulsivity when Distressed	13.21	5.04	15.31	6.33			$F(1, 181) = 5.52; p < .05$
Awareness/Clarity	26.06	7.58	26.44	7.21			$F(1, 180) = .10; p = .75$
Substance Use Frequency	1.90	.92	1.63	1.02			$F(1, 174) = 2.89; p = .09$
Age	43.43	10.68	41.94	7.64			$F(1, 176) = .82; p = .37$
Marital Status (% Single)	65.6		74.5				$\chi^2 = 1.33; p = .25$
Income	\$22,898	\$13,000	\$16,100	\$11,700			$F(1, 175) = 2.53; p = .11$
Education (%)							$\chi^2 = 1.65; p = .44$
Some high school	27.3%		31.4%				
High school graduate/GED	41.7%		31.4%				
Some college and above	31.1%		37.3%				
Employment							$\chi^2 = 5.70; p = .13$
Unemployed	82%		64%				
Employed	16%		29%				
Student	0%		2%				
Retired	2%		4%				

Note. PTS = PTSD Checklist; IMP = Difficulties Controlling Impulsive Behaviors when Distressed; Awareness/Clarity - Lack of Emotional Awareness and Clarity.

Correlations between Potential Covariates, Independent and Dependent Variables, and Potential Mediators among Male Participants

Table 3

	1	2	5	7	8	9	10	11
1. PCL	1	.23**	.49**	.26**	.01	-.14	.14	.00
2. Substance Use Frequency		1	.11	.26**	.01	-.02	.12	-.06
. DERS- IMP			1	.21*	-.14	.01	.07	-.01
7. DERS-AW/CLAR				1	-.07	-.07	.05	.00
8. Age					1	-.18*	-.09	-.00
9. Marital Status						1	-.24**	.04
10. Income							1	.23*
11. Education								1

Table 4  
 Correlations between Potential Covariates, Independent and Dependent Variables, and Potential Mediators among Female Participants

	1	2	5	7	8	9	10	11
1. PCL	1	.37**	.48**	.49**	.00	.05	-.05	-.05
2. Substance Use Frequency		1	.44**	.14	-.06	-.07	-.15	-.02
5. DERS-IMP			1	.38**	-.07	.06	.06	-.09
7. DERS-AW/CLAR				1	-.30*	.23	-.27	-.25
8. Age					1	-.04	-.03	.12
9. Marital Status						1	-.16	-.12
10. Income							1	.13
11. Education								1