Published in final edited form as:

Psychol Addict Behav. 2009 June ; 23(2): 303–314. doi:10.1037/a0015355.

Substance Use following Residential Treatment among Individuals with Co-occurring Disorders: The Role of Anxiety/Depressive Symptoms and Trauma Exposure

Virginia Gil-Rivas,

University of North Carolina at Charlotte

JoAnn Prause, and

University of California, Irvine

Christine E. Grella

University of California, Los Angeles

Abstract

This longitudinal study examined the contribution of anxiety/depressive symptoms and lifetime and recent trauma exposure to substance use following residential substance abuse treatment among individuals with co-occurring disorders. Data were collected from adults at treatment entry, 6- and 12-months later. At treatment entry nearly all of the participants reported lifetime trauma exposure and over one third met criteria for PTSD. Over the follow-up, nearly one third of the participants were exposed to trauma. Lifetime trauma exposure and a diagnosis of PTSD at treatment entry were not associated with substance use over the follow-up. Trauma exposure and anxiety/depressive symptoms over the follow-up were associated with an increased likelihood of substance use. Gender did not moderate the association between trauma exposure and anxiety/depressive symptoms and substance use. These findings highlight the importance of monitoring for trauma exposure and symptoms of anxiety/depression to better target interventions and continuing care approaches to reduce the likelihood of post-treatment substance use in this population.

Keywords

substance use; co-occurring disorders; anxiety; depressive symptoms; trauma exposure; PTSD

Substance use following residential treatment among individuals with co-occurring disorders: The role of anxiety/depressive symptoms and trauma exposure

A substantial number of adults entering substance abuse treatment have at least one co-occurring psychiatric disorder (Center for Substance Abuse Treatment [CSAT], 2005; Havassy, Alvidrez, & Owen, 2004). At treatment entry, those with co-occurring substance use (SUD) and psychiatric disorders (PSYC) report using multiple drugs (Compton, Cottler, Jacobs, Ben-Abdallah, & Spitznagel, 2003), have more recent admissions to psychiatric and medical services, and report more severe medical, social, and family problems compared to

those with SUD-only (Chi, Satre, & Weisner, 2006). Following treatment, many of these individuals return to substance use, experience employment and social difficulties, and report significant distress and psychiatric symptoms (Ouimette, Gima, Moos, & Finney, 1999). Identifying factors associated with substance use may aid clinicians and providers in their efforts to better meet the needs of this population. Anxiety and depressive symptoms and further trauma exposure are common experiences among individuals with co-occurring disorders that may contribute to their resumption of substance use following treatment, or may be consequences of their substance use.

Substance Use and Anxiety and Depressive Symptoms

Research has widely documented the association between anxiety and depressive symptoms, and an increased likelihood of alcohol (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Strowig, 2000) and drug use (Norman, Tate, Anderson, & Brown, 2007) among substance users. However, current empirical evidence offers mixed support for this association among substance users following treatment. Among individuals with SUDs, depressive (Curran, Flynn, Kirchner, & Booth, 2000) and anxiety (Willinger et al., 2002) symptoms have been found to predict post-treatment substance use, however, other investigators have not found support for this association (Strowig, 2000).

Among individuals with co-occurring disorders, the evidence suggests that anxiety and depressive symptoms may contribute to substance use post-treatment. For example, in a study of veterans receiving substance abuse treatment, depression, anxiety, and irritability were the symptoms most commonly experienced prior to post-treatment substance use by both individuals with co-occurring disorders and those with SUD-only (Tomlinson, Tate, Anderson, McCarthy, & Brown, 2006). Similarly, in another study of veterans with and without co-occurring disorders, feelings of depression, anger, frustration, anxiety, and tension frequently preceded alcohol and drug use following treatment among both groups (Tate, Brown, Unrod, & Ramo, 2004). Taken together, these findings suggest that anxiety and depressive symptoms, irrespective of psychiatric diagnosis, may contribute to a greater likelihood of substance use following treatment.

The literature has proposed various theoretical paradigms to clarify the complex connections between negative emotions and substance use. In the reformulated addiction motivation model, negative affect is viewed as central in understanding resumption of substance use after a period of abstinence (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Specifically, the desire to escape and avoid negative affective states is viewed as a key motivational factor in substance use.

The self-medication hypothesis (Khantzian, 1997) proposes that individuals use substances in an effort to relieve distress symptoms that may or may not be associated with a particular psychiatric condition. In fact, individuals with co-occurring disorders, frequently report the use of substances in an effort to manage depressive, anxiety (Henwood & Padgett, 2007; Spencer, Castle, & Michie, 2002), and psychiatric symptoms (Goswami, Mattoo, Basu, & Singh, 2004; Laudet, Magura, Vogel, & Knight, 2004) even though it may also lead to symptom exacerbation. Specifically, substance use may elicit feelings of shame, guilt, and powerlessness which may contribute to higher levels of anxiety and depressive symptoms (Stewart, Pihl, Conrod, & Dongier, 1998). In turn, these symptoms may increase the likelihood of further substance use (Mueser, Rosenberg, Goodman, & Trumbetta, 2002). These ideas are congruent with a model proposed by Otto and colleagues (Otto, Safren, & Pollack, 2004), in which the authors suggest that individuals with SUDs and those with Axis I psychiatric disorders may have a greater sensitivity to internal anxiety states and a tendency to use avoidance to manage these states which may motivate them to use substances. In turn, substance use may contribute

to higher levels of perceived stress which may sustain negative affectivity and thus contribute to the maintenance of this cycle.

Trauma Exposure, PTSD, and Substance Use

Exposure to potentially traumatic events is a common experience among individuals with co-occurring disorders that may contribute to greater anxiety and depressive symptoms, and a greater likelihood of substance use. Current estimates suggest that nearly two thirds of adults seeking substance abuse treatment report lifetime trauma exposure (CSAT, 2000), and 25% to 59% have a PTSD diagnosis (Stewart et al., 1998). Among samples of individuals with psychiatric disorders, rates of lifetime trauma exposure range from 51% to 97% (Goodman, Rosenberg, Mueser, & Drake, 1997) and rates of co-occurring PTSD range from 29% to 43% (Rosenberg et al., 2001). Individuals with co-occurring disorders report more lifetime episodes of violent victimization (i.e., sexual abuse, physical abuse, robbery, physical assault) than those with a PSYC-only (Sells, Rowe, Fisk, & Davidson, 2003).

Notably, a history of violent victimization during childhood appears to increase the likelihood of further victimization (Nishith, Mechanic, & Resick, 2000) and of physiological (Heim et al., 2000) and psychological reactivity to stressors later on in life (Back, Brady, Waldrop, Yeatts, Pharm, & Spratt, 2008). Trauma exposure during childhood may lead to difficulties in managing and expressing emotions, behavioral regulation, and deficits in social development (Cicchetti & Thoth, 2005). Thus, individuals with such histories may have greater difficulties managing anxiety and depressive symptoms and may be more likely to use substances in an effort to manage these emotions (Hien, Cohen, & Campbell, 2005). Furthermore, characteristics of individuals with co-occurring disorders, such as substance use severity, nature and severity of the psychiatric disorder, the presence of cognitive deficits, poor social functioning, unstable housing, and poverty (Goodman et al., 2001; Lam & Rosenheck, 1998) may increase the likelihood of further trauma. Post-treatment trauma exposure and the likely anxiety and depressive symptoms and physiological arousal associated with such experiences may further contribute to the resumption of substance use among an already vulnerable population.

A growing literature has documented interactions between PTSD and substance use among individuals with SUD (Stewart et al., 2002) and PSYC disorders (Mueser, Rosenberg, Goodman, & Trumbetta, 2002). Specifically, the presence of PTSD among individuals with SUDs is associated with greater anxiety and depressive symptoms (Norman et al., 2007), psychological distress (Ouimette et al., 1997), further trauma exposure (Dansky, Brady, & Saladin, 1998), and addiction-related psychosocial difficulties (Najavits, Weiss, & Shaw, 1997). Similarly, among individuals with PSYC disorders, PTSD is associated with hostility, more severe symptoms of depression (Holtzheimer, Russo, Zatzick, Bundy, & Byrne, 2005), anxiety, and dissociation (Mueser et al., 1998).

Support for the association among trauma exposure, PTSD, and substance use following treatment is mixed. Some investigators have reported that a history of trauma exposure and PTSD at treatment entry is associated with greater likelihood of post-treatment substance use (i.e., Ouimette et al., 1997), while others have not found support for this association (Norman et al., 2007; Read, Brown, & Kahler, 2004). Rather, it appears that unremitted PTSD (Norman et al., 2004) and trauma-related symptoms are associated with substance use post-treatment in situations involving unpleasant emotions (i.e., anger, fear, and depression), physical discomfort (Norman et al., 2007), and interpersonal conflict (Sharkansky et al., 1999).

The Moderating Role of Gender

Gender differences in sensitivity to negative emotions, patterns of substance use and pre-treatment characteristics have been identified among individuals with SUDs and those with co-occurring disorders. Women have been shown to report a greater desire to use alcohol in response to alcohol-related cues when experience negative emotions compared to men (Rubonis, Colby, Monti, Rohsenow, Gulliver, & Sirota, 1994). Also, women with SUDs have been shown to enter treatment with more severe psychosocial difficulties compared to men (Stewart, Gossop, Marsden, Kidd, & Treacy, 2003). Despite these differences, women have not been consistently found to be at a greater risk for substance use following treatment compared to men (Fiorentine, Anglin, Gil-Rivas, & Taylor, 1997; Walitzer & Dearing, 2006). Furthermore, the association between substance use relapse and depressive and anxiety symptoms does not appear to vary by gender (Grella, Scott, Foss, & Dennis, 2008; Walitzer & Dearing, 2006). Among individuals with co-occurring disorders, women have been found to have greater psychosocial difficulties (DiNitto, Webb, & Rubin, 2002) and greater substance-use severity compared to men (Mangrum, Spence, & Steinley-Bumgarner, 2006). However, men appear to be at a greater risk for poor substance use outcomes compared to women (Compton et al., 2003; Xie, McHugo, Fox, & Drake, 2005).

Gender differences in trauma exposure and the impact of these experiences on individuals with SUDs and those with PSYC have been reported. Among women with SUDs, lifetime histories of trauma and violent victimization are common (Najavits et al., 1997) and the presence of PTSD appears to increase the likelihood of further victimization and psychosocial difficulties (Najavits et al., 1999). High rates of lifetime violent victimization are also common among women with PSYC (Gearon, Nidecker, Bellack, & Bennett, 2003), and these experiences have been shown to elicit greater psychological distress among women compared to men (O'Hare, Sherrer, & Shen, 2006). Few studies have examined gender differences in trauma exposure and PTSD among individuals with co-occurring disorders, however, the current evidence suggests that women report greater lifetime exposure to interpersonal violence (DiNitto et al., 2002) and are more likely to have PTSD compared to men (Mangrum et al., 2006).

Most studies examining the contribution of trauma exposure and PTSD to substance use relapse among individuals with SUDs have not examined gender differences (i.e., Read, Brown, & Kahler, 2004; Sharkansky et al., 1999; Tate et al., 2004; Tomlinson et al., 2006). Other studies have focused exclusively on males (Norman et al., 2007; Ouimette et al., 1999) and others exclusively on females (Brown, 2000), thus it is unclear whether the pattern of relationships differs by gender or if these findings can be generalized to individuals with co-occurring disorders. Moreover, few studies have assessed the extent to which trauma exposure over the follow-up (i.e., *recent exposure*) contributes to the resumption of substance use. Given the current evidence, it is possible that trauma exposure, in particular a history of violent victimization may play a greater role in the resumption of substance use among women compared to men.

The present study

This study examines the contribution of anxiety and depressive symptoms and trauma exposure (both *lifetime* and *recent* [over the follow-up]), to substance use among individuals with co-occurring substance use and selected Axis I psychiatric disorders (i.e., mood and psychotic disorders). Our plan of analysis is congruent with a systems model approach (Bradizza, Stasiewicz, & Paas, 2006; Moos, Finney, & Cronkite, 1990), in which we aimed to examine the contribution of both proximal (i.e., trauma exposure, anxiety/depressive symptoms, treatment participation, and housing status over the follow-up) and distal factors (i.e., background characteristics, treatment history, substance use and psychiatric symptoms at

treatment entry) to the resumption of substance use over the follow-up period. The specific predictions are described below.

1. Higher levels of *lifetime* trauma exposure and the presence of a co-occurring PTSD diagnosis at treatment entry would increase the risk of substance use over the follow-up controlling for demographic characteristics, baseline frequency of substance use, and type of psychiatric disorder.
2. Higher levels of anxiety and depressive symptoms and trauma exposure over the follow-up (*recent*) would be associated with substance use after controlling for baseline anxiety and depressive symptoms, lifetime trauma exposure and potential confounding variables.
3. Individuals with higher levels of *lifetime* trauma exposure, and in particular those with a history of interpersonal violence, would be more vulnerable to the impact of *recent* trauma and hence be at greater risk for substance use than individuals with lower levels of *lifetime* trauma exposure.
4. A co-occurring PTSD diagnosis at treatment entry (SUD + PSYC + PTSD) when combined with *recent* trauma exposure would increase individuals' risk of substance use over the follow-up.
5. Gender would moderate the association between substance use and *recent* trauma exposure and anxiety and depressive symptoms. Specifically, it was expected that the magnitude of the association between *recent* trauma and substance use over the follow-up would be greater for females than for males. Likewise, it was expected that anxiety and depressive symptoms would have a stronger association with substance use among females than males.

Method

Study Design

Participants were recruited from 11 residential substance abuse treatment programs in Los Angeles County, California. Individuals were eligible for this study if they were either seeking or concurrently receiving mental health services from an outpatient mental health program in the same geographic area. Eligible individuals were initially identified by the intake coordinator at each treatment facility. Those individuals who were interested in study participation were contacted by research staff. During the initial contact, the staff provided detailed information about the study and obtained written informed consent. Individuals were recruited into the project within the first 30 days following treatment admission. This study was approved by the UCLA and the UNCC Institutional Review Boards.

As individuals with co-occurring disorders may have limited writing and reading skills, face to face interviews were conducted by trained interviewers to facilitate participation. Individuals recruited into the study had completed an initial period of detoxification. Data were collected at three time points: baseline (at a minimum of 48 hours post-admission to allow for stabilization), 6 and 12 months later. The follow-up interviews were conducted at a location convenient for participants (e.g., their home, restaurant, public place). Data were collected between August 1999 and April 2002; see Grella and Stein (2006) for a more detailed description of the study's design.

Sample

A total of 402 individuals were initially recruited into the study. The analysis sample is based on $n = 322$ of these individuals who had complete data on the study variables at one or both of the follow-up interviews (250 had complete data at both the 6- and 12-month follow-ups; 35

individuals at the 6-month interview only and 37 from the 12-month interview only). Analyses were conducted to compare the group of 80 individuals who participated in the baseline interview but had incomplete data on the study variables or did not complete any of the follow-up interviews, to the 322 individuals comprising the analysis sample. The two groups were comparable in terms of age, gender, ethnicity, baseline frequency of drug and/or alcohol use, number of lifetime drug/alcohol treatment episodes, employment in the year preceding treatment entry, lifetime trauma exposure, a lifetime and current PTSD diagnosis, psychotic disorder at treatment entry, and anxiety and depressive symptoms at baseline. The demographic and baseline characteristics of the sample are presented in Tables 1 and 2.

Measures

Background characteristics—Baseline assessment of gender, ethnicity, education, and marital status, housing and employment status were obtained. Changes in marital status and employment were assessed at each follow-up. Baseline employment status was represented as a dichotomous variable indicating whether the participant was employed in the year preceding treatment entry. Ethnicity was represented using three indicator variables representing Black, Latino, and other ethnicities (including multiple ethnicities) with the “white” group serving as the reference group. Marital status was represented by two indicator variables for “divorced/separated/widowed” and “never married” with the married group serving as the reference group.

Housing over the follow-up—Housing was assessed as: own place, parents/relatives, no regular place, supervised housing, and other. A dichotomous variable was created to represent whether housing at the 6- and 12-month interviews was supervised (in a treatment program) or unsupervised and was included in the regression model.

Psychiatric diagnosis—Participants were assessed at baseline on the Structured Clinical Interview for the DSM-IV Axis I Disorders (APA, 2004) – Patient Edition (SCID-IP, Version 2.0) (First, Spitzer, Gibbon, & Williams, 1997) for lifetime and current mood disorders (i.e., major depression, dysthymia, bipolar disorder, or mood disorder not otherwise specified [NOS]), psychotic disorder (i.e., schizophrenia, schizoaffective disorder, or psychosis NOS), PTSD, and substance use disorders. All interviewers were trained to conduct the SCID and were required to achieve 90% accuracy on diagnostic agreement, a minimum overall kappa of .75, and a minimum sensitivity kappa of .75.

Anxiety and depressive symptoms—The anxiety (6-item) and depression (6-item) subscales of the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) were used in this study. Respondents indicated how much a symptom had distressed them during the previous week on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). As these subscales were strongly correlated at all time points ($r=.71, p<.001, r=.72, p<.001$, and $r=.70, p<.001$ between the anxiety and depression subscales at baseline, 6- and 12-month interviews, respectively), they were combined to create a new scale representing anxiety/depressive symptoms. A mean score for anxiety and depressive items was computed; the scale had good reliability at baseline ($\alpha = .97$), 6-month ($\alpha = .98$), and 12-month follow-ups ($\alpha = .92$).

Lifetime trauma exposure—The Life Stressor Checklist-Revised (LSC-R; Wolfe & Kimmerling, 1997) is a 30-item scale that was administered at baseline to assess individuals' lifetime exposure to traumatic events. For the purpose of this study, trauma was defined as exposure to any of the following six events: serious accident, exposure to major disasters, inappropriate sexual touch or forced sexual activity during childhood (*before* age 16) and adulthood, physical abuse during childhood and adulthood, neglect, and assault/robbery. A variable representing a count of the number of events reported was created.

Lifetime interpersonal violence—As a lifetime history of exposure to interpersonal violence may have a greater negative impact on individuals compared to other traumatic events, a variable representing the total number of lifetime interpersonal violence events assessed by the LSC-R was created. In addition, a categorical variable representing the types of events coded as: 1 = *no interpersonal violence*, 2 = *sexual assault*, 3 = *physical abuse*, 4 = *assault robbery*, 5 = *two interpersonal trauma events*, and 6 = *all of the 3 events* was created.

Trauma exposure at follow-up—The LSC-R described above was administered at the 6- and 12-month follow-ups to assess trauma exposure during the 6-months preceding the interviews. A dichotomous variable (any trauma exposure = 1, no trauma exposure = 0) reflecting exposure over the follow-up to the events described above was included in the analyses.

Drug and alcohol treatment history—At baseline participants reported the number of lifetime drug and alcohol treatment admissions into residential (i.e., short-term inpatient, therapeutic community, long-term residential, and short-term detoxification program) and outpatient treatment services. A summary variable representing the total number of treatment episodes at baseline was created and log transformed for inclusion in the analysis.

Mental health treatment history—At baseline participants reported the total number of weeks of lifetime inpatient (i.e., residential crisis center, board and care facility, long-term residential facility, psychiatric hospital) and outpatient (i.e., community mental health center, private practitioner, and private psychiatric or public psychiatric facility) treatment. Lifetime mental health treatment history was defined as the total number of weeks of treatment and was log transformed for inclusion in the analysis.

Mental health treatment at follow-up—The number of admissions for mental health treatment (i.e., residential crisis center, hospital or psychiatric facility, long-term board and care) in the six months preceding the 6-month and 12-month interviews was included in the regression models. Seventy-three (25.6%) individuals had at least one mental health admission in the months preceding the 6-month interview and eighty-nine (31.0%) in the 6 months preceding the 12-month interview.

Participation in index treatment episode—As length of treatment participation has been shown to be associated with substance use post-treatment (Chi et al., 2006), a variable representing continuous number of days of treatment received in the current or index residential substance abuse treatment episode was created. This variable was included in all regression models.

Substance abuse treatment at follow-up—As individuals may seek substance use treatment following the index treatment episode, either because they want to prevent substance use relapse or because they have relapsed, we created continuous variables reflecting: a) number of days of participation in outpatient treatment; and b) number of days in residential substance abuse treatment services.

A majority of individuals who participated in additional residential treatment over the follow-up reported substance use (84.3% at six months and 86.7% at 12 months); as such, this variable was almost co-linear with the substance abuse outcome and was not included in the regression models. The number of days of outpatient substance abuse treatment was included in all of the models as a covariate.

Substance use at baseline—The frequency of both drug and alcohol use at baseline was reported using the following scale: 0 = *no use*, 1 = *1 to 3 times per month*, 2 = *1 to 2 times per*

week, 3 = 3 to 4 times per week, 4 = 5 to 6 times per week, 5 = daily/almost every day, 6 = 2 to 3 times per day, and 7 = 4 times per day. Individuals who reported using both drugs and alcohol were assigned the rating with the highest frequency and this variable was included in all regression models.

Substance use at follow-up—A dichotomous outcome variable was created to reflect the use of alcohol and/or drugs during the 30 days preceding the follow-up interviews. Participants provided unobserved urine samples at both follow-ups and reported frequency of drug (i.e., marijuana, cocaine/crack, heroin/other opioids, amphetamines, hallucinogens, and synthetic drugs) and alcohol use. Individuals who did not self-report substance use, yet were positive by urinalysis, were coded as having used substances post-treatment.

At the 6 month follow-up, 69 of the 207 participants who had a urinalysis tested positive for alcohol and/or drugs; 50 of the 69 participants also self-reported substance use. Of the 138 participants with a negative result, 32 self-reported substance use. Seventy-eight participants did not have urinalysis testing of whom 28 self-reported substance use.

At the 12 month follow-up, 71 of 194 participants tested positive for alcohol and/or drugs. Fifty-two of these 71 participants also self-reported substance use. Thirty-four participants with negative urinalysis self-reported substance use and 46 of the 93 participants who did not undergo urinalysis testing also self-reported substance use.

Plan of analysis

Background and contextual variables are included in the analyses because they are potential confounders of the association between substance use and the symptoms of anxiety/depression or trauma exposure or because these variables may be associated with resumption of substance use among individuals with co-occurring disorders. These variables include demographic characteristics (i.e., gender, age, ethnicity, employment status, etc.), psychiatric diagnosis, pre-treatment histories (i.e., lifetime trauma exposure), and experiences following treatment (i.e., trauma exposure, housing).

The relationship between substance use over the follow-up and the key variables of interest, namely, anxiety/depressive symptoms, trauma exposure, and PTSD was evaluated using Generalized Estimating Equations (GEE) to account for the within-subject dependency resulting from inclusion of data from both the 6- and 12-month interviews in the analyses. This technique allows for binary and other non-normal outcomes and does not require that subjects be observed at each interview. As such, individuals who are missing one of the follow-up interviews are included in the analyses. Effect sizes are represented as Odds Ratios (with 95% confidence intervals). Analyses were conducted using STATA software, version 9.2 (Stata Corp) and SPSS, version 14 (SPSS Inc).

A hierarchical GEE model was used to examine whether higher levels of *lifetime* trauma exposure and the presence of a co-occurring PTSD diagnosis at treatment entry would increase the risk of substance use following treatment (Model 1). Covariates were included to adjust for demographic characteristics (i.e., gender, age, ethnicity, employment status) and baseline measures of anxiety/distress symptoms, frequency of substance use, and number of lifetime substance use treatment episodes. The second model examined whether higher levels of anxiety/distress symptoms and trauma exposure over the follow-up (*recent*) were associated with an increased risk of substance use following the index treatment episode. The number of outpatient treatment days and indicator variables for time of follow-up (0 = *6-month interview*; 1 = *12-month interview*) and whether the participant's housing was supervised (treatment program) or unsupervised were also included.

The potential moderating effects of *lifetime* trauma exposure and a PTSD diagnosis on the association between *recent* trauma exposure and substance use over the follow-up were evaluated using product-term interactions between *lifetime* trauma exposure and *recent* trauma exposure, and PTSD diagnosis at treatment entry and *recent* trauma. The expectation that the relationship between anxiety/depressive symptoms and *recent* trauma and substance use over the follow-up would be greater for females than males was evaluated by testing product-term interactions between gender and anxiety/depressive symptoms and between gender and *recent* trauma exposure.

Other interactions between study covariates and key variables including number of *lifetime* traumatic events, psychiatric diagnosis at treatment entry (mood disorder vs. psychotic disorder), a PTSD diagnosis at treatment entry, *recent* trauma exposure and anxiety/depressive symptoms were examined to determine whether the effects of these variables might depend on the study covariates. For example, the relationship between *recent* trauma exposure and resumption of substance use may depend on baseline psychiatric diagnosis. Interactions terms reaching the $p = .05$ level of significance are reported.

Interactions between time of follow-up interview (i.e., 6 and 12 months), trauma exposure, anxiety/depressive symptoms, and all study covariates, were tested to determine whether the relationship between these variables and substance use over the follow-up depended on the specific time of interview. None of the interactions between time and the study variables reached the $p = .05$ level of significance.

Because participants were clustered within 11 residential substance abuse treatment programs, the intra-class correlation (ICC) for treatment program was examined using a generalized mixed model (SAS macro “glimmix”, with a binomial link.) This analysis accounted for clustering of interview within participant and participant within residential substance abuse treatment program. Using the same set of predictors as in the GEE, the ICC for residential substance abuse treatment program was .068 when predicting substance use post-treatment relative to no substance use. Importantly, this analysis replicated all of the significant associations from the GEE. Given the comparability of the findings and the modestly sized ICC for the clustering effect due to residential substance abuse treatment program, we elected to use the more parsimonious approach of accounting for the within-individual dependencies using the GEE technique.

Results

A summary of *lifetime* and *recent* traumatic events experienced by study participants is provided in Table 3. Descriptive statistics for the study variables measured at follow-up are provided in Table 4. Over the follow-up some individuals reported participation in substance abuse treatment services (beyond the index treatment episode). At the 6-month follow-up, forty-eight (16.8%) individuals reported both outpatient and residential treatment in the months preceding the interview, twenty-four (8.4%) reported outpatient treatment only, and three (1.1%) reported residential treatment only. At the 12-month interview, thirty-nine (13.5%) individuals reported both outpatient and residential treatment sometime in the six months preceding the interview, twenty-four (8.4%) individuals participated in outpatient treatment only, and 6 (2.1%) reported residential treatment only.

The results of analyses examining the association between substance use post-treatment and anxiety/depressive symptoms, *lifetime* trauma exposure, and PTSD at treatment entry are presented in Table 5, Model 1. Employment in the year preceding the baseline interview was associated with a reduced risk of substance use and females were more likely to report substance use over the follow-up. Latino participants were less likely to use substances over the follow-

up. Other background characteristics, namely age, lifetime substance use treatment, frequency of substance use at treatment entry, and the presence of a psychotic disorder were not significantly associated with the likelihood of substance use over the follow-up. Baseline anxiety/depressive symptoms, *lifetime* trauma exposure, current PTSD diagnosis were not associated with substance use when adjusting for baseline study covariates (see Table 5, Model 1). In analyses not shown, a history of *lifetime* interpersonal violence (total exposure and type of event experienced) was not significantly associated with substance use over the follow-up.

Results of the analysis examining the association between substance use and follow-up assessments of trauma exposure and anxiety/depressive symptoms are shown in Table 5, Model 2. As predicted, anxiety/depressive symptoms over the follow-up and *recent* trauma exposure were associated with an increased risk of substance use post-treatment, when controlling for baseline measures and other study covariates. Whether the participant lived in supervised housing (i.e., treatment program) over the follow-up period was associated with a reduced likelihood of substance use. Days in the index treatment program, number of mental health admissions over follow-up, time of the interview (6- or 12-month), and number of days of outpatient treatment over follow-up were not associated with substance use.

Interaction terms were tested to examine whether the association between *recent* trauma exposure and substance use over the follow-up would depend on *lifetime* trauma exposure or on a co-occurring PTSD diagnosis at treatment entry. Neither interaction term was statistically significant suggesting that the association between *recent* trauma exposure and substance use does not depend on these variables. Finally, the prediction that the impact of *recent* trauma exposure and anxiety/depressive symptoms on substance use over the follow-up differed by gender was not supported. These findings suggest that the relationship between *recent* trauma exposure and substance use does not differ for males and females. Other interactions between the study covariates and recent trauma exposure, a diagnosis of PTSD, and anxiety/depressive symptoms were not statistically significant.

Discussion

This longitudinal study expands our understanding of the relationships among anxiety/depressive symptoms, trauma exposure (*lifetime* and *recent*), PTSD, gender, and substance use following the index treatment episode among a severely impaired sample of individuals with co-occurring disorders.

Few background characteristics were associated with substance use over the follow-up. Specifically, a history of employment prior to treatment was associated with a lower risk of substance use. It is possible that an individual's ability to hold a job prior to treatment entry may serve as a proxy for better social and cognitive functioning and greater access to resources, which may facilitate their efforts to remain abstinent. In addition, women were more likely to use substances over the follow-up compared to men, after adjusting for other baseline characteristics such as frequency of substance use, number of substances used, number of prior treatment episodes, lifetime history of mental health treatment, type of psychiatric diagnosis, and anxiety/depressive symptoms. Interestingly, Latino participants were less likely to engage in substance use compared to Whites. In accord with previous studies (Rollins, O'Neill, Davis, & Devitt, 2005), supervised housing over the follow-up was associated with a lower risk of substance use. Nearly all of the sample had prior episodes of mental health treatment, and most had prior substance abuse treatment; thus, the lack of variation in these treatment experiences may produce a "ceiling effect" which may account for the lack of association between prior treatment history and substance use over follow-up.

Consistent with expectations, higher levels of anxiety/depressive symptoms over the follow-up were associated with substance use after adjusting for background characteristics and prior treatment history. Further, congruent with findings reported by other investigators (i.e., Grella et al., 2008; Walitzer & Dearing, 2006), the association between anxiety/depressive symptoms and substance use over the follow-up did not differ by gender.

The study's design does not allow us to ascertain the causal direction of the relationship between anxiety/depressive symptoms and substance use. It is possible that individuals may have resumed substance use in an attempt to manage their anxiety/depressive symptoms, which would be consistent with both the self-medication hypothesis (SMH) and the reformulated addiction motivation model. At the same time, resumption of substance use may have generated higher levels of anxiety/depressive and psychiatric symptoms as suggested by the rebound effect hypothesis (REH) (Blume, Schmalting, & Marlatt, 2000). A recent study of veterans with SUD-only and those with co-occurring disorders provides some support for these hypotheses (Tomlinson et al., 2006). In accordance with the SMH, depressive and anxiety were the symptoms most commonly experienced prior to post-treatment substance use among both groups, however, contrary to the SMH, symptoms did not diminish following use. Rather, as predicted by the REH, individuals with co-occurring conditions reported an exacerbation of the symptoms associated with their psychiatric diagnosis (i.e., depression, anxiety, and psychotic symptoms) following use. Overall, the present findings, as well as the results of the earlier study of veterans, are consistent with the model proposed by Otto and colleagues (2004) whereby individuals' sensitivity to internally generated negative affect is part of a feedback loop involving chronic stress and substance use.

One implication of the present findings is that it may be beneficial to assess individuals' anxiety sensitivity and their tendency to use avoidance as a form of managing anxiety/depressive symptoms. In addition, beliefs and expectations regarding the extent to which substance use can help ameliorate distress symptoms may contribute to the resumption of substance use. Importantly, the extent to which post-treatment use may contribute to behavioral and thought processes that increase anxiety/depressive symptoms should also be studied. Ideally, the use of ecological momentary assessment methodology (EMA) would allow better examination of the temporal sequencing of these symptoms and substance use (Shiffman & Stone, 1998).

As documented by previous studies among treatment-seeking individuals with co-occurring disorders (Gearon et al., 2003; Mueser et al., 1998; Norman et al., 2007; Resnick et al., 2003), trauma exposure was a common experience among participants of this study, with nearly all reporting *lifetime* trauma and about one third reporting exposure over the 12-month follow-up period. At treatment entry, about one third of the participants also met criteria for PTSD (SUD + PSYC + PTSD). Consistent with recent findings (i.e., Norman et al., 2007; Read, Brown, & Kahler, 2004), a history of *lifetime* trauma exposure and a PTSD diagnosis at treatment entry were not associated with an increased risk for substance use over the follow-up. In contrast, trauma exposure over the follow-up was associated with an increased risk of substance use after accounting for baseline frequency of substance use, a diagnosis of PTSD, length of participation in the index treatment episode, and other covariates. Also, contrary to expectation, females and individuals with higher levels of *lifetime* trauma exposure, a history of interpersonal violence, and a PTSD diagnosis were not more vulnerable to the negative impact of *recent* trauma. This suggests that individuals with co-occurring disorders are generally vulnerable to the impact of these experiences, regardless of gender or past trauma history.

The findings of this study agree with recent views suggesting that ongoing anxiety and depressive symptoms and the severity of trauma-related symptoms rather than the presence of a co-occurring PTSD diagnosis at treatment entry may contribute to substance use post-treatment (see Read et al., 2004). In particular, the severity of trauma-related symptoms appears

to be associated with an increased risk for substance use in situations involving negative emotional (i.e., depression, frustration, anger, and fear) and physiological states (Norman et al., 2007). Individuals may find themselves attempting to sustain abstinence, while also managing their anxiety/depressive and trauma-related symptoms, and the symptoms associated with their psychiatric diagnosis.

Limitations

Several limitations of this study should be mentioned. Reliance on retrospective self-reports of trauma exposure may lead to memory distortions and recall biases (Schraedley, Turner, & Gotlib, 2002; Widom & Shepard, 1997). Yet given the difficulties associated with obtaining independent verification of these events, and recent evidence suggesting adequate levels of test-retest reliability for measures of trauma exposure (Goodman et al., 2001; Lauterbach & Vrana, 1996), the study's reliance on self-reports does not represent a critical flaw. Also, this study did not assess all potentially traumatic events, however, the events assessed are widely considered to have the ability to elicit symptoms of clinical significance and contribute to the development of PTSD. In addition, the Structured Clinical Interview (SCID) for DSM-IV employed in this study is not the current "gold standard" for the diagnosis of PTSD (Weathers, Keane, & Davidson, 2001). Nevertheless, the SCID has been widely used in clinical and research settings to identify psychiatric disorders and PTSD (Subcommittee on Posttraumatic Stress Disorder, 2006). Importantly, the aims of the original study necessitated the assessment of other psychiatric disorders, as such, the use of the SCID allowed for the identification of PTSD and other disorders while minimizing the burden on participants.

The study's design does not disentangle the temporal sequencing between *recent* trauma exposure, anxiety/depressive symptoms, and substance use. Although it is reasonable to assume that exposure to potentially traumatic events over the follow-up may contribute to higher levels of symptomatology, which in turn may contribute to a greater risk of substance use, other factors may account for this relationship. For example, the severity of anxiety/depressive symptoms reported is not solely the result of these experiences but may rather be explained by the exacerbation of trauma-related and psychiatric symptoms or some other individual characteristics such as coping (Ouimette et al., 1999). Alternatively, it is unclear whether substance use over the follow-up may increase the risk of further trauma exposure, higher levels of anxiety/depression or psychiatric symptomatology. Specifically, substance use may have increased individuals' vulnerability to further trauma exposure by contributing to lower social functioning and greater behavioral disorganization.

In addition, the differing time frames employed to assess trauma exposure (within the previous 6 months), anxiety/depressive symptoms (over the previous 7 days), and substance use (previous 30 days) over the follow-up further challenge our ability to make causal inferences. Alternatively, assessing anxiety/depressive symptoms and substance use over long-time periods may increase the risk of reporting biases, which may be especially problematic in this severely impaired population. Furthermore, objective verification of self-reported substance use via urinalysis requires assessing use over a narrow time frame (i.e., few days to a week) which makes testing over a period of several months less feasible. Regarding trauma exposure, assessing exposure over a narrower time period (i.e., past 7 or 30 days) would have decreased the study's ability to capture events that may occur somewhat infrequently and would provide no information about events experienced prior to that narrow interval. Future studies might consider the use of EMA to determine the temporal ordering of these variables or, alternatively, researchers may consider conducting more frequent follow-ups to assess these variables within the same time frame. However, it is unclear whether the use of EMA or more frequent assessments would be feasible given the unique characteristics of this population and the increased burden these strategies would place on participants.

Finally, because this sample includes only participants from the treatment program who met the study's inclusion criteria (i.e., presence of co-occurring disorders) and data from those who were not eligible for participation were not collected, it is unclear to what extent this sample is representative of the population served by these programs. Despite these limitations this is one of the very few longitudinal studies examining the impact of anxiety/depressive symptoms, *lifetime* and *recent* trauma exposure (post-treatment), and PTSD, on substance use over time among individuals with co-occurring disorders. A unique strength of the study was the diversity of the sample which allowed the examination of potential gender differences.

Future Directions

The high rates of trauma exposure and re-exposure among this population suggest that researchers and treatment providers may benefit from routinely assessing trauma exposure both during and post-treatment. Also, as suggested by recent findings related to treatment and prevention of substance use relapse among individuals with trauma histories and PTSD (Morrissey, Jackson, Ellis, Amaro, Brown, & Najavits, 2005) and those with co-occurring disorders (i.e., Drake, Wallach, & McGovern, 2005), providers would benefit from incorporating relapse prevention interventions not only during the initial treatment episode but as part of ongoing care for this population. Relapse prevention efforts should include skills training aimed at helping individuals identify internal and external cues for use, acknowledge and manage negative emotions, and at learning skills to more effectively manage their anxiety/depressive and psychiatric symptoms (Otto et al., 2004). In addition, these services need to incorporate training aimed at teaching individuals how to identify, anticipate, and avoid situations that may lead to further trauma exposure and increase the likelihood of substance use.

The literature on the development and implementation of trauma-informed services for women can guide efforts aimed at addressing the needs of this population. Services for individuals with co-occurring disorders and trauma histories need to be “integrated,” that is, they need to address all mental health, substance abuse, and trauma concurrently (Markoff, Reed, Fallot, Elliott, & Bjelajac, 2005). Recent studies on treatment outcomes among women with co-occurring disorders and trauma histories have demonstrated that the provision of “integrated” counseling services was associated with greater improvements in the severity of alcohol and drug use, and psychological distress following treatment relative to usual care (Cocozza et al., 2005; Morrissey et al., 2005). Moreover, as suggested by other investigators, efforts at promoting long-term abstinence and recovery in this population need to include services aimed at addressing poverty, unemployment, promoting safe and supervised living situations, and the development of supportive social relationships (Drake et al., 2005; Markoff et al., 2005).

Several empirically validated treatment models for addressing the needs of individuals with co-occurring disorders have been developed (Markoff et al., 2005). Of these treatments, “Seeking Safety” has the most empirical support (Najavits, 2007). This treatment program aims to provide individuals with cognitive, behavioral, and interpersonal skills that will allow them to safely cope with the symptoms associated with SUDs and PTSD (Najavits, 2003). This model has demonstrated utility in reducing psychiatric and trauma-related symptoms among women (Hien, Cohen, Miele, Litt, & Capstick, 2004), men (Najavits, Schmitz, Gotthard, & Weiss, 2005), homeless female veterans with co-occurring disorders (Desai, Harpaz-Rotem, Najavits, & Rosenheck, 2008), women with substance use disorders who had been exposed to complex trauma (Cohen & Hien, 2006), and incarcerated women (Zlotnick, Najavits, Rohsenow, & Johnson, 2003).

The prevailing emphasis on continuing care approaches for substance use (McLellan 2002; McLellan, Lewis, O'Brian, & Kleber, 2000) focus on the chronic nature of these disorders which necessitate the maintenance of long-term behavioral changes. The continuing goal to

implement these approaches for individuals with co-occurring disorders who demonstrate poorer long-term outcomes and more enduring trajectories of substance use than individuals with substance use disorders only (Chi et al., 2007) remains a challenge.

Acknowledgments

Support for this research was provided by the National Institute on Drug Abuse, grants R03-DA19991 and R01-DA11966.

Reference

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Vol. 4th ed.. Author; Washington, D. C.: 1994.
- Back SE, Brady KT, Waldrop AE, Yeatts SD, McRae AL, Pharm D, Spratt E. Early life trauma and sensitivity to current life stressors in individuals with and without cocaine dependence. *The American Journal of Drug and Alcohol Abuse* 2008;34:389–396. [PubMed: 18584568]
- Baker TB, Piper ME, McCarthy DE, Majeskie MR, Fiore MC. Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review* 2004;111:33–51. [PubMed: 14756584]
- Blume AW, Schmalting KB, Marlatt GA. Revisiting the self-medication hypothesis from a behavioral perspective. *Cognitive and Behavioral Practice* 2000;7:379–384.
- Bradizza CM, Stasiewicz PR, Paas ND. Relapse to alcohol and drug use among individuals diagnosed with co-occurring mental health and substance use disorders: A review. *Clinical Psychology Review* 2006;26:162–178. [PubMed: 16406196]
- Brown PJ. Outcome in female patients with both substance use and post-traumatic stress disorder. *Alcoholism Treatment Quarterly* 2000;18:127–135.
- Center for Substance Abuse Treatment. Treatment Improvement Protocol series. Department of Health and Human Services; Washington DC: 2000. Substance abuse and treatment for persons with child abuse and neglect issues..
- Center for Substance Abuse Treatment. Treatment Improvement Protocol series 42. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2005. Substance abuse treatment for persons with co-occurring disorders..
- Chi FW, Satre DD, Weisner C. Chemical dependency patients with co-occurring psychiatric diagnoses: Service patterns and 1-year outcomes. *Alcoholism: Clinical and Experimental Research* 2006;30:851–859.
- Cicchetti D, Toth SL. Child maltreatment. *Annual Review of Clinical Psychology* 2005;1:409–438.
- Cocozza JJ, Jackson EW, Hennigan K, Morrissey JP, Reed BG, Fallot R, Banks S. Outcomes for women with co-occurring disorders and trauma: Program-level effects. *Journal of Substance Abuse Treatment* 2005;28:109–119. [PubMed: 15780540]
- Cohen LR, Hien DA. Treatment outcomes for women with substance abuse and PTSD who have experienced complex trauma. *Psychiatric Services* 2006;57:100–106. [PubMed: 16399969]
- Compton WM, Cottler LB, Jacobs JL, Ben-Abdallah A, Spitznagel EL. The role of psychiatric disorders in predicting drug dependence treatment outcomes. *American Journal of Psychiatry* 2003;160:890–895. [PubMed: 12727692]
- Cooney NL, Litt MD, Morse PA, Bauer LO, Gaupp L. Alcohol cue reactivity, negative mood reactivity, and relapse in treated alcoholic men. *Journal of Abnormal Psychology* 1997;106:243–250. [PubMed: 9131844]
- Curran GM, Flynn HA, Kirchner J, Booth BM. Depression after alcohol treatment as a risk factor for relapse among male veterans. *Journal of Substance Abuse Treatment* 2000;19:259–265. [PubMed: 11027896]
- Dansky BS, Brady KT, Saladin ME. Untreated symptoms of PTSD among cocaine-dependent individuals. *Journal of Substance Abuse Treatment* 1998;15:499–504. [PubMed: 9845863]
- Derogatis LR, Melisaratos N. The brief symptom inventory: An introduction report. *Psychological Medicine* 1983;13:595–605. [PubMed: 6622612]

- Desai RA, Harpaz-Rotem I, Najavits LM, Rosenheck RA. Impact of the Seeking Safety Program on clinical outcomes among homeless female veterans. *Psychiatric Services* 2008;59:996–1003. [PubMed: 18757592]
- DiNitto DM, Webb DK, Rubin A. Gender differences in dually-diagnosed clients receiving chemical dependency treatment. *Journal of Psychoactive Drugs* 2002;34:105–117. [PubMed: 12003108]
- Drake RE, Wallach MA, McGovern MP. Future directions in preventing relapse to substance abuse among clients with severe mental illness. *Psychiatric Services* 2005;56:1297–1302. [PubMed: 16215199]
- Fiorentine R, Anglin MD, Gil-Rivas V, Taylor E. Sexual and physical abuse: Do they compromise treatment outcomes? *Journal of Substance Abuse Treatment* 1997;14:351–358. [PubMed: 9368211]
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, J. Structured Clinical Interview for DSM-IV Axis I Disorders: Patient Edition (SCID-I/P, Version 2.0, 4/97 Rev). Biometrics Research, New York State Psychiatric Institute; New York: 1997.
- Ford JD, Hawke J, Alessi S, Ledgerwood D, Petry N. Psychological trauma and PTSD symptoms as predictors of substance dependence treatment outcomes. *Behaviour Research and Therapy* 2007;45:2417–2431. [PubMed: 17531193]
- Gearon JS, Nidecker MA, Bellack A, Bennett M. Gender differences in drug use behavior in people with serious mental illness. *The American Journal on Addictions* 2003;12:229–241. [PubMed: 12851019]
- Goodman LA, Rosenberg SD, Mueser KT, Drake RE. Physical and sexual assault history in women with serious mental illness: Prevalence, correlates, treatment and future research. *Schizophrenia Bulletin* 1997;23:685–696. [PubMed: 9366004]
- Goodman LA, Salyers MP, Mueser KT, Rosenberg SD, Swartz M, Essock SM, Osher FC, Butterfield MI, Swanson J. Recent victimization in women and men with severe mental illness: Prevalence and correlates. *Journal of Traumatic Stress* 2001;14:615–632. [PubMed: 11776413]
- Goswami S, Mattoo SK, Basu D, Singh G. Substance-abusing schizophrenics: Do they self-medicate? *The American Journal of Addictions* 2004;13:139–150.
- Grella CE, Scott CK, Foss M, Dennis ML. Gender similarities and differences in the treatment, relapse, and recovery cycle. *Evaluation Review* 2008;32:113–137. [PubMed: 18198172]
- Grella CE, Stein JA. Impact of program services on treatment outcomes of patients with comorbid mental health and substance use disorders. *Psychiatric Services* 2006;57:1007–1015. [PubMed: 16816286]
- Havassy BE, Alvidrez J, Owen KK. Comparisons of patients with comorbid psychiatric and substance use disorders: Implications for treatment and service delivery. *American Journal of Psychiatry* 2004;161:139–145. [PubMed: 14702262]
- Heim C, Newport J, Heit S, Graham YP, Wilcox M, Bonsall R, Miller AH, Nemeroff CB. Pituitary-adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *JAMA* 2000;284:592–597. [PubMed: 10918705]
- Henwood B, Padgett DK. Reevaluating the self-medication hypothesis among the dually diagnosed. *The American Journal on Addictions* 2007;16:160–165. [PubMed: 17612818]
- Hien D, Cohen L, Campbell A. Is traumatic stress a vulnerability factor for women with substance use disorders? *Clinical Psychology Review* 2005;25:813–823. [PubMed: 15967556]
- Hien DA, Cohen LR, Miele GM, Litt LC, Capstick C. Promising treatments for women with comorbid PTSD and substance use disorders. *American Journal of Psychiatry* 2004;16:1426–1432. [PubMed: 15285969]
- Holtzheimer PE, Russo J, Zatzick D, Bundy C, Roy-Byrne PP. The impact of comorbid posttraumatic stress disorder on short-term clinical outcome in hospitalized patients with depression. *American Journal of Psychiatry* 2005;162:970–976. [PubMed: 15863800]
- Khantzian EJ. The self-medication hypothesis of substance use disorders: A consideration and recent applications. *Harvard Review of Psychiatry* 1997;4:231–244. [PubMed: 9385000]
- Lam JA, Rosenheck R. The effect of victimization on clinical outcomes of homeless persons with serious mental illness. *Psychiatric Services* 1998;49:678–683. [PubMed: 9603576]
- Laudet AB, Magura S, Vogel HS, Knight EL. Perceived reasons for substance misuse among persons with a psychiatric disorder. *American Journal of Orthopsychiatry* 2004;74:365–375. [PubMed: 15291712]

- Lauterbach D, Vrana S. Three studies on the reliability and validity of a self-report measure of posttraumatic stress disorder. *Assessment* 1996;3:17–26.
- Mangrum LF, Spence RT, Steinley-Bumgarner MD. Gender differences in substance-abuse treatment clients with co-occurring psychiatric and substance-use disorders. *Crisis Intervention* 2006;6:255–267.
- Markoff LS, Reed BG, Fallot RD, Elliott DE, Bjelajac P. Implementing trauma-informed alcohol and other drug and mental health services for women: Lessons learned in a multisite demonstration project. *American Journal of Orthopsychiatry* 2005;75:525–539. [PubMed: 16262512]
- McLellan AT. Have we evaluated addiction treatment correctly? Implications from a chronic care perspective. *Addiction* 2002;97:249–52. [PubMed: 11964098]
- McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: Implications for treatment, insurance, and outcomes evaluation. *Journal of the American Medical Association* 2000;284:1689–95. [PubMed: 11015800]
- Morrisey JP, Jackson EW, Ellis AR, Amaro H, Brown VB, Najavits LM. Twelve-month outcomes of trauma-informed interventions for women with co-occurring disorders. *Psychiatric Services* 2005;56:1213–1222. [PubMed: 16215186]
- Moos, RH.; Finney, JW.; Cronkite, RC. *Alcoholism treatment: Context, process and outcome*. Oxford University Press; New York: 1990.
- Mueser KT, Goodman LA, Trumbetta SL, Rosenberg SD, Osher FC, Vidaver R, Auciello P, Foy DW. Trauma and posttraumatic stress disorder in severe mental illness. *Journal of Consulting and Clinical Psychology* 1998;66:493–499. [PubMed: 9642887]
- Mueser KT, Rosenberg SD, Goodman LA, Trumbetta SL. Trauma, PTSD, and the course of severe mental illness: and interactive model. *Schizophrenia Research* 2002;53:123–124. [PubMed: 11728845]
- Najavits, LM. Seeking safety: A new psychotherapy for posttraumatic stress disorder and substance use disorders.. In: Ouimette, P.; Brown, PJ., editors. *Trauma and substance abuse: Causes, consequences and treatment of comorbid disorders*. American Psychological Association; Washington, DC: 2003. p. 147-170.
- Najavits, LM. Psychosocial treatments for posttraumatic stress disorder.. In: Nathan, PE.; Gorman, JM., editors. *A guide to treatments that work*. Vol. 3rd ed.. Oxford; New York: 2007. p. 513-530.
- Najavits LM, Schmitz M, Gotthard S, Weiss RD. Seeking Safety plus exposure therapy: An outcome study on dual diagnosis men. *Journal of Psychoactive Drugs* 2005;37:425–435. [PubMed: 16480170]
- Najavits LM, Weiss RD, Shaw SR. The link between substance abuse and posttraumatic stress disorder in women: A research review. *The American Journal of Addictions* 1997;6:273–283.
- Najavits LM, Weiss RD, Shaw SR. A clinical profile of women with posttraumatic stress disorder and substance dependence. *Psychology of Addictive Behaviors* 1999;13:98–104.
- Nishith P, Mechanic MB, Resick PA. Prior interpersonal trauma: The contribution of current PTSD symptoms in female rape victims. *Journal of Abnormal Psychology* 2000;109:20–25. [PubMed: 10740932]
- Norman SB, Tate SR, Anderson KG, Brown SA. Do trauma history and PTSD influence addiction relapse context? *Drug and Alcohol Dependence* 2007;90:89–96. [PubMed: 17459611]
- O'Hare T, Sherrer MV, Shen C. Subjective distress from stressful events and high-risk behaviors as predictors of PTSD symptom severity in clients with severe mental illness. *Journal of Traumatic Stress* 2006;19:375–386. [PubMed: 16788997]
- Otto MW, Safren SA, Pollack MH. Internal cue exposure and the treatment of substance use disorders: Lessons from the treatment of panic disorder. *Journal of Anxiety Disorders* 2004;18:69–87. [PubMed: 14725869]
- Ouimette PC, Ahrens C, Moos RH, Finney JW. Posttraumatic stress disorder in substance abuse patients: Relationship to one-year posttreatment outcomes. *Psychology of Addictive Behaviors* 1997;11:34–47.
- Ouimette PC, Coolheart D, Funderburk JS, Wade M, Brown PJ. Precipitants of first substance use in recently abstinent substance use disorder patients with PTSD. *Addictive Behaviors* 2007;32:1719–1727. [PubMed: 17188816]
- Ouimette PC, Finney JW, Moos RH. Two-year posttreatment functioning and coping of substance abuse patients with posttraumatic stress disorder. *Psychology of Addictive Behaviors* 1999;13:105–114.

- Ouimette PC, Gima K, Moos RH, Finney JW. A comparative evaluation of substance abuse treatment IV. The effect of comorbid psychiatric diagnoses on amount of treatment, continuing care and 1-year outcomes. *Alcoholism: Clinical and Experimental Research* 1999;23:552–557.
- Ouimette PC, Wolfe J, Chrestman KR. Characteristics of posttraumatic stress disorder-alcohol abuse comorbidity in women. *Journal of Substance Abuse* 1996;8:335–346. [PubMed: 8934438]
- Read JP, Brown PJ, Kahler CW. Substance use and posttraumatic stress disorders: Symptom interplay and effects on outcome. *Addictive Behaviors* 2004;29:1665–1672. [PubMed: 15451135]
- Rollins AL, O'Neill SJ, Davis KE, Devitt TS. Substance abuse relapse and factors associated with relapse in an inner-city sample of patients with dual diagnoses. *Psychiatric Services* 2005;56:1274–1281. [PubMed: 16215195]
- Rosenberg SD, Mueser KT, Friedman MJ, Gorman PG, Drake RE, Vidaver RM, Torrey WC, Jankowski MK. Developing effective treatments for posttraumatic disorders among people with severe mental illness. *Psychiatric Services* 2001;52:1453–1461. [PubMed: 11684740]
- Rubonis AV, Colby SM, Monti PM, Rohsenow DJ, Gulliver SB, Sirota AD. Alcohol cue reactivity and mood induction in male and female alcoholics. *Journal of Studies on Alcohol and Drugs* 1994;55:487–494.
- Schraedley PK, Turner RJ, Gotlib IH. Stability of retrospective reports in depression: Traumatic events, past depressive episodes, and parental psychopathology. *Journal of Health and Social Behavior* 2002;43:307–316. [PubMed: 12467255]
- Sells DJ, Rowe M, Fisk D, Davidson L. Violent victimization of persons with co-occurring psychiatric and substance use disorders. *Psychiatric Services* 2003;54:1253–1257. [PubMed: 12954942]
- Sharkansky EJ, Brief DJ, Peirce JM, Meehan JC, Mannix LM. Substance abuse patients with posttraumatic stress disorder (PTSD): Identifying specific triggers of substance use and their associations with PTSD symptoms. *Psychology of Addictive Behaviors* 1999;13:89–97.
- Shiffman, S.; Stone, AA. Ecological momentary assessment: a new tool for behavioral medicine research.. In: Krantz, D.; Baum, A., editors. *Technology and Methods in Behavioral Medicine*. Academy of Behavioral Medicine Research; 1998. p. 117-131.
- Spencer C, Castle D, Michie PT. Motivations that maintain substance use among individuals with psychotic disorders. *Schizophrenia Bulletin* 2002;28:233–247. [PubMed: 12693430]
- SPSS Inc.. SPSS statistical software: Release 14. Chicago, Illinois, USA:
- Stata Corporation. Stata statistical software: Release 9. 2. College Station, Texas, USA: 2006.
- Stewart D, Gossop M, Marsden J, Kidd T, Treacy S. Similarities in outcomes for men and women after drug misuse treatment: Results from the National Treatment Outcome Study (NTORS). *Drug and Alcohol Review* 2003;22:35–41. [PubMed: 12745357]
- Stewart SH, Pihl RO, Conrod PJ, Dongier M. Functional associations among trauma, PTSD, and substance-related disorders. *Addictive Behaviors* 1998;23:797–812. [PubMed: 9801717]
- Strowig AB. Relapse determinants reported by men treated for alcohol addiction: The prominence of depressed mood. *Journal of Substance Abuse Treatment* 2000;19:469–474. [PubMed: 11166511]
- Subcommittee on Posttraumatic Stress Disorder of the Committee on Gulf War and Health: Physiologic, psychologic and psychosocial effects of deployment-related stress. *Posttraumatic Stress Disorder: Diagnosis and Assessment*. The National Academies Press; Washington D.C.: 2006.
- Tate SR, Brown SA, Unrod M, Ramo DE. Context of relapse for substance-dependent adults with and without comorbid psychiatric disorders. *Addictive Behaviors* 2004;29:1707–1724. [PubMed: 15530716]
- Tomlinson KL, Tate SR, Anderson KG, McCarthy DM, Brown SA. An examination of self-medication and rebound effects: Psychiatric symptomatology before and after alcohol or drug relapse. *Addictive Behaviors* 2006;31:461–474. [PubMed: 15972246]
- Walitzer KS, Dearing R. Gender differences in alcohol and substance use relapse. *Clinical Psychology Review* 2006;26:128–148. [PubMed: 16412541]
- Weathers TW, Keane TM, Davidson JRT. Clinician-administered PTSD scale: A review of the first ten years of research. *Depression and Anxiety* 2001;13:132–156. [PubMed: 11387733]
- Widom CS, Shepard RL. Accuracy of adult recollections of childhood victimization: Part 1. Childhood sexual abuse. *Psychological Assessment* 1997;8:412–421.

- Willinger U, Lenzinger E, Hornik K, Fischer G, Schönbeck G, Aschauer HN, Meszaros K. Anxiety as a predictor of relapse in detoxified alcohol-dependent patients. *Alcohol and Alcoholism* 2002;37:609–612. [PubMed: 12414556]
- Wolfe, J.; Kimerling, R. Gender issues in the assessment of Posttraumatic Stress Disorder.. In: Wilson, J.; Keane, TM., editors. *Assessing psychological trauma and PTSD*. Guilford; New York: 1997. p. 192-238.
- Xie H, McHugo GJ, Fox MB, Drake RE. Substance abuse relapse in a ten-year prospective follow-up of clients with mental and substance use disorders. *Psychiatric Services* 2005;56:1282–1287. [PubMed: 16215196]
- Zlotnick C, Najavits LM, Rohsenow DJ, Johnson DM. A cognitive-behavioral treatment for incarcerated women with substance abuse disorder and posttraumatic stress disorder: findings from a pilot study. *Journal of Substance Abuse Treatment* 2003;25:99–105. [PubMed: 14629992]

Table 1Descriptive Statistics at Baseline ($n=322$)

Study variables	M	SD	%
Male			51.2
Age (years)	36.2	8.7	
Ethnicity			
White			45.7
Black			34.5
Latino			12.4
Other/Multi-ethnic			7.5
Marital Status			
Married			9.6
Separated/Divorced/Widowed			36.7
Never Married			53.7
Education			
Less than High School			34.5
High School or GED			30.1
Some College/College graduate			35.4
Employed (past year)			46.9
Psychiatric Diagnosis			
Psychotic disorder			27.0
Mood disorder			73.0
PTSD - Current			38.5
PTSD - Lifetime			52.5
Anxiety/depressive symptoms	1.7	0.9	
Alcohol use (past 30 days)			
None			55.5
1 to 3 times/month			11.2
1 to 2 times/week			2.8
3 to 4 times/week			3.1
5 to 6 times/week			2.2
Daily			5.0
2 to 3 times /day			2.5
4 or more times/day			17.8
Drug use (past 30 days)			
None			48.5
1 to 3 times/month			6.2
1 to 2 times/week			4.7
3 to 4 times/week			5.3
5 to 6 times/week			3.1
Daily			4.7
2 to 3 times /day			3.7
4 or more times/day			23.9
Most severe use of drugs or alcohol ^b	3.1	3.1	

Study variables	M	SD	%
Lifetime # substance use treatment episodes (log transformed)	1.2	0.9	
Lifetime # weeks in-patient and out-patient mental health treatment (log transformed)	4.1	1.7	
Days in index substance abuse treatment	93.0	53.5	

Note. ^a scale ranged from 0 (*not at all*) to 4 (*extremely*)

^b Scale ranged from 0 (*no use in the prior 30 days*) to 7 (*4 times per day*).

Table 2

Substance Use Disorders at Treatment Entry

Diagnosis	Abuse %		Dependence %	
	Lifetime	Current	Lifetime	Current
Alcohol	15.2	0.3	70.2	17.7
Cocaine	8.4	0.6	66.8	18.3
Cannabis	28.3	3.4	45.0	6.5
Amphetamine	9.3	0.0	42.2	3.7
Opiate	6.5	0.3	27.6	4.4
Sedatives	11.2	0.3	24.5	1.6

Table 3

Lifetime Trauma Exposure

Variable	M	SD	%
Any lifetime exposure			98.5
Disaster			59.0
Serious accident			67.1
Physical assault/robbery			62.1
Childhood neglect			19.6
Unwanted sexual touch			
Before age 16			42.9
After age 16			17.2
Sexual abuse			
Before age 16			32.6
After age 16			32.0
Physical abuse			
Before age 16			49.1
After age 16			53.1
Categorical lifetime interpersonal violence			
No interpersonal violence			7.1
Sexual abuse only			4.0
Physical abuse only			9.6
Physical assault/robbery only			9.9
Two interpersonal events			36.7
All types of interpersonal events			32.6
Number of lifetime traumatic events	4.4	2.2	

Table 4
Descriptive Statistics for Substance Use and Time-Varying Covariates

	Follow-up Interview					
	6-month			12-month		
	M	SD	%	M	SD	%
Any Substance use ^a			45.3			52.6
Alcohol or drugs			23.2			26.8
Alcohol and drugs			22.1			25.8
Anxiety/depressive symptoms ^b	1.2	0.9		1.2	0.9	
Outpatient substance abuse treatment ^c	12.8	50.6		17.5	43.9	
Inpatient substance abuse treatment ^c	9.1	25.6		9.6	30.0	
Mental health treatment admissions ^d	0.4	0.8		0.5	0.9	
Trauma exposure (<i>recent</i>)			23.5			28.9
Housing						
Own house			22.8			29.3
Treatment program			34.4			26.1
Parents/relatives			23.2			22.3
No regular place			4.2			4.9
Other			15.4			17.4
Sample size ^d			285			287

Note.

^e 250 individuals had complete data at both the 6- and 12-month interviews; 35 individuals provided data at the 6- only and 37 at the 12-month interview only.

^a Coded as 1 = substance use; 0 = no substance use.

^b scale ranged from 0 (*not at all*) to 4 (*extremely*).

^c Days in treatment

^d Number of admissions

Table 5Association between Substance Use Over the Follow-up and Study Variables^a

	Model 1: Baseline		Model 2: Follow-up	
Study Variables ^b	OR ^c	95% CI ^c	OR ^c	95% CI ^c
Gender (1= male; 0 =female)	1.62 *	1.07, 2.46	1.57 *	1.01, 2.44
Age (years)	0.98	0.96, 1.01	0.98	0.95, 1.01
Ethnic background (reference White)				
Black	0.78	0.50, 1.24	0.83	0.51, 1.35
Latino	0.43 *	0.22, 0.83	0.42 *	0.21, 0.85
Other/Multi-ethnic	0.65	0.30, 1.44	0.56	0.24, 1.31
Baseline employment (yes/no)	0.59 *	0.39, 0.89	0.59 *	0.39, 0.91
Lifetime substance use treatment episodes (log transformed)	0.97	0.77, 1.21	0.98	0.72, 1.24
Baseline frequency of substance use ^d	1.04	0.97, 1.11	1.04	0.97, 1.11
Baseline anxiety/depressive symptoms ^e	1.08	0.87, 1.35	0.99	0.78, 1.26
PTSD diagnosis at baseline	1.09	0.71, 1.67	1.04	0.66, 1.63
Lifetime trauma exposure	0.96	0.87, 1.06	0.91	0.82, 1.02
Time of interview (0= 6 mo; 1= 12 mo)	--	--	1.30	0.98, 1.73
Supervised housing (yes/no)	--	--	0.49 **	0.33, 0.73
Days in index treatment episode	--	--	0.998	0.99, 1.00
Days in outpatient substance abuse treatment at follow-up	--	--	1.00	0.99, 1.01
Mental health admissions at follow-up			0.93	0.74, 1.15
Recent trauma (yes/no)	--	--	1.92 **	1.27, 2.89
Follow-up anxiety/depressive symptoms ^e	--	--	1.61 **	1.28, 2.02
Wald Chi-Square (DF)	20.1 (11) *	--	69.2(18) **	

Note.

*
p<.05**
p<.005^a322 individuals; 572 longitudinal records.^bMarital status, income, education, and psychiatric diagnosis at treatment entry, employment over follow-up, lifetime number weeks of mental health treatment, and type of lifetime traumatic events and of events experienced over follow-up were not significantly associated with substance use and are not included in regression models.^cOdds Ratio for substance use relative to no use over the follow-up and 95% Confidence Interval.^dScale ranged from 0 (*no use in the prior 30 days*) to 7 (*4 times per day*).^escale ranged from 0 (*not at all*) to 4 (*extremely*).