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The Relationship between Perceived Stress and Depression in Substance Use Disorder Treatment

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Abstract

Background.—Depression is highly prevalent among individuals with SUDs, especially women, and has been noted to improve during SUD treatment. Perceived stress is independently related to severity of depression and substance use disorders (SUD) as well as recurrence of symptoms and relapse following treatment. The aim of this study was to investigate among adults enrolled in SUD treatment whether levels of perceived stress and substance use over the course of treatment were related to reduction in depression.

Methods.—This is a secondary analysis of data from the Women's Recovery Group Study. Women (n=100) were randomized to either single- or mixed-gender group therapy and men (n=58) received mixed-gender group therapy. Measures of substance use, perceived stress and depressive symptoms were collected for 6 months following treatment completion. In this study, we used lagged mixed models to investigate whether levels of substance use and perceived stress at each time point were associated with changes in depression at the subsequent time point.

Results.—Results indicated that depressive symptoms significantly improved over time. Both substance use and perceived stress were associated with subsequent depressive symptoms. Importantly, stress was associated with symptoms when controlling for substance use, suggesting that changes in depressive symptoms were not solely attributable to levels of substance use.

Conclusions.—These results suggest that both stress and substance use are associated with improvements in depressive symptoms in substance use disorder treatment. Although preliminary,

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Contributors:

Drs. Greenfield and McHugh designed this secondary data analysis. Drs. McHugh and Fitzmaurice undertook the statistical analysis, and Dr. McHugh and Ms. Meyer wrote the first draft of the manuscript. Drs. McHugh, Sugarman, Fitzmaurice, and Greenfield and Ms. Meyer contributed to the interpretation and presentation of study findings. All authors contributed to and have approved the final manuscript.

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Conflict of Interest

The authors declare they have no conflicts of interest.

these results provide further support for the importance of targeting stress reduction in people with substance use disorders.

Keywords

substance use disorder; depression; gender; stress

1. Introduction

Depressive symptoms and disorders are highly prevalent in people with substance use disorders¹ (Grant et al., 2004; Greenfield et al., 1998) and are associated with worse substance use disorder course and prognosis (Hasin et al., 2002; Samet et al., 2013). Many studies have found that substance use disorder treatment is associated with reductions in depression (Driessen et al., 2001; Kosten et al., 1990; Liappas et al., 2002); however, it is unclear why substance use disorder treatment is associated with improved depression.

In people with substance use disorders, depressive symptoms decrease substantially following a period of 3–4 weeks of abstinence (Driessen et al., 2001; Liappas et al., 2002; Strain et al., 1991) and continue to decline over the course of outpatient treatment, even when depression is not specifically targeted (Kosten et al., 1990; McHugh and Greenfield, 2010). There are several potential explanations for why depressive symptoms improve with substance use disorder treatment. The first is that reduction in substance use results in improvements in depression because of the profound effects of substances on mood (Milby et al., 2015; Witkiewitz and Villarroel, 2009). Another possibility is that remission of depressive symptoms is attributable to reduction in stress, as the consequences of substance use disorders (e.g., financial, social) decrease during treatment. However, it is unclear whether stress is associated with improvements in depression above and beyond the effect of substance use reductions.

In this secondary analysis of a multi-site clinical trial of treatment for men and women with DSM-IV substance dependence, we examined the associations between levels of stress and substance use over time and subsequent changes in depression among men and women receiving substance use disorder treatment. The aims of this study were to investigate changes in depressive symptoms over the course of substance use disorder treatment and to examine whether perceived stress and substance use were prospectively associated with changes in depressive symptoms. We hypothesized that (1) depressive symptoms would decrease significantly over the course of treatment, and (2) that perceived stress and days of substance use would be prospectively and incrementally associated with changes in depressive symptoms (i.e., these variables would predict future depressive symptoms).

2. Material and Methods

This secondary analysis used data from the Stage II Women's Recovery Group Study (Greenfield et al., 2014), a randomized controlled clinical trial comparing two active

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¹We use the term "substance use disorders" broadly to include both DSM-IV substance abuse and dependence and DSM-5 substance use disorder.

substance use group therapies: the single-gender Women's Recovery Group (WRG) and mixed-gender Group Drug Counseling (GDC). The WRG is an evidence-based, cognitive-behavioral group therapy that includes gender-specific content (Greenfield, 2016). GDC (Daley et al., 2002) is a mixed-gender, evidence-based group therapy focused on abstinence, education about addiction and recovery, participation in self-help groups, and use of coping skills. Both treatments included 12 weekly 90-minute sessions, and participants were followed monthly during treatment, and at 3- and 6-months post-treatment. Two trials have shown that women in the WRG and GDC showed clinically relevant reductions in substance use days during treatment and at 6-months post-treatment (Greenfield et al., 2014; Greenfield et al., 2007). In the parent trial, the WRG was equally as effective as the GDC for women with substance use disorders (Greenfield et al., 2014).

A detailed description of the study methods and group treatments has been previously published (Greenfield et al., 2014). A brief overview of the study and methods pertinent to the aims of this paper are presented below.

2.1. Participants

Participants were recruited from substance use treatment programs, private practices, and by media notices (e.g., radio, newspaper, and craigslist ads). Eligibility criteria included: 18 years of age or older, DSM-IV diagnosis of substance dependence (not including nicotine dependence), and substance use within the past 60 days. A total of 158 participants (women = 100; men = 58) were enrolled in the study; 20 participants (50% female) were excluded from the current analysis due to missing data on the stress and depression measures. The mean age of the sample was 47 years and the sample was predominantly White (94.3%). Sample characteristics are presented in Table 1.

2.2. Procedures

The study occurred at two outpatient treatment sites: an academic psychiatric hospital (McLean Hospital in Belmont MA) and a community treatment program (Stanley Street Treatment and Resources; SSTAR, in Fall River, MA). The McLean Hospital Institutional Review Board approved the study protocol for both sites, and all participants provided written informed consent.

The current analysis used data on depressive symptoms, perceived stress, and substance use collected at four assessment points, each three months apart. Participants completed self-report measures of depressive symptoms and perceived stress at baseline and 3-, 6-, and 9-month follow up appointments. Although days of substance use was assessed monthly during treatment, three months after treatment (months 4–6), and at month nine, only baseline and 3-, 6-, and 9-month data points were included in this secondary analysis

2.3. Measures

Participants completed a battery of self-report and interviewer-administered measures. Demographic information was self-reported used a standard questionnaire (Weiss, 1998). Clinical diagnoses were assessed using the Composite International Diagnostic Interview for DSM-IV diagnoses (World Health Organization, 1997).

The Beck Depressive Inventory (BDI-II) (Beck and Steer, 1987) is a 21-item self-report inventory that was used to assess depressive symptoms in the past two weeks. Each item is rated on a four-point scale (0–3), and ratings are summed into a single score, with a possible range of 0–63; higher scores indicate more severe symptoms. The internal consistency reliability (Cronbach's alpha) of the BDI-II in this sample was .93.

The Perceived Stress Scale (PSS-10) (Cohen, 1988) was used to measure perceived stress levels over the past month. The PSS comprises 10-items rated on a five-point scale (0–4). Ratings are summed across items (range = 0–40), with higher scores indicating higher levels of perceived stress. The internal consistency reliability of the PSS-10 in this sample was .86.

The Timeline Follow-Back (TLFB) (Sobell and Sobell, 1992) was used to assess substance use. Using a calendar method, the TLFB measures the number of days of any alcohol or drug use in the past 30 days. To confirm self-reported substance use, participants completed urine toxicology screens at each assessment point.

2.4. Data Analysis

We used linear mixed models to investigate the main study aims, which included random intercepts and slopes for time to account for the correlation among repeated measures within participants. First, to determine whether depressive symptoms changed over time, we examined the effect of time on depressive symptoms (BDI-II score), controlling for treatment condition, age, gender, and the presence of a major depressive disorder (MDD) diagnosis. We also examined whether MDD diagnosis and gender moderated these effects. Second, we used a lagged mixed model with depressive symptoms as the dependent variable and perceived stress (PSS score) and substance use from the prior assessment time-point as the focal independent variable to determine whether substance use and perceived stress predicted later depressive symptoms. This model also controlled for the effects of treatment condition, MDD diagnosis, gender, and depression at the previous time point. The categorical variables were dummy coded; these include: treatment condition (reference = Women's Recovery Group), MDD diagnosis (reference = no diagnosis), and gender (reference = male).

3. Results

Overall, 55.7% of the sample met diagnostic criteria for current MDD and 65.8% for lifetime MDD. The mean BDI score was 13.8 (SD = 10.0), reflecting a mild level of depressive symptoms, on average. The average BDI score was significantly higher ($t[156] = 5.01, p < .001$) among people with a current MDD diagnosis (mean = 17.13, SD = 10.59) compared to those without a current MDD diagnosis (mean = 9.61, SD = 7.51). Men and women did not significantly differ with respect to prevalence of current MDD diagnosis ($\chi^2 = 3.11, p = .08$); however, BDI symptoms were higher among women relative to men (mean difference = 3.77, $t = 2.30, p < .05$). Descriptive data on the sample are presented in Table 1.

Depressive symptoms significantly decreased over the course of treatment, reflected by a main effect of time (i.e., every 3 months starting at baseline) on BDI score (Est = -0.30 , $SE_{\text{est}} = 0.08, t = -4.02, p < .001$). This effect of time was not moderated by MDD diagnosis,

implying a similar rate of change in those with and without a depression diagnosis ($p = .94$). Likewise, gender did not moderate the effect of time on depressive symptoms ($p = .84$), although women had higher depression overall, as indicated by a main effect of gender on depression symptom severity (Est = -4.79 , SE = 1.73 , $t = -2.77$, $p < .01$). Finally, this effect was not moderated by treatment condition ($p = .46$).

The results of the lagged mixed model found that perceived stress was associated with subsequent depressive symptoms, even when controlling for depressive symptoms at the prior time point as well as days of substance use (Est. = 0.23 , SE_{est} = 0.07 , $t = 3.34$, $p < .01$). Days of substance use were also associated prospectively with depressive symptoms over time (Est. = 0.18 , SE_{est} = 0.05 , $t = 3.58$, $p < .001$). When controlling for these variables, the effect of time was no longer significant. These results were not moderated by depression diagnosis or gender. Table 2 presents the results of the lagged analysis.

In an exploratory analysis, we ran a second mixed model examining the association between grand mean-centered perceived stress scores at each time point and depression, controlling for the average perceived stress score and substance use. This model allows us to identify the degree to which the lagged effect of stress on change in depression was attributable to within-subjects effects (i.e., whether within-subject *change* in perceived stress was associated with within-subject change in depression). The results of this model indicated that within-subject change in perceived stress was not associated with the change in depression (Est. = -0.03 , SE_{est} = 0.07 , $t = -0.45$, $p = .65$).

4. Discussion

This study provided further support that depressive symptoms decrease during substance use disorder treatment. Our study adds to the extant literature by suggesting that both perceived stress and substance use are associated with reductions in depressive symptoms over time. Our study cannot provide confirmation of the mechanism by which substance use disorder treatment is associated with depressive symptom reduction; however, it does suggest that both perceived stress and substance use are prospectively, and independently, associated with decreases in depressive symptoms.

Notably, when disentangling the within-subjects (i.e., change over time) effect of perceived stress, this was not significantly associated with change in depression. This suggests that the effect was driven by between-subjects differences in perceived stress over time. In other words, those with a lower level of perceived stress had more of a reduction in depression over the next 3 months. This suggests that people with higher perceived stress may need additional intervention for the reduction in depressive symptoms. This is consistent with prior research demonstrated that stress-related vulnerabilities are a robust predictor of substance use disorder treatment outcome (Sinha et al., 2006; Sinha et al., 2011), and further suggests that specifically targeting stress-related vulnerability may be essential for people in substance use disorder treatment.

Co-occurring major depressive disorder was highly prevalent in this sample. The presence of a co-occurring depressive disorder is associated with greater symptom severity and worse

prognosis, including a heightened risk for suicide attempt (Conner et al., 2014). Accordingly, effective treatment for depression is critically important among people with substance use disorders. This may be particularly important for women. Depressive symptoms and disorders have a disproportionate effect on women with substance use disorders, who are more likely to be diagnosed with depression (Khan et al., 2013a; Khan et al., 2013b) and more likely to report use of substances to cope with negative affective states (McHugh and Greenfield, 2010; Thornton et al., 2012). Our findings provide further support for the disproportionate prevalence of depression in women with substance use disorders. Although the reduction in depressive symptoms over time did not vary between men and women, there was a main effect of gender, suggesting that women exhibited more severe depressive symptoms throughout the trial.

There are several limitations to this analysis. First, this was a secondary data analysis, and thus a post-hoc analysis. Second, we relied on self-report measures of stress and depression; replication with clinician-administered measures would strengthen confidence in these findings. Although statistically significant, the magnitude of these associations was somewhat modest. This may have been attributable to the temporal precision of our analysis, which relied on 3-month time periods. More proximal evaluation of the association between stress, substance use and depression will provide a more precise estimate of how these variables covary over time. Nonetheless, our findings suggest that levels of perceived stress are associated with depression over time, even controlling for previous depression and substance use. Finally, although our longitudinal design is a strength, causality cannot be assumed in this observational analysis.

There are several potential future research directions related to this work, including include replication of this finding, particularly in more racially diverse samples. One promising area for further research is studies of the addition of stress-targeted interventions to substance use disorder treatment. Early promise has been shown for the use of pharmacologic (e.g., adrenergic agents; Sinha et al., 2007) and behavioral (e.g., mindfulness; Brewer et al., 2009) treatments to reduce stress-related vulnerability in people with substance use disorders. These interventions may be particularly important for women.

5. Conclusions

This study provided further support that depression improves in standard substance use disorder treatment. Both levels of stress and substance use were associated with changes in depression and accounted for reduction in depression symptoms over time. Accordingly, among people with higher levels of stress, additional intervention for depression may be needed. Although causality cannot be assumed, this highlights the importance of both stress and substance use to the severity of mood symptoms in both men and women with substance use disorders.

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Highlights

- Women and men with DSM-IV substance dependence received group therapy.
- Depression symptoms significantly decreased during substance use disorder treatment.
- Women reported more severe depressive symptoms than men throughout the trial.
- Higher perceived stress was associated with less reduction in depressive symptoms.
- Stress was associated with change in depression controlling for days of substance use.

Table 1.

Sample Characteristics, N = 158

Variable	Mean (SD) or n (%)
Age (years), M (SD)	47.0(12.1)
Sex, n (%)	
Male	58 (36.7%)
Female	100 (63.3%)
Ethnicity	
Non-Hispanic	157(99.4%)
Race, n (%)	
White	149 (94.3%)
Marital Status, n (%)	
Married	60 (38.0%)
Educational status, n (%)	
Less than high school	11(7%)
High school graduate (or equivalent)	62 (39.2%)
College graduate	52 (32.9%)
Post-graduate education	33 (20.9%)
Current Major Depressive Disorder, n (%)	88 (55.7%)
Lifetime Major Depressive Disorder, n (%)	104 (65.8%)
Beck Depression Inventory Baseline, mean (SD)	13.8(10.0)
Current Substance Use Disorder Diagnoses, n (%)	
Alcohol Dependence	140 (88.6%)
Opioid Dependence	26 (16.5%)
Cannabis Dependence	19 (12.0%)
Sedative Dependence	16(10.1%)
Cocaine Dependence	28 (17.7%)
Amphetamine Dependence	6 (3.8%)
Hallucinogen Dependence	4 (2.5%)
Other Dependence	3 (1.9%)

Table 2.

Effects of Substance Use and Stress on Depression (BDI Score) Over Time

Variable	Estimate	SEestimate	t	p
Age	−0.04	0.03	−1.10	.27
Sex (reference = male)	−2.48	0.98	−2.51	.01
Treatment Condition (reference = Women's Recovery Group)	−2.53	0.97	−2.60	.01
Major Depressive Disorder (reference = presence of diagnosis)	−1.97	0.83	−2.38	.02
Time	0.60	0.47	1.30	.20
Previous Time Point Beck Depression Inventory	0.55	0.05	10.33	<.001
Perceived Stress Scale	0.23	0.07	3.34	<.01
Days of Substance Use	0.18	0.05	3.58	<.001