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Associations between Posttraumatic Stress Symptoms, Stimulant Use, and Treatment Outcomes: A Secondary Analysis of NIDA's Women and Trauma Study

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Abstract

Background and Objectives—To examine the associations between posttraumatic stress disorder (PTSD) symptoms, stimulant use, and treatment outcomes among dually-diagnosed women.

Methods—Participants were 141 women who participated in a multisite clinical trial of group treatments for PTSD and addictions.

Results—Generalized linear models indicated Seeking Safety (SS; a cognitive-behavioral intervention) was significantly more effective than Women's Health Education (WHE; a control group intervention) in reducing stimulant use at follow-up among women who were heavy stimulant users at pre-treatment and who showed improvements in PTSD symptoms. There were no significant differences between the interventions among women who were light stimulant users at treatment entry.

Conclusions and Scientific Significance—These findings suggest that integrated treatment of co-occurring PTSD and addictions may be more effective than general health education approaches for heavy stimulant users. Assessment of frequency of stimulant use among individuals with PTSD symptoms may inform treatment selection for this population.

Background and Objectives

The relationship between Posttraumatic Stress Disorder (PTSD) and Substance Use Disorders (SUDs) has been well-documented.^{1–6} The self-medication hypothesis^{7–8} posits that individuals use substances as a way to cope with distressing PTSD symptoms. Studies have shown that improvements in PTSD symptoms are often related to subsequent reductions in SUD symptoms whereas the reverse relationship has not been demonstrated.^{9–12} One limitation of these studies is the focus on PTSD and SUD as global diagnostic categories, which obscures the differential relationships between PTSD symptoms and different types of substances. The present analyses examined the relationships between PTSD symptoms, stimulant use, and treatment outcomes in a sample of dually-diagnosed women who received community based outpatient treatment. Stimulant

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use may be a risk factor for exacerbation of pre-existing psychiatric disorders; thus understanding more about the interplay between PTSD symptoms and stimulant use may have important implications for treatment interventions.^{13,14} We predicted that frequency of stimulant use at baseline would be a moderator of PTSD and stimulant use outcomes and that improvements in PTSD symptoms, after receiving treatment, would be associated with decreases in stimulant use at follow-up. We also examined the differential impact of improvements in the three separate PTSD symptom clusters on stimulant use outcomes.

Methods

Participants

Data for these analyses were derived from the “Women and Trauma” study conducted within the Clinical Trials Network (for complete details on procedures see Hien et al.).¹⁵ Of the 353 randomized participants, 141 reported stimulant use (cocaine/amphetamines) in the 30 days prior to baseline assessment and were included in these analyses.

Procedures

Eligible participants were randomized into one of two 12-session group interventions (Seeking Safety or Women’s Health Education). Participants completed weekly assessments during treatment and were reassessed at 1-week, 3-, 6-, and 12-months posttreatment. These analyses focused solely on the baseline and posttreatment assessments.

Interventions, training, and fidelity

Seeking Safety (SS)¹⁶ is a manualized integrated cognitive-behavioral treatment designed to reduce co-occurring PTSD and SUDs. *Women’s Health Education* (WHE)¹⁷ is a psychoeducational comparison intervention focused on general health topics pertinent to women (e.g., female anatomy and nutrition). *Training and Fidelity* have been extensively described elsewhere (see Hien et al.¹⁵ for a description of the adherence measures and procedures). Internal consistency and inter-rater reliability for both interventions were good to excellent.

All study participants were enrolled in a participating community-based substance abuse treatment program and received *treatment-as-usual* at the program during the 6-week treatment phase of the study. Participants who dropped from their community based treatment program prior to completing the research treatment but completed at least one follow-up assessment were included in these analyses.

Measures

Basic demographic data (age, race/ethnicity, education, and marital status) were collected at the screening and baseline visits.

The Life Events Checklist,¹⁸ a self-report measure, was utilized to assess exposure to a variety of *potentially traumatic events*.

The Clinician Administered PTSD Scale (CAPS)^{19,20} is a structured interview, which measures the frequency and intensity PTSD symptoms in the past 30 days and is used as a measure of DSM-IV PTSD diagnosis. The CAPS has three PTSD symptom cluster subscales: 1) re-experiencing, 2) avoidance/emotional numbing, and 3) hyperarousal. PTSD symptom cluster severity scores were calculated by summing the frequency and intensity scores obtained from each subscale items; a total PTSD severity score is obtained by summing the subscale scores. Clinical assessors received formal training in administering the CAPS. Diagnostic reliability checks were conducted on 18% of the audiotaped

assessments. Based on 62 baseline assessments, percent agreement between two raters for current PTSD diagnosis was 94%.

The Addiction Severity Index Lite (ASI-Lite)^{21,22} is a semi-structured clinical interview, which assesses current (past 30-days) alcohol and other substance use. At baseline, the maximum number of days of stimulant use (cocaine and amphetamines) in the 30 days prior to study entrance was calculated and categorized into two levels: light use (used 1–12 days), and heavy use (used 13 or more days). At posttreatment follow-up, stimulant use was categorized into three levels: abstinent (no use), light use (used 1–12 days), and heavy use (used 13 or more days). This is in line with ASI convention of coding more than three days of use per week as heavy use.²¹

Analyses

Demographic information and psychiatric symptoms by baseline frequency of stimulant use were compared using the *t* test for continuous variables and chi-square test for categorical variables.

Outcome variables were PTSD symptom severity (total PTSD severity scores and each of the three PTSD symptom cluster scores) as assessed by the CAPS and frequency of stimulant use as assessed by the ASI-Lite. The stimulant use model had two sub-sets; one included the change scores of the total PTSD symptom severity from baseline to each successive follow-up time-point, the possible interactions with treatment, and the baseline values of the outcome measure; and the other controlled for changes in the PTSD symptom clusters scores from baseline to each successive follow-up time-point. Generalized estimating equations (GEEs)²³ were used to examine the effect of treatment group (*Seeking Safety* vs. *Women's Health Education*) on the main outcome variables over each successive follow-up time-point for the intention-to-treat (ITT) sample of stimulant users. Pairwise comparisons were applied to detect average group differences during follow-up. Each outcome was modeled as a function of treatment, time of assessment, and baseline value of that outcome. Consistent with the primary outcomes analyses,¹⁵ all models included the following a priori baseline covariates: race/ethnicity, age, marital status, and education level. The possible interactions among treatment, the baseline level of the outcome measure, and time were tested and included in the final model only if statistically significant ($p < .05$).¹ Site was tested as an additional fixed effect in each model. Because two sites each had a case with only one follow-up, these two cases were excluded when the site covariate was controlled in the models on categorical outcomes for substance use.

Results

Participant Characteristics

Participants were women with a mean age of 41 years ($SD = 9.02$). The majority of participants had experienced physical assault (83.6%) and sexual assault (67.9%) during adulthood (See Table 1). There were no significant differences between the light and heavy stimulant users on any of the demographic variables or rates of exposure to traumatic events ($p > .05$).

Relationship between PTSD symptoms and Frequency of Stimulant Use at Baseline

At baseline, the average total PTSD severity score among all participants was 65.17 ($SD = 18.62$), consistent with severe levels of PTSD.¹⁹ Heavy stimulant users had significantly

¹Further analyses examined an additional effect of the frequency of other substance use on treatment outcomes, but it was not significant and thus was not included in the final models.

higher total PTSD severity scores than light users ($M = 69.31$; $SD = 18.47$ versus $M = 61.92$; $SD = 18.19$ respectively, $t = 2.38$, $p = .02$). Heavy stimulant users also had significantly higher avoidance/numbing scores compared with light stimulant users ($M = 29.15$; $SD = 8.71$ versus $M = 25.39$; $SD = 10.04$, respectively, $t = 2.33$, $p = .02$).

PTSD Symptoms and Symptom Clusters Outcomes at Follow-up

The final mixed effect analysis revealed no significant treatment effect on total PTSD severity scores during follow-up ($\chi^2(1) = 0.99$, $p = 0.32$; See Table 2) nor any significant effect of baseline levels of stimulant use (heavy versus light use) on total PTSD severity scores during follow-up ($\chi^2(1) = 0.07$, $p = 0.79$). Significant effects included time ($\chi^2(3) = 10.26$, $p = 0.017$), and baseline total PTSD severity scores ($\chi^2(1) = 14.82$, $p < 0.001$). For the total sample, the mean total PTSD severity score decreased about 49% from baseline to 1-week after treatment ($t = 9.94$, $p < 0.001$), and continuously dropped an additional 9% through 12-month follow-up. Total PTSD severity scores at 12-month follow-up were significantly lower than 1-week posttreatment. ($t = 2.98$, $p < .01$).

The final mixed effect analysis revealed no significant treatment effects on any of the PTSD symptom cluster scores during follow-up ($p > .05$), nor any significant effects of baseline levels of stimulant use on PTSD symptom cluster scores during follow-up ($p > .05$).

Stimulant Use Outcome at Follow-Up

The generalized multinomial logistic mixed effects model revealed there was no significant main effect of treatment condition on stimulant use frequency during follow-up ($\chi^2(1) = 1.13$, $p = 0.29$). Both treatment conditions demonstrated significant reductions in frequency of stimulant use at posttreatment follow-ups (see Table 2).

Changes in PTSD symptoms and its relationship to Stimulant Use at Follow-Up

There was a significant three-way interaction among baseline stimulant use, treatment group, and total PTSD symptoms improvement from baseline to each follow-up timepoint ($\chi^2(1) = 7.00$, $p < 0.01$). The effect of total PTSD symptoms improvement on stimulant use outcomes during follow-up differed significantly by treatment group but only among baseline heavy stimulant users. Among participants with heavy stimulant use at baseline who were randomized to *Seeking Safety*, one unit of improvement on their total PTSD severity scores *decreased* the odds of being a heavy stimulant user at follow-up by 6.8% ($t = 2.93$, $p < 0.01$). Among participants with heavy stimulant use at baseline who were randomized to *Women's Health Education*, one unit of improvement on their total PTSD severity scores *increased* the odds of being a heavy stimulant user at follow-up by 2.0% ($t = 2.02$, $p < .05$) (See Table 3). At baseline, 40.8% of the participants who received *Seeking Safety* and 47.7% of participants who received *Women's Health Education* were classified as heavy stimulant users. By the 12-month follow-up, there was a 66.7% decrease in the number of *Seeking Safety* participants classified as heavy stimulant users compared to only a 21.4% decrease in the number of *Women's Health Education* participants classified as heavy stimulant users.

In the model that included the three PTSD symptom clusters, there was a significant association between improvement on the avoidance/emotional numbing cluster scores and stimulant use. For the total sample, one unit of improvement on the avoidance/emotional numbing cluster scores decreased the odds of being a heavy stimulant user by 4.0% ($\chi^2(1) = 4.88$, $p = 0.03$) from baseline through follow-up. There was also a significant three-way interaction among baseline level of stimulant use, treatment group, and hyperarousal cluster scores ($\chi^2(1) = 10.8$, $p < 0.001$). Among participants with heavy stimulant use at baseline and who were randomized to *Seeking Safety*, one unit of improvement on their hyperarousal

cluster scores *decreased* the odds of being a heavy stimulant user at follow-up by 13.4 % ($t = 3.35, p < 0.001$). Among participants with heavy stimulant use at baseline and who were in the WHE group, one unit of improvement on their hyperarousal cluster scores *increased* the odds of being a heavy stimulant user at follow-up by 7.3 % ($t = 2.13, p < .05$).

Conclusions and Scientific Significance

Results indicated that heavy stimulant users had significantly greater PTSD symptoms at baseline compared to light stimulant users. All stimulant users, however, benefited from both interventions and showed significant reductions in their PTSD symptoms and stimulant use posttreatment. In support of our hypothesis, improvement in total PTSD severity, after receiving treatment, was related to a reduction in the odds of heavy stimulant use at follow-up but only among heavy baseline stimulant users who received the *Seeking Safety* treatment. These findings are consistent with the growing body of research indicating that when individuals achieve relief from PTSD symptoms, they then are able to reduce substance use.^{9–12} And, findings are in line with examinations of psychiatric severity and treatment outcomes showing that for those with more severe psychiatric conditions, specific and tailored integrated treatments are more effective than general approaches.²⁴ *Seeking Safety*, an integrated treatment, provides psychoeducation around the links between PTSD and substance abuse and teaches specific coping strategies to deal with difficulties related to both issues. Individuals who were heavy stimulant users at baseline received greater benefit from exploring the interrelationship between PTSD and substance use compared to those who were heavy baseline stimulant users and only received general health information.

There was a small but significant increase in the odds of heavy stimulant use at follow-up among heavy baseline stimulant users who received the *Women's Health Education* intervention and showed improvement in their total PTSD severity. The intervention's lack of focus on substance use coping strategies may have been a disadvantage for this subgroup. Among heavy substance users with co-occurring PTSD, interventions that do not incorporate skills training for substance use reduction may be contra-indicated. Nevertheless, the improvement in PTSD symptoms observed among individuals who received WHE should not be overlooked. The impact of trauma on the body is now well known.²⁵ The material presented in the health intervention was relevant to trauma-survivors' understanding of their body and how to think about proper self care, which may have contributed to improvements in their PTSD.

Regarding specific PTSD symptom clusters: in the total sample, improvement in the avoidance/numbing symptom cluster reduced the risk of heavy stimulant use at follow-up. This finding is consistent with research by Smith et al.¹⁴ who found a positive association between methamphetamine use and avoidance symptoms and with Najavits et al.²⁶ who found elevated avoidance/numbing symptoms among cocaine dependent individuals with PTSD. Individuals with PTSD, particularly those who feel emotionally numb and detached from people around them, may be particularly drawn to the use of stimulants. Thus, interventions that alleviate the avoidance and emotional numbing symptoms among traumatized individuals may obviate the need to use stimulants as a therapeutic agent. There was also a significant association between improvement in the hyperarousal symptom cluster and stimulant use outcomes, but only among heavy baseline stimulant users in the *Seeking Safety* group. Heavy stimulant use is often associated with a worsening of hyperarousal symptoms secondary to stimulant intoxication or withdrawal.^{2, 26} While stimulants may be initially used to reduce certain PTSD symptoms (e.g., avoidance/emotional numbing), excessive use over time may lead to an exacerbation of other symptoms such as sleep disturbance, hypervigilance, and autonomic arousal, which in turn may lead to a cycle whereby stimulant use and PTSD symptoms mutually maintain each

other.^{27–29} These findings suggest that for stimulant users in general, addressing the avoidance/numbing symptoms is beneficial; while among heavy stimulant users, incorporating treatment strategies that help the client cope with hyperarousal symptoms may be useful.

Several limitations should be noted. This study is primarily comprised of participants with poly-substance use and was not designed to examine women with stimulant use disorders specifically. The stimulant use variable is based on self-reported substance use and not abuse or dependence diagnosis or reported primary substance of abuse. Moreover, the stimulant use measures did not capture recent routes of use or quantity of use. Future research with women with co-occurring PTSD and stimulant use should replicate the above findings with more comprehensive measures of substance use, including time-line methodologies that can capture potential causal relationships between these two disorders.³⁰

Nonetheless, these findings add to the growing body of literature on the functional relationship between traumatic stress responses and substance use. Findings suggest that, among heavy stimulant users, integrated treatments that lead to PTSD symptom reductions can in turn improve stimulant use outcomes. This supports treatment models that address PTSD concurrently with substance use disorder treatment.

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Table 1

Baseline sociodemographics and clinical characteristics stratified by frequency of stimulant use.

	Total (N = 141)	Light Users (n = 79)	Heavy Users (n = 62)
Age	41.01 (9.02)	40.76 (9.58)	41.33 (8.32)
Race/Ethnicity			
African American	46.10	44.30	48.39
Caucasian	28.37	30.38	25.81
Latina	9.22	7.59	11.29
Multi-Racial or Other	16.31	17.72	14.52
Marital Status			
Married	17.02	16.46	17.74
Single	36.88	43.04	50.00
Divorced/Separated	46.10	40.51	32.26
Education (Years)	12.34 (2.12)	12.33 (2.18)	12.35 (2.06)
Treatment – Seeking Safety (vs. Women’s Health Education)	53.90	56.96	50.00
Lifetime Traumatic Events			
Adulthood Physical Assault	83.57	82.05	85.48
Adulthood Sexual Assault	67.86	66.67	69.35
Childhood Sexual Abuse	67.63	69.23	65.57
Childhood Physical Abuse	53.57	50.00	58.06
Transportation Accidents	71.43	72.15	70.49
Life threatening Illness	43.57	46.84	39.34
Stimulant Use (Days in past 30)	11.68 (10.01)	3.85 (2.98)*	21.66 (6.15)*
CAPS Severity (Total)	65.17 (18.62)	61.92 (18.19)*	69.31 (18.47)*
Re-experiencing Symptoms	16.82 (6.58)	16.23 (5.97)	17.58 (7.26)
Avoidance/Numbing Symptoms	27.04 (9.63)	25.39 (10.04)*	29.15 (8.71)*
Hyperarousal Symptoms	21.30 (7.35)	20.30 (7.06)	22.58 (7.58)

Notes. CAPS = Clinician-Administered PTSD Scale, range = 0–136. Items that are marked with an asterisk (*) are significantly different from each other at the $p < .05$ level.

Unadjusted Comparisons Between the Seeking Safety and Women's Health Education Groups on Continuous and Categorical Measures of Outcome

Table 2

Outcomes	Baseline	Posttreatment	3-month	6-month	12-month
Means (SD)					
CAPS Severity Score					
SS	62.75 (18.46)	34.88 (26.80)	32.40 (23.54)	29.02 (23.21)*	25.82 (25.42)
WHE	68.00 (18.54)	35.16 (24.68)	37.53 (24.89)	41.07 (32.43)*	33.27 (29.25)
t-test	1.68	0.05	0.95	1.99	1.27
p-value	0.10	0.96	0.35	0.05	0.21
Stimulant Use (Days in Prior 30 Days)					
SS	11.45 (9.92)	2.41 (4.88) *	3.00 (5.16)	4.00 (7.69)	3.88 (7.49)
WHE	11.95 (10.18)	5.46 (8.72) *	6.19 (8.91)	6.47 (9.97)	6.03 (9.72)
Z-test ^a	0.12	2.00	1.18	1.06	0.98
p-value	0.90	0.05	0.24	0.29	0.33
Stimulant Use Categories (% and No.)					
SS					
Abstinence		60.98% (N=25)	51.06% (N=24)	58.33% (N=28)	58.00% (N=29)
1-12 days	59.21% (N=45)	31.71% (N=13)	42.55% (N=20)	33.33% (N=16)	30.00% (N=15)
13-30 days	40.79% (N=31)	7.32% (N=3)	6.38% (N=3)	8.33% (N=4)	12.00% (N=6)
WHE					
Abstinence		41.46% (N=17)	44.44% (N=16)	48.84% (N=21)	48.65% (N=18)
1-12 days	52.31% (N=34)	43.90% (N=18)	33.33% (N=12)	30.23% (N=13)	29.73% (N=11)
13-30 days	47.69% (N=31)	14.63% (N=6)	22.22% (N=8)	20.93% (N=9)	21.62% (N=8)
χ ²	0.68	3.33	4.49	2.97	1.57
p-value	0.41	0.19	0.11	0.23	0.46

Notes. Abbreviations: SS, Seeking Safety; WHE, Women's Health Education; CAPS, Clinician-Administered PTSD Scale. N=141 for total sample; At baseline, n = 76 for SS and N = 65 for WHE; at posttreatment n = 41 for SS and n = 41 for WHE; at 3-month follow-up, n = 47 for SS and n = 36 for WHE; at 6-month follow-up, n = 48 for SS and 43 for WHE; At 12 month follow-up, n = 50 for SS and n = 37 for WHE. Items with an asterisk (*) indicate a significant difference between SS and WHE at the p = 0.05 level.

^aZ-score from Mann-Whitney U nonparametric test.

Table 3

Generalized multinomial logistic analysis examining the effect of Clinician Administered PTSD Scale (CAPS) severity score change from baseline to each follow-up timepoint on the number of days of stimulant use during follow-up by treatment group (N=141).

	(A) included Total CAPS scores		(B) included CAPS cluster scores	
	AOR	95% CI	AOR	95% CI
Seeking Safety				
Total PTSD Severity Change x Light Users	0.98	0.94–1.01		
Total PTSD Severity Change x Heavy Users	0.93**	0.89–0.98		
Hyperarousal Cluster Change x Light Users			1.01	0.94–1.09
Hyperarousal Cluster Change x Heavy Users			0.87***	0.80–0.94
Women's Health Education				
Total PTSD Severity Change x Light Users	0.95**	0.92–0.99		
Total PTSD Severity Change x Heavy Users	1.02*	1.00–1.04		
Hyperarousal Cluster Change x Light Users			0.93	0.84–1.02
Hyperarousal Cluster Change x Heavy Users			1.07*	1.01–1.14
Total Sample				
Re-experiencing Cluster Change			1.00	0.96–1.05
Avoidance/Numbing Cluster Change			0.96*	0.92–1.00

Note. AOR = Adjusted Odds Ratio. CI = Confidence Interval. Both models adjusted by site, age, race/ethnicity, education, marital status, and all four follow-up timepoints.

*
p < 0.05,

**
p < 0.01,

p < 0.001