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Modeling Associations between Posttraumatic Stress Symptoms and Substance Use

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Abstract

Comorbid substance use and posttraumatic stress disorders (SUD-PTSD) predict poorer treatment outcomes. Self-medication has been forwarded as a symptom-level explanatory model. However, research has yet to be conducted that can provide detailed examination of SUD and PTSD symptom fluctuations over time as posited by such a process. This pilot study examined associations between PTSD and substance dependence (SD) symptoms/substance use using two established methodologies that assess week-by-week symptom and substance use/dependence status. Outpatients ($N = 35$) in SUD treatment completed the Longitudinal Follow-Up Evaluation and the Time Line Follow Back Interview, retrospectively reporting weekly PTSD and SD symptoms, and substance use over the previous 6-months. Results indicated that weekly PTSD symptom fluctuations were concurrently associated with the presence of alcohol and cocaine dependence symptoms and were associated with presence of opiate dependence symptoms in the following week. These findings support a self-medication conceptualization, underscore the utility of using a more detailed process analysis of PTSD and SD symptoms, and suggest that PTSD fluctuations are associated with substance problems, rather than with substance use *per se*.

Keywords

PTSD; substance use disorders; trauma; etiology

1. Introduction

Individuals with substance use disorders (SUD) often have comorbid PTSD. Studies suggest that SUD-PTSD patients have poorer addiction and functional outcomes and cost more to treat than patients without PTSD (e.g., Jacobsen, Southwick, & Kosten, 2001). Knowledge of how SUD and PTSD symptoms are inter-related will aid in developing effective treatments and may help prevent associated costly and harmful outcomes.

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Self-medication (i.e., using substances to alleviate PTSD symptoms) often is cited to explain the process of PTSD and SUD comorbidity (Khantzian, 1999). Community research finds that current PTSD often precedes SUDs (Kessler, 2000). In a study of SUD patients, chronic PTSD (but not baseline PTSD status) predicted fewer percent days abstinent during 6-month follow-up (Read, Brown, & Kahler, 2004). In a study of PTSD patients (Vietnam veterans), the course of PTSD symptoms and SUD was assessed retrospectively before, during, and after the war, in two-year increments, over the prior 24 years. Results indicated that increases in SUD mirrored increases in PTSD both during and immediately after the war (Bremner, Southwick, Darnell, & Charney, 1996). Collectively, these studies not only offer support for self-medication conceptualizations, but also highlight the dynamic nature of the relationship between PTSD and substance use. As such, closer examination of symptom patterns over time will shed important clinical insights into PTSD and the risk for problem substance use behaviors. It is especially important to examine PTSD at the symptom level given that self-medication is a process model (i.e., symptom flare-ups may lead to substance use, independent of PTSD diagnostic status).

To date, the majority of research on PTSD and SUDs has been limited by assessments that do not allow a detailed analysis of dynamic changes in symptoms. This paper addresses this gap in the literature by providing an initial test of PTSD-SD symptom inter-relations using two established methodologies that allow for a more fine-grained analysis of the course of psychiatric disorders. The Longitudinal Interval Follow-up Evaluation (LIFE; Keller et al., 1987) was used to document *weekly* PTSD and SUD symptom fluctuations, and the Time Line Follow Back Interview (TLFB; Sobell et al., 1980) was used to gather information on *daily* substance use among SUD patients with PTSD symptoms. We expected: (1) week-by-week PTSD and substance dependence (SD) symptoms to co-vary concurrently and (2) PTSD symptom changes to be associated with later changes in SD.

2. Method

2.1. Participants and procedures

A total of 35 outpatients in SUD treatment were referred by clinicians and completed the protocol. Average age of participants was 35 ($M = 34.74$, $SD = 10.05$), half were female ($n = 18$), half were white ($n = 18$; 31% ($n = 11$) were black), 68% were single ($n = 24$), 71% had a high school education or less, 74% reported yearly income below \$10,000 ($n = 26$), and 77% were unemployed ($n = 27$). Inclusion criteria included the absence of cognitive impairment.

Based on interviews, 75 % ($n = 26$) of participants had alcohol dependence, 57% ($N=20$) each had cannabis and cocaine dependence 57%, 43% ($n = 15$) had opioid dependence, 43% ($n = 15$), 26% ($n = 9$) each had sedative-hypnotic-anxiolytic and stimulant dependence, 17% ($n = 6$) had hallucinogen dependence, and 11% ($n = 4$) had “other” substance dependence.

All participants reported at least one DSM-IV criterion A traumatic life event, the majority reporting interpersonal violence (83%; $n = 29$). Based on interviews, 37% ($n = 13$) had PTSD, 11% ($n = 4$) met criterion B only, 9% ($n = 3$) met criterion B and C; and 3% ($n = 1$) met criterion D only. Participants’ average score on the PTSD checklist suggested clinically significant PTSD symptoms ($M = 44.90$; $SD = 16.38$; Blanchard, Jones-Alexander, Buckley, Forneris, 1996; Harrington & Newman, 2007). One-quarter ($n = 9$) reported past treatment for trauma symptoms.

MA and Ph.D. level raters conducted interviews at the clinic. The LIFE - PTSD and SD assessments were counter-balanced. Participants received a \$50 honorarium. The Institutional Review Boards of the Crouse Hospital, SUNY Upstate Medical University, and the Syracuse VA Medical Center approved this research project.

Training of raters included background reading about PTSD-SUD, and the interviews, rating videotapes, practicing mock interviews, and observing and rating in-person interviews until 100% inter-rater agreement was established. Dr. Ouimette who has expertise in these interviews provided training and supervision. All interviews were videotaped. Inter-rater reliability for diagnostic status was high for PTSD ($\kappa=.92$) and MDD ($\kappa=.92$), and for SD, kappas ranged from .82 for cocaine to 1.0 for hallucinogen dependence.

Measures—Structured Clinical Interview for DSM-IV (SCID; Spitzer, Williams, Gibbon, & First, 1992), considered to be the gold standard for diagnosing mental disorders, was used to diagnose SUDs (APA, 1994).

Clinician Administered PTSD Scale (CAPS; Blake et al., 1995) assessed DSM-IV PTSD. The CAPS has excellent psychometric properties (Blake et al., 1995).

PTSD Checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) is a 17-item self-report measure of the 17 DSM-IV symptoms of PTSD.

Longitudinal Interval Follow-Up Evaluation (LIFE; Keller et al., 1987), a semi-structured interview and rating system for assessing the course of DSM mental disorders, was used to assess symptom course over the 26-week period. The LIFE has established psychometric properties (Warshaw, Dyck, Allsworth, Stout, & Keller, 2001). As is typical in the LIFE, participants were asked to retrospectively describe their PTSD and substance dependence (SD) symptoms at beginning of the time period and then changes were probed for (i.e., “I had nightmares for two months until I got a job. When I got laid off last month the dreams started again”). A calendar was used to provide temporal cues (e.g., holidays) to assist in recall. Each week of the 26 was assigned a LIFE “Psychiatric Status Rating” (PSRs) indicating level of symptom expression. Each disorder is rated individually, hence simultaneously charting PTSD and SD PSRs.

PTSD was rated on a 6-point LIFE PSR scale, which ranged from 1 - no symptoms, 2 - residual (symptoms present but does not meet PTSD B, C, or D criteria), 3 - partial remission (meets 1 of 3 PTSD criteria), 4 - marked (meets 2 of 3 PTSD criteria), 5 - full PTSD criteria, and 6 - PTSD plus extreme impairment. SDs were rated on a 4-point PSR scale, which ranged from 1 - no symptoms, 2 - partial remission (meets 1 or 2 symptoms but not full criteria), 3 - full SD criteria (3 or more symptoms) and 4 - SD with physiological dependence (3 or more symptoms, including withdrawal and/or tolerance). In the current sample, reliability of weekly PSR ratings was good. Intra-class correlations across the 26 weeks for PTSD averaged .91 and ranged from a high of .95 for cocaine dependence to low of .71 for alcohol dependence. PTSD PSR ratings were associated with alternative measures of PTSD, such as the PCL, $r(33) = .70$ and the SD PSR ratings were associated with TLFB-assessed substance use, r 's (33) ranging from .86 for opioid to .62 for cocaine (Ouimette et al., 2009).

As the LIFE PSR SD ratings greater than one were sparsely populated, they were dichotomized as indicators of symptom presence (2, 3 or 4) or absence (1). All SD diagnoses were followed on the LIFE and accounted for in a combined “any SD” PSR rating. Only alcohol, cocaine and opioid dependence PSR ratings had sufficient variability over the 26-weeks to be individually examined.

Time-Line Follow-Back (TLFB; Sobell et al., 1980) was used to assess alcohol and other drug use over the 26-week period prior to the interview. A calendar format was used to provide temporal cues to assist in recall. The TLFB has demonstrated psychometric properties. We assessed all drugs of abuse. Dichotomous summary scores were created indicating any substance use, any alcohol, cocaine, or opioid use (yes/no) for each week of the 26-weeks.

Only alcohol, cocaine, and opioids were individually analyzed as other substance use (e.g., marijuana, hallucinogens) ratings had: (1) low prevalence of use and/or (2) sporadic outcome distributions, both of which prevented data analytic model convergence.

1.2. Data Analytic Plan

To assess the relationship between PTSD and SD using LIFE PSR scores and TLFB weekly summaries, generalized estimating equations (GEE) was used with an auto-regressive (AR) correlational structure. This accommodates the within subject correlation among the successive 26-weeks of data. A binomial distribution was used to model the log-odds of substance dependence based on concurrent and lagged within subject PTSD effects. This allowed us to test whether PTSD symptoms and substance use co-occur during the same weeks, and if PTSD symptom fluctuations in one week were associated with changes in substance use the following week.

All analyses were run with and without adjusting for sex, age, ethnicity (white versus nonwhite), and history of trauma treatment (yes/no). Given that the pattern of results were the same, we present only the unadjusted findings here.

3. Results

We examined PTSD in relation to alcohol, opioid, and cocaine dependence and use (Table 1). The association between PTSD symptoms and alcohol dependence was almost significant ($p = .056$); a 1-unit increase in PTSD was associated with a 2.9% increase in the odds of concurrent alcohol dependence symptoms. The association between PTSD symptoms and cocaine dependence was positive; a 1-unit increase in PTSD was associated with a 7.2% increase in the odds of concurrent cocaine dependence symptoms. The lagged opioid dependence-PTSD association was significant; a 1-unit increase in PTSD was associated with a 19% increase in the odds of having opioid dependence symptoms present the following week (see Figure 1).

To illustrate clinical significance, we calculated the effect of a change in PTSD status from remission to meeting full criteria (PSR of 1 to a PSR of 5) on the likelihood of SD symptoms. Change to full PTSD was associated with an 11% and 29% relative increase in the probability of alcohol and cocaine dependence symptoms, respectively. Change to full PTSD was associated with a 94% relative increase in the probability of having opioid dependence symptoms in the following week.

We examined PTSD PSR scores in relation to TLFB weekly summaries. None of the analyses were significant.

4. Discussion

Despite models that suggest dynamic associations between PTSD, substance use, and substance abuse, there has been little detailed analysis of such inter-relations. This pilot study is the first to our knowledge to provide a closer examination of these relations, by mapping weekly symptom fluctuations and substance use over a 26-week period. Our data suggest that PTSD and substance dependence symptoms co-vary concurrently, and over time. Important to note is that we did not find associations between PTSD symptoms and substance use alone, suggesting that at least for this sample of SUD outpatients with PTSD symptoms, PTSD symptoms more closely co-occur with the problematic substance behaviors and symptoms associated with DSM-defined SUD. The latter is consistent Khantzian's self-medication model (1999), which asserted that PTSD-induced emotional dysregulation would be closely associated with heavy or problematic substance use due to the powerful pain-relieving effects of the drugs.

Limitations to the study include that we employed a smaller volunteer sample, self-reports of substance use, and limited assessment of trauma-related treatments received. To maximize the likelihood of accurate symptom reporting, we employed established methodologies (i.e., the LIFE and TLFB) with strong evidence of reliability and validity. Still, reports were retrospective. Further, though different drug types were examined here, we did not have the information to examine the effects of individual PTSD symptoms or clusters on specific drugs of abuse as specified by self-medication processes (Khantzian, 1999). Future work with larger diverse samples with clinically significant PTSD, objective measures of substance use to confirm self-reports, detailed measurement of trauma-related treatment and PTSD symptom clusters, and prospective assessments will build on the initial findings reported here.

In summary, this pilot study suggests that increases in PTSD symptoms are associated with increases in concurrent alcohol and cocaine dependence symptoms, and with increases in later opiate dependence symptoms, consistent with the self-medication model. Future studies using course methodologies could incorporate questions on moderators (e.g., trauma treatment) mediators (e.g., coping) of the PTSD-SUD association, which could further inform treatment development.

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Figure 1. Covariation between weekly PTSD and SUD Psychiatric Status Rating Scores.
 Note: Higher PTSD symptoms were associated with increased concurrent alcohol and cocaine dependence symptoms and with increased opioid dependence symptoms during the following week.

Table 1
The Association between Posttraumatic Stress Disorder (PTSD) Symptoms and Substance Dependence (SD) and Use over 26-Weeks

	Odds Ratio (95% Confidence Interval)	
	Concurrent PTSD	Lagged PTSD
LIFE Substance Dependence PSRs		
Any SD	1.15 (.72 - 1.83)	.87 (.70 - 1.08)
Alcohol	1.03 (1.01 - 1.05)**	1.02 (.98 - 1.05)
Opioid	2.57 (.69 - 9.46)	1.19 (1.01 - 1.41)*
Cocaine	1.07 (1.02 - 1.13)**	.819 (.62 - 1.08)
TLFB Substance Use Weekly Summaries		
Any substance use	1.17 (.67 - 2.05)	.88 (.64 - 1.20)
Alcohol	1.68 (.94 - 3.01)	.84 (.59 - 1.19)
Opioid	1.16 (.97 - 1.38) ^t	1.16 (.97 - 1.39) ^t
Cocaine	1.72 (.92 - 3.24) ^t	.70 (.45 - 1.10)

Note. PSR = Psychiatric Status Rating; LIFE = Longitudinal Interval Follow-Up Evaluation; TLFB = Time Line Follow-Back Interview. PSR substance dependence variables are coded as dichotomous indicators of symptom presence. TLFB substance use weekly summaries are coded as dichotomous indicators of any substance use. Odds ratios indicate whether the odds of substance dependence decrease or increase for a 1-unit increase in the PTSD score. The pattern of results remained the same controlling for age, sex, ethnicity, and PTSD treatment, thus unadjusted results are presented in the table.

^t
 $p < .10$

*
 $p < .05$

**
 $p < .01$