Published in final edited form as:
Depress Anxiety. 2009 ; 26(12): 1158–1164. doi:10.1002/da.20637.

The Effect of Posttraumatic Stress Disorder on Risk-Taking Propensity among Crack/Cocaine Users in Residential Substance Abuse Treatment

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Abstract

Background—The co-occurrence of posttraumatic stress disorder (PTSD) and substance use disorders (SUDs) has been found to be associated with a range of negative clinical outcomes (e.g., relapse, suicide, legal problems, HIV infection). However, less is known about the particular factors that may be placing individuals with a co-occurring PTSD and SUD diagnosis at risk for these outcomes. The construct of risk-taking propensity may hold particular promise.

Methods—To investigate the relevance of risk-taking propensity to PTSD-SUD patients, differences in risk-taking propensity were examined among 90 crack/cocaine dependent patients in residential substance abuse treatment with (n = 20) or without (n = 70) a current PTSD diagnosis. Risk-taking propensity was assessed using an established behaviorally-based measure, the Balloon Analogue Risk Task (BART).

Results—Crack/cocaine dependent patients with PTSD exhibited significantly greater levels of risk-taking propensity than patients without PTSD, and this difference remained significant even when controlling for the presence of comorbid psychiatric disorders and current psychotropic medication use. No evidence was found for a different pattern of change in risk-taking propensity from the beginning to the end of the task as a function of PTSD status.

Conclusions—Although preliminary, results suggest the need to further investigate risk-taking propensity as a factor that may be associated with the negative clinical outcomes observed among crack/cocaine users with PTSD.

1. Introduction

Posttraumatic stress disorder (PTSD) is characterized by the development and persistence of re-experiencing, avoidance, and hyperarousal symptoms following exposure to a traumatic event [1]. The lifetime prevalence of PTSD in the general population is 6.8% [2]; however, higher rates have been found among individuals with other psychiatric disorders, especially

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substance use disorders (SUDs) [2–6]. Compared to non-substance users, substance users are approximately three times as likely to have PTSD [4], and studies of treatment-seeking substance users have found lifetime prevalence rates of PTSD ranging from 36% to 50%, with the prevalence of current PTSD ranging from 25% to 42% [3–5]. These data indicate that individuals with a SUD are at significantly greater risk for PTSD than those without a SUD.

The co-occurrence of PTSD and SUDs is clinically relevant, as a PTSD-SUD diagnosis is associated with numerous maladaptive behaviors and negative clinical outcomes. Individuals with a PTSD-SUD diagnosis are more likely to use "harder substances" (e.g., cocaine, heroin) and have more severe substance use patterns than substance users without PTSD [4,7–9]. Patients with a PTSD-SUD diagnosis have also been found to exhibit greater legal problems [8,10,11] and quicker relapse to substance use following discharge from substance abuse treatment than patients without PTSD [12,13]. High rates of suicide attempts and/or deliberate self-harm have also been found among individuals with a PTSD-SUD diagnosis [10,14–16]. Finally, Hoff et al. [17] found that veterans with (versus without) a PTSD-SUD diagnosis were at significantly greater risk for HIV infection.

Despite these findings, there is limited research on factors that may be associated with these negative clinical outcomes among individuals with a PTSD-SUD diagnosis. Given the nature of these outcomes, risk-taking propensity, defined as the tendency to engage in behaviors that involve some potential for danger or harm while also providing an opportunity to obtain some form of reward [18,19], may be a relevant factor to examine. Risk-taking propensity has been associated with substance use across a variety of substances [20,21] and especially crack/cocaine use [22]. While no studies have examined risk-taking propensity among individuals with PTSD, there is evidence of higher levels of risky sexual behavior among individuals with PTSD compared to those without PTSD [23,24].

Although there is evidence that SUDs and PTSD are separately associated with heightened levels of risk-taking propensity or risky behaviors, no studies to date have examined risk-taking propensity among individuals with a co-occurring PTSD-SUD diagnosis. Therefore, this study compared levels of risk-taking propensity (assessed with a behaviorally-based measure, the Balloon Analogue Risk Task [BART] [19]) among a sample of crack/cocaine dependent patients in residential substance abuse treatment with and without a current diagnosis of PTSD. The BART has been used to assess risk-taking propensity in adult substance users [21,22,25] and has been found to be associated with real-world risky behaviors [19,25–29]. It was expected that crack/cocaine dependent patients with a current PTSD diagnosis would exhibit significantly greater levels of risk-taking propensity than those without current PTSD. It was also predicted that this relationship would remain when controlling for other relevant variables (e.g., psychiatric comorbidity, psychotropic medication use).

2. Method

2.1. Participants

Data were collected at two different time points approximately 6 months apart at a residential substance abuse treatment facility in northeast Washington, D.C. These data were collected as part of two larger studies examining the relationship between psychopathy and risk-taking (Sample 1) and associations between crack/cocaine and/or heroin use and risky sexual behavior (Sample 2). The hypotheses examined in the present study were separate from those investigated in the studies from which these data were drawn. There was no overlap of participants between the two samples. Inclusion criteria for this study were current crack/cocaine dependence, crack/cocaine as the drug of choice, and the ability to provide written informed consent. Exclusion criteria were current mania/hypomania or a psychotic disorder. Ninety participants (48 from the first recruitment period [Sample 1] and 42 from the second

recruitment period [Sample 2]) met these criteria and were examined in this study (see Table 1).

2.2. Measures

Participants initially completed a questionnaire assessing basic demographic information, as well as current psychotropic medication usage.

All participants were interviewed using the current mood, anxiety, psychotic, and SUD modules of the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, 4th edition [30]. Interviews were conducted by senior graduate students and Ph.D.-level clinicians trained in the administration of the interview. A Ph.D.-level clinician (CWL) reviewed 25% of the interviews. In the three cases where a discrepancy was evident, areas of disagreement were discussed as a group to reach a consensus. Data pertaining to the specific types of traumatic events experienced were not recorded, and thus, not available for analysis. Instead, interviewers only collected enough information to determine whether or not participants had experienced a Criterion A traumatic event for a possible PTSD diagnosis.

The BART [19] was administered to assess risk-taking propensity. This measure has been used to investigate risk-taking propensity in both non-clinical samples [19,31] and substance users [21,22,25,32], and it has been found to be associated with real-world risky behaviors. For example, Lejuez et al. [19] found that the BART was significantly associated with problem drinking (r = .28), drug use frequency (r = .28), gambling consequences (r = .44), and stealing (r = .25). Lejuez et al. [19] also found that BART performance was significantly related to HIV-risk behavior (e.g., risky sexual behavior) (r = .25), consistent with Lejuez et al. (r = .26) [25] and Bornovalova et al. (r = .30) [26]. Studies [27–29] have also found that the BART is significantly correlated with composites of risk behaviors (rs = .25–.48). In addition, the BART has demonstrated strong test-retest reliability (r = .77) across a period of approximately two weeks [33].

Participants were seated in front of a computer screen that displayed a small simulated balloon accompanied by a balloon pump, a reset button, a permanent money earned display, a display indicating the amount of money earned on the current balloon, and a final display indicating the number of pumps made on the current balloon. Participants were to pump the balloon to earn as much money as possible, taking into consideration that the balloon could pop at any time. All balloons had the same probability of exploding. For each pump that did not explode the balloon, 2 cents were accumulated in a temporary bank. If a balloon was pumped past its explosion point, the balloon would explode and all money in the temporary bank was lost. Then, the next uninflated balloon would appear on the screen. At any point during each trial, the participant could stop pumping the balloon and click the reset button which transferred all money from the temporary bank to the permanent bank. Similar to real-world situations that a person might encounter, risky behavior on the BART is rewarded up to a certain point, following which further risky behavior leads to poorer outcomes [19]. Thus, the BART involves some potential for punishment (i.e., loss of money accrued by pumping a balloon past its explosion point) while at the same time providing an opportunity to obtain reinforcement (i.e., the collection of money with each pump where the balloon does not explode). After each balloon explosion or money collection, exposure to that balloon would end, and a new balloon appeared. There were 20 balloon trials. For a complete description of the development of and procedures for the BART, see Lejuez et al. [19].

Sample 1 and 2 participants were provided with the same version of the BART with one minor modification. Instead of manually pumping the BART (as was done for Sample 1), Sample 2 participants typed into the computer how many times they wanted to pump the balloon, and the balloon inflated to the desired level on its own. The provision of two slightly different

versions of the BART was necessitated by the goals of each larger study. However, the outcome variables obtained from each BART were the same. The average number of pumps (converted to a z-score) on balloons that did not explode was used as an index of risk-taking propensity, with higher scores indicating greater risk-taking propensity. This adjusted value is recommended as it is not constrained by the explosion points across balloons [19]. Given that risk-taking propensity might change over the course of the task depending upon success or failure in previous trials, we also examined whether there was a different pattern of change in risk-taking propensity from the first to the last 10 trials (also converted to z-scores) as a function of PTSD status.

2.3. Procedure

Procedures for this study were reviewed and approved by the University of Maryland's Institutional Review Board and were the same for both recruitment periods. All participants were recruited no sooner than 72 hours after entering treatment to limit the possible interference of withdrawal symptoms on task performance. Participants were told that their participation was voluntary, and refusal to participate would not affect status in treatment. Participants who gave informed written consent were interviewed using the SCID-IV. Participants were then administered the BART. Upon completing the study, participants were debriefed and reimbursed with a $25 gift card to a local grocery store (provided upon treatment discharge).

3. Results

3.1. Sample Consistency

Prior to combining samples, analyses were conducted to determine whether or not participants were comparable across recruitment time periods. Participants in Sample 1 exhibited a significantly lower rate of major depression than Sample 2. Therefore, this variable was entered as a covariate in subsequent analyses. Samples did not significantly differ on any other measured variable (see Table 1). These findings supported combining the samples. Across both samples, 29% (N = 20) of participants met criteria for current PTSD (see Table 2).

3.2. Identification of covariates

A series of analyses were then conducted to identify other potential covariates. No variables were associated with risk-taking propensity. However, compared to those without current PTSD, participants with a current diagnosis of PTSD were more likely to be prescribed psychotropic medications, have a current diagnosis of major depression, alcohol dependence, social anxiety disorder, and generalized anxiety disorder (see Table 2). Consequently, these variables were included as covariates in primary analyses.

3.3. Primary Analyses

An independent sample t-test was first conducted to examine whether crack/cocaine dependent patients with PTSD demonstrated higher levels of risk-taking propensity than those without PTSD. PTSD status served as the independent variable and a z-score representing the average number of pumps on non-exploded balloons served as the dependent variable. Patients with PTSD exhibited significantly higher levels of risk-taking propensity than those without PTSD (see Table 2).

A univariate analysis of covariance (ANCOVA) was then conducted to examine the difference between PTSD and non-PTSD patients on risk-taking propensity while controlling for the identified covariates. PTSD status was again entered as the independent variable in the analysis. Psychotropic medication use, alcohol dependence, major depression, generalized anxiety disorder, and social anxiety disorder status served as covariates. A z-score representing the

average number of pumps on non-exploded balloons served as the dependent variable. Consistent with our hypothesis, patients with PTSD exhibited significantly higher risk-taking propensity than those without PTSD, F (1, 83) = 4.40, $p < .05$. A repeated measures ANCOVA was then conducted to determine whether there was a significantly different pattern of change in risk-taking propensity from the first to the last 10 trials as a function of PTSD status. No evidence was found for a different pattern of change across trials as a function of PTSD status, F (1, 83) = 0.08, $p > .10$.

To ensure that our significant between-group difference in risk-taking propensity was not due to greater levels of comorbidity overall, we reran our ANCOVA controlling for the number of comorbid psychiatric disorders and psychotropic medication use. Results did not change, F (1, 86) = 4.91, $p < .05$. Finally, to determine the effect of recruitment period on findings, a dichotomous variable representing when participants were recruited was created and included as an additional covariate in the ANCOVA. Results did not change, F (1, 82) = 4.51, $p < .05$.

4. Discussion

This study examined whether or not crack/cocaine dependent patients with current PTSD evidence greater risk-taking propensity than those without current PTSD. In support of our hypothesis, crack/cocaine dependent patients with PTSD exhibited significantly greater overall levels of risk-taking propensity than their non-PTSD counterparts, and this difference remained significant even when controlling for the presence of other psychiatric disorders and psychotropic medication use.

Although promising, findings are preliminary and must be considered in light of limitations present. First, this study only examined risk-taking propensity. There is evidence that other factors related to risk-taking propensity (e.g., impulsivity) [19] are also heightened among crack/cocaine users [22,34–36] and individuals with PTSD [37,38]. Likewise, separate lines of research have demonstrated that emotion dysregulation is heightened among crack/cocaine users [39], individuals with PTSD [40,41], and crack/cocaine users with PTSD [42]. In addition, risky behavior may serve an emotion regulating function [43]. Consequently, future studies would benefit from the concurrent examination of risk-taking propensity and other constructs that may contribute to the negative clinical outcomes observed among PTSD-SUD patients. Doing so would better determine whether there is a unique association between a PTSD-SUD diagnosis and risk-taking propensity.

Although evidence was provided that crack/cocaine dependent patients with PTSD demonstrate significantly higher levels of risk-taking propensity than those without PTSD, the lack of a comparison group of participants with PTSD and no SUDs (and neither diagnosis) limits the extent with which we can establish that this relationship is unique to a PTSD-SUD diagnosis. Studies are needed that utilize more extensive comparison groups.

The absence of analyses focused on examining differences between crack/cocaine dependent patients with just PTSD and those with anxiety disorder diagnoses besides PTSD may also be considered a limitation. However, only 11 participants had a PTSD diagnosis and no other anxiety disorder. In addition, of participants with anxiety disorder diagnoses besides PTSD (N = 29), only 9 did not have PTSD. This is not surprising given the high rate of anxiety disorder comorbidity with PTSD [2]. However, the small sample of both participants with only an anxiety disorder and only PTSD preclude the examination of differences due to low power. Yet, our analyses may have provided a more conservative test of hypotheses given evidence that anxiety has been found to be negatively associated with risk-taking propensity [44,45]. Consequently, it might be expected that there are even greater differences between participants

with PTSD and those with another anxiety disorder on risk-taking propensity than was found in this study.

The data for the present study was drawn from two larger studies, and data on real-world risky behaviors was not available for analysis. Therefore, the goal of this study was to only examine whether risk-taking propensity was a construct worth investigating in future studies focused on understanding the negative clinical outcomes associated with a PTSD-SUD diagnosis. Prospective studies are now needed that examine whether risk-taking propensity predicts specific negative outcomes (substance abuse treatment drop-out) and maladaptive behaviors (risky sexual behavior) among PTSD-SUD patients.

Another limitation is that we did not have full diagnostic data for our participants. First, we did not have data on lifetime diagnoses for all participants, which may have influenced our findings. Future studies would benefit from conducting a full diagnostic interview to examine the effect of past and current diagnoses on risk-taking propensity. We also did not have access to data pertaining to the specific types of traumatic events experienced by participants. History of traumatic exposure would be important to investigate in future studies examining associations between PTSD and risk-taking propensity, especially given evidence that certain forms of traumatic exposure (e.g., childhood sexual abuse) may be strongly associated with risk-taking behaviors [46]. In addition, we did not have data on the presence of impulse control disorders (e.g., pathological gambling) or eating disorders, both of which have been found to frequently occur among individuals with SUDs [47,48] and PTSD [47,49,50]. Given the lack of information on these diagnoses, it is important to consider that the between-group difference on the BART may actually be the result of co-occurring impulse control and/or eating disorder diagnoses within our PTSD participants, especially as the BART may be associated with gambling behavior as its focus is on increasing money based on a chance-related game. Further evaluation of the BART's relationship to gambling behavior is needed.

We also did not have data on the severity of withdrawal symptoms. Although participants were recruited no sooner than 72 hours upon entry into treatment to limit the effect of withdrawal symptoms on task performance, some level of withdrawal symptoms may have still been present, and persistent withdrawal symptoms may have influenced BART performance. They may have also resulted in participants being misclassified as having a mood or anxiety disorder (given the overlap of withdrawal symptoms and symptoms of certain mood and anxiety disorder diagnoses). Future studies would benefit from a more comprehensive assessment of withdrawal symptoms.

Findings were obtained in a primarily African-American inner-city sample of crack/cocaine dependent patients, and thus, may not be generalizable to other samples of substance users and racial/ethnic groups. Although this focus on an underserved and understudied population may be considered an asset of this study, findings must be replicated across a more diverse group of substance users. Finally, it warrants mention that the BART was developed by an author on this study (CWL); consequently, it will be important that the findings of this study are replicated by other research groups.

4.1. Conclusion

Findings provide preliminary evidence for one factor that may be associated with negative clinical outcomes among substance users with PTSD. Although treatments are available that have been found to be efficacious in treating PTSD-SUD diagnoses (e.g., Seeking Safety [51]), it will be important for future research to examine their impact on risk-taking propensity. Research is also needed that elucidates the precipitants (e.g., hyperarousal symptoms) and function (e.g., emotion regulation) of risk-taking among substance users with PTSD.

Acknowledgments

Support for this work was provided by in part by R01 DA19405 awarded to the last author (CWL). Portions of the data presented in this study were also collected as part of the second author's doctoral dissertation.

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Table 1

Descriptive Data for Participants Arranged According to Recruitment Period.

Variable	Sample 1 (N = 48)		Sample 2 (N = 42)		Test of Significance
	Mean or %	SD	Mean or %	SD	
Age	44.44	7.72	43.97	7.82	t (88) = 0.27
Gender (male)	54.2%	---	69.0%	---	χ^2 (1) = 2.09
Racial/ethnic Background					χ^2 (4) = 4.82
African American	89.6%	---	81.0%	---	
White	8.3%	---	7.1%	---	
Latino	2.1%	---	2.4%	---	
Other	0.0%	---	9.6%	---	
Psychotropic Medication	22.9%	---	28.6%	---	χ^2 (1) = 0.38
Major Depression	10.4%	---	35.7%	---	χ^2 (1) = 8.29*
Substance Use Disorders					
Alcohol Dependence	29.2%	---	31.0%	---	χ^2 (1) = 0.03
Sedative Dependence	0.0%	---	2.4%	---	χ^2 (1) = 1.16
Cannabis Dependence	2.1%	---	9.5%	---	χ^2 (1) = 2.36
Stimulant Dependence	0.0%	---	0.0%	---	χ^2 (1) = 0.00
Hallucinogen Dependence	4.2%	---	7.1%	---	χ^2 (1) = 0.38
Opiate Dependence	29.2%	---	19.0%	---	χ^2 (1) = 1.24
Anxiety Disorders					
PTSD	16.7%	---	28.6%	---	χ^2 (1) = 1.84
Specific Phobia	0.0%	---	4.8%	---	χ^2 (1) = 2.34
Panic Disorder	0.0%	---	7.1%	---	χ^2 (1) = 3.55
Social Anxiety Disorder	12.5%	---	7.1%	---	χ^2 (1) = 0.71
Obsessive-Compulsive	2.1%	---	2.4%	---	χ^2 (1) = 0.01
Generalized Anxiety	20.0%	---	1.4%	---	χ^2 (1) = 3.55
Mean Number of Disorders	1.13	1.08	1.60	1.62	t (88) = −1.63
Overall BART Score	40.17	14.71	37.27	15.03	t (88) = 0.93

Note. All diagnoses are current diagnoses.

* $p < .01$ (two-tailed).

Table 2

Descriptive Data for Crack/Cocaine Users with and without PTSD.

Variable	PTSD (N = 20) Mean or %	SD	No PTSD (N = 70) Mean or %	SD	Test of Significance
Age	43.63	8.10	44.42	7.66	t (88) = 0.27
Gender (male)	50.0%	---	64.3%	---	χ^2 (1) = 1.34
Racial/ethnic Background					χ^2 (4) = 8.02
African American	70.0%	---	90.0%	---	
White	20.0%	---	4.3%	---	
Latino	5.0%	---	1.4%	---	
Other	5.0%	---	4.3%	---	
Psychotropic Medication	65.0%	---	14.3%	---	$\chi^2(1) = 21.03^{***}$
Major Depression	40.0%	---	17.1%	---	χ^2 (1) = 4.70^{*}
Substance Use Disorders					
Alcohol Dependence	50.0%	---	24.3%	---	χ^2 (1) = 4.90^{*}
Sedative Dependence	0.0%	---	1.4%	---	χ^2 (1) = 0.29
Cannabis Dependence	5.0%	---	5.7%	---	χ^2 (1) = 0.02
Stimulant Dependence	0.0%	---	0.0%	---	χ^2 (1) = 0.00
Hallucinogen Dependence	5.0%	---	5.7%	---	χ^2 (1) = 0.02
Opiate Dependence	25.0%	---	24.3%	---	χ^2 (1) = 0.00
Anxiety Disorders					
Specific Phobia	5.0% (1)	---	1.4% (1)	---	χ^2 (1) = 0.91
Panic Disorder	10.0% (2)	---	1.4% (1)	---	χ^2 (1) = 3.55
Social Anxiety Disorder	25.0% (5)	---	5.7% (4)	---	χ^2 (1) = 6.43^{**}
Obsessive-Compulsive	5.0% (1)	---	1.4% (1)	---	χ^2 (1) = 0.91
Generalized Anxiety	20.0% (4)	---	1.4% (1)	---	χ^2 (1) = 10.23^{**}
Mean Number of Disorders	2.90	1.59	0.90	0.92	t (88) = -7.18^{***}
Overall BART Score	45.04	17.02	37.04	13.79	t (88) = -2.17^{*}
Overall BART Score (z-score)	0.45	1.11	−0.13	0.93	t (88) = -2.33^{*}

Note. All diagnoses are current diagnoses.

* $p < .05$.

** $p < .01$.

*** $p < .001$ (two-tailed).