Published in final edited form as:

J Behav Med. 2017 October ; 40(5): 794–802. doi:10.1007/s10865-017-9848-9.

Psychological and behavioral moderators of the relationship between trauma severity and HIV transmission risk behavior among MSM with a history of childhood sexual abuse

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Abstract

Childhood sexual abuse (CSA) is associated with post-traumatic stress disorder (PTSD), which can be associated with condomless sex among men who have sex with men (MSM). However, the impact of moderating factors on the relationship between PTSD symptom severity and condomless sex is poorly understood. We examined whether PTSD symptom severity was associated with condomless sex among MSM with CSA histories, and whether substance dependence, self-esteem, and distress tolerance moderated that relationship ($n = 288$). Notably, no direct relationship between PTSD symptom severity and condomless sex was found. Adjusted models indicated that condomless sex was differentially impacted by PTSD symptom severity among those without substance dependence ($R^2 = 0.03$, $p = 0.034$) and, counterintuitively, those with high self-esteem ($R^2 = 0.07$, $p = 0.005$). PTSD symptom severity was associated with condomless sex across levels of distress tolerance. Findings indicate that substance use, self-esteem, and distress tolerance should be targeted in high-risk MSM with CSA even if they do not have PTSD.

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Compliance with ethical standards

Conflict of interest Abigail Batchelder, Peter P. Ehlinger, Michael S. Boroughs, Jillian C. Shipherd, Steven A. Safren, Gail H. Ironson, and Conall O’Cleirigh declares that they have no conflict of interest.

Human and animal rights and Informed consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Keywords

Childhood sexual abuse; Distress tolerance; Substance use; Self-esteem

Introduction

Childhood sexual abuse (CSA), and resulting trauma symptoms are risk factors for a range of negative mental and physical health outcomes in adults (Boroughs et al., 2015). Among men-who-have-sex-with-men (MSM) in the United States (US), CSA is alarmingly common, with estimates as high as 35.5% (Lenderking et al., 1997) compared with the general population estimates of 13.5% of women and 2.5% of men generally (Molnar et al., 2001). CSA is linked to other syndemic pathways including depression, substance use, and post-traumatic stress disorder (PTSD), which may develop even years later and are linked synergistically to perpetuate risk behavior (Parsons et al., 2011; Rowan & Foy, 1993; Rowan et al., 1994; Stall et al., 2003). Both CSA and PTSD are associated with a host of comorbid psychological health issues in adulthood, including substance use disorders (Banducci et al., 2014a; Suvak et al., 2012), low self-esteem (Browne & Finkelhor, 1986; Ekinici & Kandemir, 2015; Payne et al., 2014), and difficulty regulating emotions including distress intolerance (Stevens et al., 2013). CSA and related psychological and health sequelae, have also been associated with HIV-related condomless sex (Banducci et al., 2014a, b; Boroughs et al., 2015). Therefore, the relationship between trauma-related symptoms and condomless sex in adulthood experienced by people with a history of CSA may be impacted by psychobehavioral vulnerabilities associated with CSA including patterns of problematic substance use, low self-esteem, and distress intolerance (Fergusson et al., 2013). Conversely, high self-esteem and distress tolerance, as well as absence of problematic substance use can be considered resiliencies that may be associated with less condomless sex.

MSM, or sexual minority men, a group that includes gay, bisexual, mostly heterosexual, and other men-who-have-sex-with-men regardless of self-identified sexual orientation, remain at highest risk for HIV in the U.S. (Center for Disease Control, 2012) and experience disproportionately high rates of CSA along with psychological and behavioral sequelae, compared to heterosexual men (Paul et al., 2001; Stall et al., 2003). However, it is not necessarily the CSA, but perhaps the sequelae of PTSD, a pattern of problematic substance use, low self-esteem, and general distress that leads to HIV-related condomless sex (O'Cleirigh et al., 2012, 2013; Paul et al., 2001; Stall et al., 2003). For MSM, sexual minority stress and stigma may influence psychological and behavioral vulnerabilities, including problematic substance use (Boroughs et al., 2015; King et al., 2003) and low self-esteem (Berg et al., 2013; Zervoulis et al., 2015), which may affect high-risk behaviors (Hatzenbuehler, 2009; Meyer, 2003). Studies have identified that sexual minority men and women have greater levels of psychological distress and drug use than their heterosexual peers (Blosnich et al., 2013; King et al., 2003), which could be due to ego depletion (Baumeister et al., 1998) or negative reinforcement pathways (Baker et al., 2004) associated with minority stress. Further, sexual minority individuals also have significantly greater prevalence of mental and physical illnesses, possibly linked to discrimination (Lehavot et al., 2016; Warner et al., 2004). Internalized homophobia, or the internalization of negative

societal beliefs about sexual minority status, may increase the likelihood of these psychological and behavioral vulnerabilities (Berg et al., 2013; Garcia et al., 2016).

While PTSD symptom severity has been associated with condomless sex, substance use, self-esteem, and distress intolerance, less is known about how the relationship between PTSD symptom severity and condomless sex is impacted by these psychobehavioral vulnerabilities. The ability to tolerate emotional distress has been negatively associated with PTSD symptom severity, including among people who use substances (Vujanovic et al., 2013, 2016). In some substance-using samples, distress tolerance is shown to be a significant correlate of PTSD symptom severity (Vujanovic et al., 2016). Emerging evidence indicates that low tolerance of emotional distress is associated with higher PTSD symptomatology and substance use (Banducci et al., 2016; Brooks Holliday et al., 2016). A better understanding of the relationship between PTSD symptom severity and condomless sex among MSM with a history of CSA is needed, as well as how psychological vulnerabilities (e.g., substance dependence, self-esteem, and distress tolerance) impact the relationship between trauma severity and condomless sex.

This study examines the different relationship between current PTSD symptom severity and condomless sex among MSM with a history of CSA and the moderated effect of substance dependence, self-esteem, and distress tolerance on the relationship between PTSD symptom severity and condomless sex behaviors. Together, minority stress theory and the existing literature suggest that PTSD symptoms would be associated with higher rates of condomless sex and that PTSD symptoms may trigger substance use (i.e., through negative reinforcement) and could deplete resilience factors (i.e., self-esteem and distress tolerance), which may impact rates of condomless sex. We hypothesized that there would be a direct relationship between current PTSD symptom severity and condomless sex. We also hypothesized that substance dependence, low self-esteem, and low distress tolerance would moderate the relationship between severity of PTSD symptoms and condomless sex among MSM with a history of CSA such that the relationship between PTSD symptom severity and condomless sex would be stronger among those with substance dependence, low self-esteem, and low distress tolerance.

Methods

Participants

Data from 290 HIV-negative MSM were collected as part of the baseline assessment from a multi-site randomized clinical trial in Boston, MA and Miami, FL (demographics described in Table 1). All participants reported sexual risk and a history of CSA before age 17. Participants were recruited through advertising and outreach to bars, clubs, cruising areas, and community venues in addition to a variety of social media. In order to protect individuals' privacy and minimize stigma associated with endorsing a history of CSA, recruitment efforts were combined with other ongoing studies and health promotion initiatives. In the final sample, 9 participants from Boston and 4 from Miami reported being on pre-exposure prophylaxis (PrEP).

Study Procedure—Prior to the completion of a baseline assessment, prospective participants were screened by trained clinical staff using a structured questionnaire. Enrollment criteria included: (1) male sex assigned at birth aged 18 or older; (2) self-reported history of sex with men (or men and women); (3) reporting sexual contact before 13 years of age with an adult or person 5 years older, or sexual contact between 13 and 16 years of age with a person 10 years older, or any age if threat of force or harm; (4) reporting more than one episode of unprotected anal or vaginal intercourse within the past 3 months with someone other than primary, HIV-uninfected partner(s); and (5) being HIV-uninfected as confirmed via rapid testing. All participants completed a comprehensive diagnostic baseline assessment that included HIV and other STI testing, a psychiatric evaluation, and computer-based psychosocial assessments. Given the substantial evidence indicating participants are more likely to disclose sensitive information via computer questionnaire compared to a face-to-face interview, computer-based assessment was used to obtain and confirm data on sexual partner(s) and activities (Des Jarlais et al., 1999; Metzger et al., 2000; Millstein, 1987; Navaline et al., 1994; O'Reilly et al., 1994; Turner et al., 1998; Wilson et al., 1985). All procedures were IRB approved by the IRB at Fenway Health, Massachusetts General Hospital, and the University of Miami.

Measures

Demographics—Participants self-reported age, race, ethnicity, educational attainment, income, and self-identified sexual orientation (regardless of the gender of their sexual partners). Age was treated as continuous. Consistent with U.S. Census categories, we disaggregated race into White, African American, and other categories for analyses. Ethnicity was a dichotomous variable: Hispanic versus non-Hispanic. Education was disaggregated into 4 categories, based on distribution: some high school- high school diploma or GED, some college, college degree (BA or BS) or some graduate school, and graduate degree.

Post-Traumatic Stress Disorder (PTSD) Symptoms and Clusters—PTSD was assessed with the Davidson Trauma Scale (DTS; Davidson et al., 1997), a 17-item self-report questionnaire used to evaluate the frequency and severity of PTSD symptoms consistent with the DSM-IV-TR. Each question is rated on a scale from 0 to 8 (0–4 for frequency and 0–4 for severity), resulting in a total score range of 0–136. Scores ≥ 40 are consistent with the presence of PTSD (McDonald et al., 2009). The DTS demonstrates good test–retest reliability ($r = 0.86$), and internal consistency ($r = 0.99$; Davidson et al., 1997). Cronbach's alpha coefficient for this scale was 0.88.

Condomless sex—Condomless sex was defined as any unprotected anal or vaginal intercourse with a serodiscordant or unknown status partner(s) in the past 3 months. Of participants who were prescribed Pre-exposure Prophylaxis (i.e., PrEP or Truvada; $n = 13$), those who reported being at least 80% adherent to PrEP ($n = 11$) were considered to have not engaged in condomless sex.

Substance dependence—Substance dependence was assessed using the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998), a widely used

diagnostic instrument to determine Axis I psychiatric disorders in clinical populations. The substance dependence variable included meeting DSM-IV criteria for dependence (0 = did not meet criteria and 1 = met criteria for dependence) on stimulant, opioid, sedative/hypnotic/anxiolytic, hallucinogens, inhalants, or marijuana but did not include alcohol dependence. The MINI was administered by clinical interview with trained clinical staff who were training in clinical psychology (i.e., advanced doctoral students, doctoral interns, or post-doctoral fellows). Participants' substance use patterns were assessed for a period of the past 12 months.

Self-Esteem—Self-esteem was assessed using the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). Scores on this scale range from 0 to 30, with higher scores indicating better self-esteem. Scores between 15 and 25 are generally considered within normal range and scores below 15 suggest low self-esteem. Cronbach's alpha coefficient for this scale was 0.90.

Distress Tolerance—Distress tolerance was assessed with Simon and Gaher's Distress Tolerance Scale (Simons & Gaher, 2005); a 15 item self-report questionnaire that assesses four domains: absorption, appraisal, regulation, and tolerance. These subscales have important distinctions: lower scores on absorption reflect the attention paid to negative emotion and relevant interference with functioning; lower scores on appraisal indicate a lack of acceptance of distress; lower scores on regulation indicate that the individual is more likely to expend great effort or utilize a quick solution (e.g., substance use) to alleviate negative emotions; and low scores on tolerance signify that feelings of distress are considered unbearable and difficult to handle (Simons & Gaher, 2005). Response options range from 1 (strongly agree) to 5 (strongly disagree) resulting in a possible range of 15–75 with higher scores indicating higher distress tolerance. Cronbach's alpha coefficient for this scale was 0.91.

Statistical analyses

Descriptive statistics (e.g., means, standard deviations, and frequencies) were used to examine sample characteristics. We assessed bivariate relationships between demographic variables (age, race, ethnicity, education) and condomless sex in the past 3 months using independent t-tests and Chi square to determine covariates to include in the models. We used logistic regression to assess the relationship between PTSD symptom severity and condomless sex (condomless anal or vaginal sex with a serodiscordant partner or partner of unknown HIV-status – in the absence of PrEP adherence for those using PrEP) in a sample of 290 HIV-negative MSM with a history of CSA. We then conducted moderation analyses using multiple logistic regressions to examine the relationships between PTSD symptom severity and three psychobehavioral vulnerabilities (substance dependence, low self-esteem, and low distress tolerance), over and above the demographic covariates, in relation to engagement in condomless sex. PTSD symptom severity, self-esteem, and distress tolerance were mean-centered to reduce the influence of multicollinearity. Substance dependence was not mean centered because it was dichotomous. For all significant interaction effects, we evaluated change in Nagelkerke R^2 (Pampel, 2000). To examine the moderating role of the proposed psychobehavioral vulnerabilities, we examined the proportion of participants

endorsing condomless sex in disaggregated groups of high and low PTSD symptom severity (mean split, 34.5 vs. >34.5) and high and low values of the three vulnerabilities. After exploring the distributions, we dichotomized PTSD severity and the vulnerabilities by mean-splitting (substance dependence vs. no substance dependence; self-esteem mean split, 17.4 vs. >17.4; and distress tolerance mean split, 29.6 vs. >29.6). We created line graphs representing the proportion of individuals who endorsed condomless sex, based on high and low PTSD severity and high and low levels of the vulnerability (or presence or absence of substance dependence). Finally, we conducted four additional models post hoc, replacing the total Distress Tolerance Scale with the four subscales, including similar analyses to explore significant moderation effects. Statistical analyses were performed using IBM SPSS, version 22.

Results

Sample characteristics

The average age of participants was 38, $SD = 12$ (range 18–67). The sample self-identified as 68% White, 22% African American, and 29% identified as Hispanic. One quarter of the sample reported having high school education, 36% some college, and 37% some graduate school or a completed graduate degree. Education (high school diploma, some college, college degree- some graduate school, or graduate degree) was significantly associated with engagement in high risk sex ($\chi^2 (df) = 8.004 (3), p = 0.046$), such that a larger proportion of those with less education reported high risk sex than those with more education. Education was therefore included as a covariate in all final models. Thirty percent reported an annual income of less than \$10,000. Sixty-nine percent ($n = 199$) identified as gay or homosexual, 22% ($n = 64$) identified as bisexual, and 9% ($n = 27$) identified as straight or heterosexual, unsure, or other when asked to categorize their sexual orientation. Approximately 23% of the sample met criteria for substance dependence, not including alcohol. Thirty-eight percent of the samples' Davidson Trauma Scale total score indicated likely PTSD (score of 40).

Procedure

In the first set of logistic regression models, we did not find any direct effects of PTSD symptom severity, substance dependence, self-esteem, or distress tolerance on condomless sex, with and without controlling for education. In a priori models, not controlling for education, we found significant interaction effects between both self-esteem ($R^2 = 0.05, p = 0.004$) and distress tolerance ($R^2 = 0.03, p = 0.031$) and PTSD symptom severity in relation to condomless sex, and a trend between substance dependence ($R^2 = 0.02, p = 0.08$), and PTSD symptom severity in relation to condomless sex. We found significant interaction effects between all three psychobehavioral vulnerabilities including substance dependence, self-esteem, and distress tolerance and PTSD symptom severity in relation to condomless sex, controlling for education (see Table 2). Specifically, substance dependence significantly moderated the relationship between symptom severity and condomless sex ($R^2 = 0.03, p = 0.034$), such that for those with substance dependence the proportion of condomless sex was high across PTSD symptom severity levels and for those without substance dependence the proportion of condomless sex differed by PTSD symptom severity with participants with high symptom severity having a higher proportion of condomless sex

than those with low symptom severity. Specifically, among participants without substance dependence, high PTSD symptom severity was associated with a greater proportion of condomless sex compared to lower PTSD symptom severity (see Fig. 1). When alcohol use was assessed in the regression models, the relationship between condomless sex and PTSD symptom severity was no longer significant.

Self-esteem significantly moderated the relationship between PTSD symptom severity and condomless sex (Nagelkerke $R^2 = 0.07$, $p = 0.005$), such that among those with low self-esteem, level of PTSD symptom severity did not appear to be associated with condomless sex, as those with low self-esteem had a high proportion of condomless sex across PTSD symptom severity levels. However, among those with high self-esteem, the proportion who endorsed condomless sex differed by level of PTSD symptom severity with those with high PTSD symptom severity reporting a higher proportion of condomless sex compared to those with low symptom severity (see Fig. 1).

Distress tolerance also significantly moderated the relationship between PTSD symptom severity and condomless sex ($R^2 = 0.03$, $p = 0.024$). However, among both those with high and low levels of distress tolerance, high PTSD symptom severity was associated with a greater proportion of condomless sex than those with low PTSD symptom severity (see Fig. 1). To explore these results, we conducted additional models replacing distress tolerance with the distress tolerance subscales: absorption, appraisal, regulation, and tolerance. We found that appraisal significantly moderated ($R^2 = 0.06$, $p = 0.004$) the relationship between PTSD symptom severity and condomless sex, such that high appraisal was associated with a greater impact on the relationship between PTSD symptom severity and proportion of condomless sex than low levels of appraisal. Specifically, among participants with high appraisal, those with high PTSD symptom severity had a higher proportion of condomless sex than those with low PTSD symptom severity. Among both those with low and high levels of appraisal, high PTSD symptom severity was associated with greater proportion of condomless sex, although the difference between the proportions of condomless sex by PTSD symptom severity was greater for those with high appraisal.

Discussion

This study examined the relationship between current PTSD symptom severity and condomless sex among a sample of MSM with histories of CSA. Moderators of this relationship including substance dependence, self-esteem, and distress tolerance were also explored. While we did not find a direct relationship between current PTSD symptom severity and engagement in condomless sex, our findings were consistent with previously identified relationships between substance dependence and low self-esteem and condomless sex among MSM with histories of CSA, across levels of PTSD symptom severity (O'Leirigh et al., 2012; Paul et al., 2001). Our findings expanded on previous findings by investigating the extent substance dependence, self-esteem, and distress tolerance moderate the relationship between PTSD severity and condomless sex among this vulnerable population of MSM with a history of CSA. Specifically, our results indicate that these psychological vulnerabilities seem to be significantly related to likelihood of condomless

sex, and level of PTSD symptom severity has a greater impact on the likelihood of condomless sex among those not dependent on substances or who have high self-esteem.

While our results were consistent with published literature regarding substance dependence and low-self-esteem being associated with greater proportion of condomless sex, our results related to distress tolerance were unexpected. Our findings indicate a potentially complex relationship between distress tolerance, PTSD symptoms severity, and condomless sex. Both low and high levels of distress tolerance were associated with condomless sex among those with high PTSD symptom severity. While we expected low distress tolerance, coupled with high PTSD symptom severity to be associated with condomless sex, we did not expect those with high distress tolerance and high PTSD symptom severity to be associated with condomless sex. This may be indicative of higher levels of distress tolerance enabling engagement in or tolerance of condomless sex among this sample. Analyses of distress tolerance subscales identified that only appraisal significantly moderated relationships between PTSD symptom severity and condomless sex. With the exception of appraisal, higher distress tolerance groups had greater proportions of participants who reported recent condomless sex, indicating a need to consider both low and high levels of distress tolerance when intervening to reduce condomless sex among MSM with a history of CSA. These findings are counter to our hypotheses that lower distress tolerance in conjunction with higher PTSD symptom severity would be associated with the greatest proportion of condomless sex. Additional work is needed to further explore the relationships between level of distress tolerance, PTSD symptom severity, and condomless sex among MSM with a history of CSA.

Our findings could alternatively be interpreted as level of PTSD symptom severity moderating the relationships between psychobehavioral vulnerabilities and condomless sex. Taking this perspective, both substance dependence and self-esteem only appeared to have a relationship with condomless sex among those with low PTSD severity, such that condomless sex was only differentially impacted among those with low PTSD severity. Proportion of condomless sex was high for those with high PTSD symptom severity, for those with and without substance dependence and across level of self-esteem. From this perspective, higher levels of PTSD symptom severity were associated with a greater proportion of condomless sex compared to those with low PTSD symptom severity and only slightly higher for those with high levels of distress tolerance in addition to high PTSD symptom severity. Appraisal significantly moderated the relationship between PTSD symptom severity and condomless sex, such that among those with low PTSD symptom severity, high levels of appraisal were associated with the lowest proportion of condomless sex. From this perspective, our findings were consistent with previously identified relationships between substance dependence and self-esteem and condomless sex among MSM with histories of CSA, but only among those with low PTSD symptom severity. Interpreting the results from this perspective is interesting because those with low levels of PTSD symptom severity are not likely to present for treatment and psychosocial interventions that address substance dependence, self-esteem, and distress tolerance, may improve functioning and reduce condomless sex among this population.

This study has several limitations and should be considered an incremental contribution to the literature. Our design was cross-sectional, and thus we were unable to assess temporal influences. Moreover, all participants endorsed a history of CSA and recent condomless sex, limiting the generalizability of the findings. As the sample was selected for their history of sexual abuse, the range of trauma symptoms was therefore restricted. Although, the specific nature of the sample is also a strength of the study, as we were able to assess the impact of previously identified psychobehavioral vulnerabilities among a particularly high-risk population of MSM with a history of CSA. Future research may benefit from testing these relationships longitudinally to properly address any temporal ordering of effects. Additionally, as efforts to increase the uptake of PrEP among high risk populations intensify, more sophisticated methods of measuring adherence may be warranted.

Our results suggest that substance dependence, self-esteem, and distress tolerance (specifically appraisal), all significantly moderated the relationship between PTSD symptom severity and condomless sex among MSM with a history of CSA. Clinicians should consider substance dependence, self-esteem, and distress tolerance when wanting to impact risky sex among MSM with histories of CSA both with and without PTSD. Given that distress tolerance is not commonly assessed in a typical psychological evaluation, clinicians might consider assessing this construct with patients presenting with this profile. However, results regarding self-esteem and distress tolerance also highlight the possibility that focusing on resilience is necessary but not sufficient to address sexual risk behaviors, and clinicians might consider the possibility that higher self-esteem and distress tolerance may facilitate risk in the context of higher PTSD symptom severity vis-à-vis engaging in condomless sex as a means of avoidance. Specifically, among those with PTSD, increasing distress tolerance may be problematic, as our results indicate a combination of high PTSD symptom severity and high distress tolerance may be associated with condomless sex. Conversely, higher levels of appraisal in conjunction with low PTSD symptom severity may be protective, or conceptualized as resiliencies, in regards to condomless sex. Future work may benefit from addressing alexithymia in a similar high-risk sample as well as how different PTSD symptom clusters and diagnostic measures interact with these and other vulnerabilities to predict condomless sex. While more work is needed to better understand how these psychobehavioral vulnerabilities impact the relationship between PTSD symptom severity and condomless sex among MSM with a history of CSA, these results indicate that even within a sample of high-risk MSM with trauma histories, psychological and behavioral variables may contribute to elevations in HIV-related condomless sex.

Acknowledgments

Funding was provided by National Institute of Mental Health (Grant No. R01MH095624).

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Fig. 1.

The relationship between level of PTSD symptom severity and proportion of sample endorsing high-risk sex, as moderated by substance dependence, self-esteem, and distress tolerance. *SUD* substance use dependence, *SE* self-esteem, and *DT* distress tolerance. Participants were those who engaged in high-risk sex in past 3 months (participants 80% adherent to PrEP were considered not to have engaged in recent high risk sex)

Table 1

Sample characteristics

Variable	N (%)
Age (mean (SD))	37.95 (11.68)
Race	
White	201 (67.9)
African American	66 (22.3)
Other	29 (9.8)
Ethnicity	
Hispanic	87 (29.4)
Education	
High school or GED	73 (24.7)
Some college	106 (35.8)
College degree (BA/BS)—some graduate school	71 (24.0)
Graduate degree	39 (13.2)
Income	
\$10,000	88 (29.7)
\$10,001–\$20,000	66 (22.3)
\$20,001–\$40,000	53 (17.9)
\$40,001	83 (28.0)
PTSD Davidson Severity + Frequency Total (mean (SD))	34.5 (26.2) range 0–122
Scale range	0–136
Median	31.00
Substance dependence	67 (23.3%)
Self-esteem (mean (SD)) *	17.4 (6.67)
Scale range	0–30
Range	0–30.00
Median	17.00
Distress tolerance (mean (SD)) **	3.03 (0.90)
Scale range	1–5
Range	1.07–5.00
Median	31.00
Substance use (dependence)	
Stimulants	43 (14.5)
Opiates	15 (5.1)
Marijuana	46 (15.5)
Sedatives	8 (2.7)
Other (hallucinogens, inhalants, other)	3 (1.0)
Alcohol	58 (20.4)

* Higher scores indicate higher self-esteem

** Higher scores indicate greater distress tolerance

Table 2

Test of moderation of the adjusted relationships between level of PTSD symptom severity and sexual risk by:
(A) substance dependence, (B) self-esteem, and (C) distress tolerance

	OR	p value
Any substance dependence (MINI) total **	2.391	0.193
PTSD severity (Davidson frequency + severity) *	1.018	0.068
Any substance dependence × PTSD severity *	0.958	0.034
Self-esteem total *	1.005	0.900
PTSD severity * (Davidson frequency + severity)	1.017	0.122
Self-esteem total * × PTSD severity *	1.003	0.005
Distress tolerance total *	1.289	0.332
PTSD severity * (Davidson frequency + severity)	1.019	0.070
Distress tolerance total * × PTSD severity *	1.018	0.024

Bold values indicate significant results

Outcome = Any recent high risk sex in the past 3 months (participants 80% adherent to PrEP were considered not to have engaged in recent high risk sex).

* = centered.

** = not inclusive of alcohol

All models controlled for education (high school diploma, some college, college degree-some graduate school, and graduate degree)