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Peer reviewed

Temporal Relationship of Sex Risk Behaviors and Substance Use Severity Among Men in Substance Use Treatment

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Abstract

Sex risk behaviors and substance use are intertwined. Many men continue to engage in high-risk sexual behaviors even when enrolled in substance use disorder (SUD) treatment. We hypothesized that changes in sex risk behaviors would coincide with changes in drug/alcohol use severity among men in SUD treatment. During an HIV risk-reduction trial, men in methadone maintenance and outpatient drug free treatment ($N = 359$) completed assessments at baseline and six months after. We assessed changes in sex risk and substance use severity, using the Addiction Severity Index-Lite, controlling for treatment condition. In multinomial logistic regressions, decreased alcohol severity was significantly associated with decreases in reported sex partners, and increased alcohol severity was significantly associated with increases in reported sex partners. Increasing drug use severity was significantly associated with maintaining and initiating sex with a high-risk partner, while decreasing alcohol use severity was significantly associated with discontinuing sex under the influence. However, changes in drug/alcohol use severity were not associated with changes in unprotected sex. Substance use reductions may decrease HIV risk behaviors among male substance users. Our findings highlight the importance of integrating interventions in SUD treatment settings that address the intersection of sex risk behaviors and substance use.

Keywords

AIDS/HIV; drug abuse; alcohol and safer sex

Introduction

The human immunodeficiency virus (HIV) epidemic is shifting away from people who inject drugs (PWID), as most new cases of HIV in the U.S. are attributed to unsafe sexual practices. In 2014, sexual contact comprised 94% of new HIV infections in the U.S. (Centers for Disease Control and Prevention, 2015). Rates of new infections due to sexual transmission among non-injection drug users are increasing (Metzger, Woody, & O'Brien, 2010). Among PWID, sexual risk behaviors are independently associated with HIV

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transmission, and may be a larger factor in HIV transmission than injection behavior (Kral et al., 2001; Strathdee et al., 2001).

Sexual risk behaviors that lead to the transmission of HIV and substance use are intertwined behaviors. Stimulant use, in particular, is associated with greater sex risk behaviors (Carey et al., 2009; Plankey et al., 2007; Springer, Peters, Shegog, White, & Kelder, 2007), including having unprotected sex (Morin et al., 2008). Prescription medications, including sedatives and painkillers, are also associated with sexual risk behaviors (Benotsch, Koester, Luckman, Martin, & Cejka, 2011). Moreover, moderate drinking (Arasteh, Des Jarlais, & Perlis, 2008) and having an alcohol dependence diagnosis (Newville & Haller, 2010) have been associated with an increased likelihood of having multiple sex partners. Having sex under the influence of drugs and/or alcohol enhances sexual risk behaviors (Calsyn et al., 2010) and is more strongly associated with new infections of HIV than is unprotected receptive anal intercourse with a partner of unknown HIV status (Koblin et al., 2006). Substance use can negatively impact judgment and decision making, leading to sexual risk behaviors (Purdie et al., 2001), such as trading sex for drugs or money (Baseman, Ross, & Williams, 1999), unprotected sexual intercourse (Purcell, Parsons, Halkitis, Mizuno, & Woods, 2001), and unprotected sex with multiple partners (Booth, Kwiatkowski, & Chitwood, 2000; Leigh, Temple, & Trocki, 1994). Alcohol users are likely to seek the immediate rewards without considering the long-term consequences while under the influence (Davis, Hendershot, George, Norris, & Heiman, 2007). It is important to consider the trajectories of substance use and sexual risk behaviors concurrently in order to decrease the transmission of HIV.

Substance use disorder (SUD) treatment, including methadone maintenance programs and outpatient drug free settings, may be an important venue for prevention of sexual transmission. While enrollment in drug treatment reduces drug-related HIV risk behaviors, such as injection drug use (Metzger et al., 2010; Sorensen & Copeland, 2000), many substance users in treatment continue to engage in sex risk behaviors (Calsyn et al., 2009; Farrell, Gowing, Marsden, Ling, & Ali, 2005; Longshore & Hsieh, 1998). As substance use is linked to sexual risk behaviors that can transmit HIV, it is possible that decreases in substance use may coincide with decreases in risk behaviors. Little is known about the temporal relationship between drug and alcohol use severity and high risk sexual behaviors among individuals in substance use treatment (Calsyn et al., 2010).

The current study extends past research by examining whether reductions in alcohol and drug use severity predicted reductions in sexual risk behaviors among men in SUD treatment who were followed for a six month period. We hypothesized that decreases in drug and alcohol use at follow-up would coincide with decreases in sex risk behaviors.

Method

Setting and study design

Participants were enrolled in a multi-site clinical trial of the National Institute on Drug Abuse Clinical Trials Network (CTN) designed to test an experimental risk-reduction intervention, Real Men Are Safe (REMAS), a five-session intervention that included motivation enhancement exercises and skills training, against a standard one-session HIV

education intervention that taught HIV prevention skills. The intervention was delivered by counselors in SUD treatment programs, and approved by the local Institutional Review Boards. Details about this study have been published in greater detail elsewhere (Calsyn et al., 2009).

In the parent study, participation was restricted to men in SUD treatment, who were at least 18 years of age, reported engaging in unprotected vaginal or anal intercourse during the prior six months, were willing to be randomly assigned to one of two interventions and complete study assessments, and were able to speak and understand English. HIV status was not assessed as part of this study. Exclusion criteria included gross mental status impairment, which was defined as severe distractibility, incoherence or retardation as measured by the Mini Mental Status Exam (MMSE; Cockrell & Folstein, 1988; Folstein, Folstein, & McHugh, 1975) or clinician assessment, or having a primary sexual partner who was intending to become pregnant over the course of the trial. All participants enrolled from methadone maintenance needed to be stabilized in treatment for at least 30 days to ensure the greatest likelihood that they had achieved a stable dose of methadone before starting the intervention groups. Participants were examined prior to receiving the clinical intervention and six months following the intervention. All participants provided informed consent prior to participating.

Participants and treatment programs

Participants were recruited from seven methadone maintenance and seven outpatient drug free treatment programs in the U.S. that are affiliated with the CTN to participate in a research study on HIV risk reduction interventions. These modalities were chosen as the program's counselors were trained to deliver the intervention. The treatment programs represented different geographic regions, population density, and HIV prevalence rates. Programs were located in U.S. states that included California, Connecticut, Kentucky, New Mexico, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Washington, and West Virginia; they treated patients in urban (e.g., Philadelphia, Pennsylvania), suburban (e.g., Norwalk, Connecticut), and rural areas (e.g., Huntington, West Virginia).

Recruitment was accomplished through posters and fliers posted in clinic waiting rooms, announcements about the study to clinic patients at group therapy meetings, directly through a participant's individual counselor, and at clinic "open houses" designed to introduce the study to clinic patients. Most participants from the drug-free outpatient clinics were recruited close to treatment entry, to reduce the possibility of early dropout. Assessments were conducted at baseline, prior to randomization, and six months after.

Measures

Sociodemographics

We collected data on participants' age, ethnicity, education, recent employment, and days of participation in SUD treatment from self-report.

Alcohol and drug use severity

Alcohol and drug use severity were assessed with the Addiction Severity Index-Lite (ASI-Lite), a standardized clinical interview that provides problem severity profiles in seven domains of functioning (alcohol use, drug use, medical, psychiatric, legal, family/social, and employment/support) by providing an overview of problems related to substance use, in addition to days of use (McLellan, Cacciola, & Zanis, 1992). This instrument has been used in many studies of drug and alcohol abusing populations and its reliability and validity are well-established (Cacciola, Alterman, McLellan, Lin, & Lynch, 2007). Composite scores for each problem domain are derived ranging from zero to one, with higher scores representing greater need for treatment. For the purposes of this study, only the composite scores for the alcohol and drug domains were analyzed. These composite scores are calculated based on the number of days of recent drug and alcohol use (in the past 30 days), problems arising from this use, and the desire for seeking treatment. We also provided days of recent use of alcohol to intoxication, cannabis, heroin, cocaine, sedatives/hypnotics/tranquilizers, and other opiates.

Sex risk behaviors

Sex risk behaviors were measured using the Sexual Behavior Interview (SBI), which was composed of items selected or adapted from the Sex and Drug Abuse Relationship Interview (SADAR; Calsyn et al., 2000) and the Sexual Risk Behavior Assessment Schedule (SERBAS; Meyer-Bahlburg, Ehrhardt, Exner, & Gruen, 1991; Sohler, Colson, Meyer-Bahlburg, & Susser, 2000). The SBI was administered using audio computer assisted structured interview (ACASI) technology, which has been shown to elicit higher self-reported rates of high-risk behaviors, and thus presumably more valid reporting than face-to-face interviews (Gross et al., 2000; Metzger et al., 2000). Risk behaviors assessed by the SBI included: (1) frequency of unprotected sexual intercourse (i.e., sex without a condom) with regular partners; (2) frequency of unprotected sexual intercourse with casual partners; (3) number of sexual partners; (4) high risk sexual partners (defined as PWID, crack cocaine using, exchanges sex for drugs/money, or thought to be HIV positive); and (5) the percentage of sex occasions under the influence of drugs or alcohol. All risk behaviors were assessed for 90 days prior to each interview. We coded the number of sexual partners into three categories: (1) no partner, (2) one partner, and (3) more than one partner. As a plurality of the sample reported no change in sex risk in each domain, unprotected sexual intercourse (regular and casual) and number of sex partners were grouped into three categories: (1) risk behavior increased, (2) risk behavior decreased, or (3) risk behavior remained constant. For having a high risk partner and sex under the influence, change in status from baseline to the six month follow-up assessment was grouped into four categories based on the presence or absence of the behavior at both time points: (1) at neither time point ("neither"), (2) at baseline, but not at follow-up ("discontinued"), (3) at follow-up, but not at baseline ("initiated"), or (4) at both time points ("maintained").

Statistical analysis

In bivariate analysis, we compared sex risk behaviors, recent substance use, and ASI drug and alcohol composite scores at baseline and follow-up to monitor changes over time. As the

ASI drug and alcohol composite scores did not meet the conditions of normality, we used Mann-Whitney U tests and Spearman correlations. Next, we compared sex risk behaviors and ASI composite scores at baseline and at six month-follow-up. Wilcoxon signed-rank tests were used for continuous data and categorical variables with more than two levels (number of partners) and McNemar's tests were used for dichotomous categorical data (having a high risk partner, any sex under the influence).

Multinomial multivariable logistic regression analysis was used to test the hypothesis that reductions in ASI alcohol and drug use severity composite scores would predict reductions in sexual risk behaviors. Separate multinomial logistic regression models were performed for each sexual risk behavior: unprotected sexual intercourse with regular partners, unprotected sexual intercourse with casual partners, number of sex partners, having at least one high risk sex partner, and engaging in sex under the influence. We calculated changes in both ASI alcohol and drug composite scores and entered them in each regression model simultaneously as independent variables. Age, ethnicity, treatment modality, intervention condition, and number of intervention sessions attended were entered into the regression models as covariates.

Results

Sample characteristics

Of the 590 participants enrolled in the trial, 359 men (61%) completed the baseline and six month follow-up assessments and thus were included in this analysis. The participants who were lost to follow-up did not differ at baseline from the current sample regarding their sexual risk behavior or days in SUD treatment (Calsyn et al., 2009). The sample was racially and ethnically diverse; reported races and ethnicities were Caucasian (59%), African-American/Black (27%), Hispanic (12%), American Indian or Alaskan Native (1%), Asian (1%) and "other" (1%). Ages ranged from 18 through 69, with a mean age of 40.3 ($SD =$ 10.5). The sample was comprised of 226 (63%) clients enrolled in methadone maintenance and 133 (37%) clients from outpatient drug free settings.

There were significant differences between participants in outpatient drug free and methadone maintenance settings. Methadone patients were on average older (42.8 vs. 36.1, $t(357) = 6.13$, $p < 0.001$), less likely to have been employed in the last thirty days (41% vs. 58%, $X^2(2) = 9.93$, $p = 0.002$), and more likely to be Caucasian and less likely to be Hispanic than those in outpatient drug free settings ($X^2(5) = 18.74$, $p = 0.002$) (Table 1).

Participants reported using alcohol to intoxication for a mean of 7.9 years ($SD = 9.4$), using cannabis for 10.2 years ($SD = 10.1$), using heroin for 7.4 years ($SD = 8.9$), using cocaine for 6.7 years ($SD = 7.7$), using sedatives/hypnotics/tranquilizers for 2.4 years ($SD = 6.0$) and using other opiates for 2.5 years ($SD = 5.4$). Participants from outpatient drug free settings reported more years of using alcohol to intoxication ($Z = -5.08$, $p < 0.001$), while participants from methadone programs reported more years of heroin ($Z = -14.69$, $p <$ 0.001), sedatives/hypnotics/tranquilizers ($Z = -4.66$, $p < 0.001$), and other opiate use ($Z = -5.24$, $p < 0.001$) (Table 1).

At the six month follow-up, approximately one third of the sample (94; 26%) reported no days of SUD treatment involvement in the past 30 days, while 146 (41%) reported less than daily engagement, and 119 (33%) reported daily engagement. Methadone maintenance participants were more likely to be in substance use treatment than outpatient drug free participants at six month follow-up ($X^2(2) = 103.08$, $p < 0.001$) (Table 1).

Sex risk behaviors and substance use

Changes in sex risk behaviors and substance use are displayed in Table 2. Sexual risk behaviors decreased in this sample across the six month timeframe. The frequency of occasions of unprotected sexual intercourse with a regular partner decreased significantly (88% at baseline, 79% at six month follow-up, $Z = -3.25$, $p < 0.001$). Among the 166 individuals reporting sex with a regular partner, thirty-seven (22%) indicated that they used condoms more frequently with their regular partner at follow-up than at baseline, while 18 (11%) reported using condoms less often at follow-up, and 111 (67%) reported no change. Rates of unprotected sex with casual partners also decreased significantly (73% at baseline, 60% at follow-up, $Z = -2.07$, $p = 0.038$). Among the 87 participants reporting sex with a casual partner, thirty-eight (44%) reported they decreased their frequency of unprotected sex with casual partners, 23 (26%) reported increased frequency, while 26 (30%) reported no change in frequency.

The number of participants who reported having multiple sex partners decreased (40% at baseline, 27% at follow-up, $Z = -4.92$, $p < 0.001$), while sexual abstinence (5% at baseline, 15% at follow-up) increased and the proportion who reported one sex partner (55% at baseline, 59% at follow-up) remained constant. Overall, 114 (33%) reported decreases in their number of sexual partners, while 63 (18%) reported increases, and 172 (49%) reported no change from baseline to follow-up.

Participants decreased their frequency of sex under the influence of drugs or alcohol in the prior 90 days (71% at baseline, 51% at six month follow-up, $X^2(1) = -39.03$, $p < 0.001$). Almost half (151; 43%) reported having sex under the influence at both time points, while 96 (28%) reported discontinuing sex under the influence, 77 (22%) reported not having sex under the influence at both time points, and 24 (7%) reported initiating sex under the influence. While a majority ($N = 210$; 62%) reported not having a high risk partner at either assessment, 42 (12%) reported discontinuing sex with a high risk partner, 32 (9%) reported initiating sex with a high risk partner, and 55 (16%) reported having high risk sex partners at both time points. There was no change in the proportion of participants who reported having a high risk sexual partner (29% at baseline, 25% at six month follow-up, $X^2(1) = -1.07$, $p = 0.302$).

Among all individuals, alcohol composite scores decreased from baseline (M $[SD]$ = 0.09 [0.15]) to six month follow-up (M $[SD]$ = 0.07 [0.12]) ($Z = -3.67$, $p < 0.001$). The same pattern was observed for drug composite scores (Baseline: M $[SD]$ = 0.19 [0.14]; six month follow-up: M $[SD]$ = 0.15 [0.13], $Z = -5.38$, $p < 0.001$). Drug and alcohol use severity were not correlated with each other at baseline ($r = 0.01$, $p = 0.926$) or at six month follow-up ($r = -0.02$, $p = 0.647$). Changes in alcohol use severity and changes in drug use severity from

baseline to six month-follow-up were correlated ($r = 0.20$, $p < 0.001$). Regarding the use of specific substances in the past 30 days, only heroin use decreased ($Z = -2.35$, $p = 0.019$).

Sex risk behaviors and drug/alcohol severity

In bivariate analysis, percent of unprotected sexual occasions with a regular partner was not associated with ASI Alcohol composite scores at either time point, and percent of unprotected sexual occasions with a casual partner was not associated with ASI Alcohol composite scores at either time point. Changes in the number of sexual partners reported were not associated with changes in the ASI alcohol composite scores.

Individuals who reported engaging in sex under the influence of drugs or alcohol at baseline had higher ASI Alcohol composite scores at baseline (0.104 [0.166] vs. 0.057 [0.096], $Z = 3.17$, $p = 0.002$). Those who reported sex under the influence at follow-up also had higher ASI Alcohol composite scores at follow-up (0.092 [0.135] vs. 0.040 [0.083], $Z = 5.16$, $p < 0.001$). Having a high risk sex partner at six-month follow-up was associated with a higher ASI Alcohol composite score (0.107 [0.160] vs. 0.053 [0.090], $Z = 2.90$, $p = 0.004$). Participants who had a high risk sex partner did not differ on the ASI Alcohol composite score at baseline (Table 2).

Regarding drug use severity, the percentage of unprotected sexual occasions with a regular partner at baseline was associated with the ASI Drug composite score at baseline ($r = 0.13$, $p = 0.046$), but not at follow-up. Percent of unprotected sexual occasions with a casual partner and the number of sex partners reported were not associated with ASI Drug composite scores at either time point.

Individuals who reported having sex under the influence of drugs or alcohol had greater ASI Drug severity at both baseline (0.114 vs. 0.214, $Z = 6.47$, $p < 0.001$) and follow-up (0.198 vs. 0.106, $Z = 6.61$, $p < 0.001$). Having a high risk sex partner was not associated with differences on the ASI Drug composite score at either time point.

Regression analysis

Results of multivariable analyses are presented in Table 3 and Table 4. The multinomial regression models that assessed changes in alcohol and drug use severity on condom use with regular partners ($X^2(18) = 25.63$, $p = 0.109$) and casual partners ($X^2(18) = 15.98$, $p = 0.594$) were not significant. Changes in drug and alcohol use severity were not associated with changes in the frequency of condom use over time.

The regression model with number of sex partners was significant ($X^2(18) = 32.78$, $p = 0.018$); change in the alcohol severity score was associated with changes in the number of sex partners ($X^2(2) = 13.59$, $p = 0.001$). Compared to people who reported no change in their number of sex partners, those who decreased their alcohol use severity also decreased their number of sexual partners ($p = 0.032$), and increases in alcohol use severity were associated with an increased likelihood of reporting a higher number of sex partners ($p = 0.042$).

The regression model with high risk sex partners was significant ($X^2(27) = 37.59$, $p = 0.048$). Changes in drug use severity were significantly associated with status of high risk sex partners ($X^2(3) = 14.67$ $p = 0.002$). Compared to individuals who did not have a high risk sex partner at either time point, those who initiated sex with a high risk partner experienced increased drug severity ($p = 0.049$), while those who maintained having high risk partners decreased their drug severity ($p = 0.006$). However, changes in alcohol severity were not associated with changes in having a high risk partner.

The regression model with sex under the influence was significant ($X^2(27) = 51.70$, $p = 0.003$). Changes in alcohol use severity were associated with changes in having sex under the influence ($X^2(3) = 11.29$, $p = 0.010$). Compared to individuals who reported no sex under the influence at either time point, individuals who discontinued sex under the influence had decreases in alcohol use severity ($p = 0.026$). Changes in drug use severity were not associated with changes in having sex under the influence.

Discussion

In the current study, we found high rates of ongoing sexual risk behaviors, with more than half of the sample reporting unprotected sex or having sex under the influence of drugs and/or alcohol, and a considerable minority reporting multiple sex partners and high risk sex partners. Most sexual risk behaviors decreased in frequency during the course of the study. We found relationships between decreased sexual risk behaviors and decreased drug/alcohol use severity, which were independent of treatment modality and intervention assignment modality. Overall, drug and alcohol use severity declined and most sexual transmission risk behaviors declined during the six month period.

Rates of unprotected sex with both regular and casual partners decreased during the six month time frame of the study. However, these changes were not associated with changes in drug or alcohol severity. The HIV risk reduction interventions received may have driven the decrease in unprotected sex. As SUD treatment outcomes were not associated with changes in unprotected sex, this behavior likely requires specific intervention. Available interventions to decrease rates of unprotected sex have proven effective. REMAS significantly increased the percentage of protected sexual occasions compared to a control condition (Calsyn et al., 2009). Other system-level interventions, such as having free condoms available, can decrease rates of unprotected sex (Song et al., 2009). Our findings demonstrate that the relationship between alcohol use severity and multiple sex partners can change over time, consistent with previous findings (Dogan, Stockdale, Widaman, & Conger, 2010). Here, alcohol treatment might serve as a method of decreasing the behavior, resulting in a decrease in the incidence of HIV.

Increases in drug use severity coincided with the initiation of a sexual relationship with a high risk partner, while the maintenance of a relationship with a high risk partner was associated with decreased drug use severity. This reduction is possibly the result of the interventions administered to participants during the course of the study. Meanwhile, the initiation of a relationship with a high risk sex partner may suggest a worsening of the individual's substance use treatment outcomes. Also, discontinuing sex with a high risk

partner was not associated with any change in drug use severity. The peer group of patients in SUD treatment may still be using drugs and engaging in risk behaviors.

Sex under the influence of alcohol and/or drugs decreased over the measured six months of drug treatment. Further, decreases in sex under the influence were associated with decreases in drug use severity. Drinking before a sexual encounter has been linked to sex with a high risk partner (White, Fleming, Catalano, & Bailey, 2009). This has been theorized to be associated with the disinhibition of alcohol, which leads users to perceive less risk and have more positive outcome expectations (Fromme, D'Amico, & Katz, 1999), and some evidence indicates it may be the case in stimulant users as well (Mullens, Young, Hamernik, & Dunne, 2009; Proudfoot, Heubeck, Ward, & Degenhardt, 2011). The percentage of individuals who reported at least one high risk sex partner, however, remained unchanged during the course of the study. It may be difficult for participants in substance use treatment, whose peers are also substance users, to find low risk partners.

Addressing one risk factor may decrease other risk factors as well. Sex under the influence is frequent and associated with other sex-risk behaviors, such as sex with casual partners and unprotected sex (Arasteh et al., 2008; Calsyn et al., 2010). Having a high risk partner has previously been associated with increased condom use (Song et al., 2009). As such, it is possible that decreasing drug use severity can impact several sex-risk behaviors through the vector of sex under the influence.

The study's results have implications for SUD treatment programs. Specifically, counselors in methadone maintenance treatment and outpatient drug-free programs should discuss the risk status of their clients' sexual partners. This can be coupled with a discussion about condom use, including hands-on demonstrations on how to apply condoms. Also, incorporating cognitive-behavioral therapy and motivational interviewing can decrease sexual risk behaviors and substance use, while also helping to increase knowledge and skills that can lead to safer sex (Melendez-Torres & Bonell, 2014; Parsons, Lelutiu-Weinberger, Botsko, & Golub, 2014). Interventions should address the isolation and vulnerability that can lead individuals into risky sexual encounters (Saleh, van den Berg, Chambers, & Operario, 2016).

This study has limitations that suggest the need for further research. First, all participants enrolled in this study to participate in HIV risk reduction interventions, suggesting greater readiness to change than expected among all SUD treatment participants. As a result, findings may not be generalizable to SUD treatment patients less concerned about HIV transmission. It is important to note that participants in this study were not tested for HIV nor was information regarding participants' HIV status gathered in the current study. Individuals may differ in their risk behavior based on their HIV status, as positive individuals may change their previous behaviors (Brewer, Zhao, Metsch, Coltes, & Zenilman, 2007). Sexual dysfunction can result from methadone (Yee, Loh, Hisham Hashim, & Ng, 2014) and chronic alcohol use (Peugh & Belenko, 2001), which could have influenced our results. We also do not have information on why certain participants are no longer in treatment (such as achieving sobriety or relapse), which could confound our data. Analyzing the data categorically obscures and fails to reveal the actual magnitudes of

changes. Also, we calculated change scores for substance use severity, which are controversial among researchers (Norman, 1989).

Our study highlights the importance of drug and alcohol treatment in the reduction of sex risk behaviors. As the sexual transmission of HIV continues to increase (Centers for Disease Control and Prevention, 2015), more understanding of this phenomenon is needed. Drug and alcohol use severity are associated with these risk behaviors, and treating the substance use in drug treatment may reduce HIV risk behaviors. However, some risk behaviors remain unchanged in spite of changes in drug and alcohol use severity, and require specific interventions. Further research is needed to pinpoint the effect of drug treatment independent of other factors, including having sex for money or drugs. Also, participants of different treatment modalities may have different risk patterns, and may respond differently to interventions. Drug treatment provides the opportunity for specialized HIV risk behavior interventions, which should be expanded upon wherever possible.

Acknowledgments

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Table 1

Demographic information (N=359)

N (%)	Total sample (N=359)	ODF (N=133)	MMT (N=226)	p
Age (M (SD))	40.3 (10.5)	36.1 (10.0)	42.8 (10.0)	<0.001
Race/ethnicity				
Caucasian	211 (59)	67 (50)	144 (64)	0.002
African-American/Black	96 (27)	36 (27)	60 (27)	
Hispanic	43 (12)	25 (19)	18 (8)	
American Indian/Alaskan native	4 (1)	4 (3)	0 (0)	
Asian	3 (1)	1 (1)	2 (1)	
"Other"	2 (1)	0 (0)	2 (1)	
Years of education (M (SD))	12.2 (1.8)	12.4 (1.9)	12.0 (1.7)	0.064
Any employment	169 (47)	77 (58)	92 (41)	0.002
Substance use (years) (M (SD))				
Alcohol to intoxication	7.9 (9.4)	10.7 (9.8)	6.2 (8.8)	< 0.001
Cannabis	10.2 (10.1)	9.2 (8.5)	10.8 (11.0)	0.609
Heroin	7.4 (8.9)	0.6 (2.1)	11.5 (8.9)	< 0.001
Cocaine	6.7 (7.7)	6.3 (7.9)	7.0 (7.5)	0.114
Sedatives/hypnotics/tranquilizers	2.4 (6.0)	0.8 (2.6)	3.4 (7.2)	< 0.001
Other opiates	2.5 (5.4)	0.9 (2.6)	3.5 (6.4)	< 0.001
Substance use treatment engagement (at six month follow-up)				
None	94 (26)	69 (52)	25 (11)	< 0.001
Less than daily	146 (41)	57 (43)	89 (39)	
Daily	119 (33)	7 (5)	112 (50)	

Note:

ODF=Outpatient drug free

MMT=Methadone maintenance treatment

Table 2

Changes in sex risk behaviors and substance use over time

	Baseline	Follow-up	Test statistic	p
Sex risk behaviors				
Unprotected sex with a regular partner (% [SD])	88.4 (27.5)	79.3 (36.2)	$Z=-3.25$	0.001
Unprotected sex with a casual partner (% [SD])	73.3 (37.2)	59.6 (44.5)	$Z=-2.07$	0.038
Multiple sex partners (N [%])	144 (40.1)	95 (26.5)	$Z=-4.92$	<0.001
At least one high risk sex partner (N [%])	103 (28.7)	89 (24.8)	$X^2(1)=-1.07$	0.302
Sex under the influence (N[%])	254 (70.8)	184 (51.3)	$X^2(1)=-39.03$	<0.001
Substance use (M [SD])				
ASI Alcohol composite score	0.09 (0.15)	0.07 (0.12)	$Z=-3.67$	<0.001
ASI Drug composite score	0.19 (0.14)	0.15 (0.13)	$Z=-5.38$	<0.001
Alcohol to intoxication	1.45 (4.25)	1.40 (4.10)	$Z=-0.40$	0.692
Cannabis	2.95 (7.34)	3.04 (7.51)	$Z=-0.40$	0.689
Heroin	1.21 (3.76)	1.07 (4.32)	$Z=-2.35$	0.019
Cocaine	2.65 (6.23)	2.48 (5.92)	$Z=-0.85$	0.394
Sedatives/hypnotics tranquilizers	3.08 (8.13)	3.26 (8.58)	$Z=-0.15$	0.878
Other opiates	1.68 (6.00)	1.43 (5.53)	$Z=-1.47$	0.143

Table 3

Changes in alcohol and drug use severity scores from baseline to follow-up as a function of change in unprotected sex and number of sex partners

Change in ASI composite scores (M[SD])[a]	Change in Sexual Risk Behavior from Baseline to Six Month Follow Up Assessments				
				Coefficients	
	Increased	Decreased	Unchanged	ASI coefficient	Full model
Unprotected sex (regular partner)					
ASI Alcohol	−0.014 (0.110)	−0.009 (0.110)	−0.023 (0.101)	$X^2(2)=0.43, p=0.809$	$X^2(18)=25.63, p=0.109$
ASI Drug	−0.027 (0.119)	0.004 (0.116)	−0.026 (0.100)	$X^2(2)=1.89, p=0.389$	
Unprotected sex (casual partners)					
ASI Alcohol	−0.035 (0.125)	−0.078 (0.169)	−0.030 (0.176)	$X^2(2)=0.616, p=0.735$	$X^2(18)=15.98, p=0.594$
ASI Drug	−0.041 (0.094)	−0.074 (0.129)	−0.020 (0.147)	$X^2(2)=1.330, p=0.514$	
Number of sex partners					
ASI Alcohol	0.011 (0.117) *	−0.057 (0.151) *	−0.017 (0.107)	$X^2(2)=13.59, p=0.001$	$X^2(18)=32.78, p=0.006$
ASI Drug	−0.023 (0.129)	−0.048 (0.107)	−0.024 (0.100)	$X^2(2)=2.15, p=0.341$	

Note:

[a] ASI Composite Scores have a range of 0 to 1.0

Significant differences are noted with a *. The reference category is "unchanged".

Table 4

Changes in alcohol and drug use severity scores from baseline to follow-up as a function of change in sex under the influence and high risk sex partners

Change in ASI composite scores (M[SD])[a]	Change in Sexual Risk Behavior from Baseline to Six Month Follow Up Assessments				Coefficients	
	Neither	Discontinued	Initiated	Maintained	ASI coefficient	Full model
Sex under the influence						
ASI Alcohol	−0.022 (0.890)	−0.063 (0.136)	0.011 (0.074) *	−0.008 (0.138)	$X^2(3)=11.22, p=0.011$	$X^2(27)=51.70, p=0.003$
ASI Drug	−0.014 (0.081)	−0.056 (0.116)	0.006 (0.145)	−0.029 (0.103)	$X^2(3)=5.97, p=0.113$	
High risk sex partner						
ASI Alcohol	−0.024 (0.104)	−0.022 (0.138)	−0.008 (0.238)	−0.041 (0.118)	$X^2(3)=0.57, p=0.904$	$X^2(27)=37.59, p=0.048$
ASI Drug	−0.023 (0.099)	−0.044 (0.117)	0.010 (0.108) *	−0.065 (0.119) *	$X^2(3)=14.67, p=0.002$	

Note:

[a] ASI Composite Scores have a range of 0 to 1.0

Significant differences are noted with a *. The reference category is "neither".