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Alcohol use disorders are associated with increased HIV risk behaviors in cocaine-dependent methadone patients

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Abstract

People who inject drugs (PWID) are at increased risk of HIV infection. Although methadone maintenance therapy can help lower this risk, many methadone patients continue to engage in HIV risk behaviors, especially patients who use cocaine and alcohol. The purpose of the current study was to investigate relations between alcohol use disorders and HIV risk behavior in 239 cocaine-dependent methadone patients participating in a randomized controlled trial of a behavioral intervention to promote cocaine abstinence. Past 3-month HIV Risk-taking Behavior Scale (HRBS) scores were compared between cocaine-dependent methadone patients who met *DSM-IV-TR* diagnostic criteria for alcohol abuse or dependence and those who did not meet these criteria. No significant differences in HRBS drug subscale scores were observed between participants with and without alcohol use disorders, indicating risky drug use was similar between groups. However, alcohol use disorder was significantly associated with HRBS sex subscale scores ($t=2.59$, $p=.01$), indicating participants with alcohol use disorders were more likely to engage in risky sexual behavior. Item-level analyses of the sex-related HRBS questions showed participants with alcohol use disorders were significantly more likely than participants without alcohol use disorders to have unprotected sex, engage in transactional (paid) sex, and have anal sex. Interventions are needed to reduce risky sexual behavior and attenuate the spread of HIV in this high-risk population.

Keywords

methadone maintenance; cocaine dependence; alcohol abuse; alcohol dependence; risky sexual behavior

1. Introduction

People who inject drugs (PWID) are at increased risk of contracting human immunodeficiency virus (HIV; Broz, 2014). Not only do risky drug use behaviors (e.g., sharing syringes) contribute to HIV transmission within this population, risky sexual behaviors (e.g., unprotected vaginal sex) also contribute to the spread of HIV among PWID

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(Kral et al., 2001). Further, HIV can spread to lower risk populations when PWID and non-drug users engage in risky sexual behaviors (Jenness, Neaigus, Hagan, Murrill, & Wendel, 2010; Liu, Grusky, Li, & Ma, 2006; Niccolai, Shcherbakova, Toussova, Kozlov, & Heimer, 2009).

Heroin is the most commonly injected drug among PWID. Methadone maintenance therapy, one of the most effective treatments for heroin dependence (Garcia-Portilla, Bobes-Bascaran, Bascaran, Saiz, & Bobes, 2014), is associated with reduced risk of HIV infection (Sorensen & Copeland, 2000). However, many patients continue to engage in HIV risk behaviors while receiving methadone treatment, especially patients who use cocaine. As many as half of methadone patients use cocaine (Cone, 2012; Dobler-Mikola et al., 2005; Magura, Rosenblum, & Rodriguez, 1998), and these patients are more likely to inject drugs, share syringes, have multiple sexual partners, and engage in transactional (paid) sex (Bux, Lamb, & Iguchi, 1995; Darke, Baker, Dixon, Wodak, & Heather, 1992; Grella, Anglin, & Wugalter, 1995; Joe & Simpson, 1995). Moreover, alcohol use is prevalent among cocaine-using methadone patients (Dobler-Mikola et al., 2005), and alcohol use may further increase HIV risk behavior in this already high-risk population.

Evidence relating alcohol use to risky drug use behaviors, however, is mixed. Some studies have found associations between alcohol use and risky injection behaviors (Matos et al., 2004), whereas others have found less evidence of such a relationship (Rash & Petry, 2009; Rees, Saitz, Horton, & Samet, 2001). For example, Rees et al. (2001) found no association between past-30-day alcohol use and recent risky injection behavior among illicit drug users. However, research has shown more reliable associations between alcohol use and risky sexual behavior in PWID and cocaine-using methadone patients (Arasteh, Des Jarlais, & Perlis, 2008; Magura et al., 1998; Matos et al., 2004; Rash & Petry, 2009; Rees et al., 2001; Stein, Anderson, Charuvastra, & Friedmann, 2001). For example, Arasteh et al. (2008) found heavy drinkers reported multiple sexual partners and unprotected sex more than moderate drinkers or nondrinkers in a large sample of PWID entering substance abuse treatment. Further, Magura et al. (1998) found heavy alcohol use was associated with transactional sex among cocaine-using methadone patients. These findings are consistent with the results of prospective studies that show alcohol use increases intentions to engage in risky sexual behavior, even among individuals from the general population (Johnson, Sweeney, Herrmann, & Johnson, 2016; Rehm, Shield, Joharchi, & Shuper, 2012).

Although the instruments used to measure HIV risk behaviors often differ across studies (e.g., Arasteh et al., 2008; Magura et al., 1998), the HIV Risk-taking Behavior Scale (HRBS; Ward, Darke, & Hall, 1990) has become increasingly popular among researchers (e.g., Ghitza, Epstein, & Preston, 2008; Hanson, Alessi, & Petry, 2008; Kaye et al., 2014; Rash & Petry, 2009; Wu et al., 2011; Zhao, Holzemer, Johnson, Tulskey, & Rose, 2012). This psychometrically reliable and valid 11-item questionnaire assesses risky drug use behaviors and risky sexual behaviors (Darke, Hall, Heather, Ward, & Wodak, 1991; Lejuez, Simmons, Aclin, Daughters, & Dvir, 2004; Petry, 2001; Ward et al., 1990). Rash and Petry (2009) administered two versions of the HRBS (a “past month” version and a “lifetime” version) to 118 cocaine-using methadone patients participating in two randomized controlled trials of substance abuse interventions (Petry & Martin, 2002; Petry, Martin, & Simcic Jr, 2005).

They found drinking alcohol to intoxication in the past month was not associated with an increase in lifetime risky drug use behaviors, but it was associated with an increase in lifetime risky sexual behaviors. However, they observed no main effects of drinking to intoxication on past month risky sexual behaviors. Notably, this study was limited by its single item characterization of alcohol use problems (i.e., at least one episode of drinking to intoxication during the past month) and analyses were not adjusted for potential covariates other than gender (e.g., age, race, education, methadone dose, etc.; Barry, Weinstock, & Petry, 2008; Brooks et al., 2010; Brooks et al., 2013; Patton et al., 2014; Sheeran, Abraham, & Orbell, 1999; Wu et al., 2010).

The purpose of the current study was to further investigate relations between alcohol use and HIV risk behavior in cocaine-dependent methadone patients. Past 3-month HRBS scores and item responses were compared between cocaine-dependent methadone patients who met *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision; *DSM-IV-TR*; American Psychiatric Association, 2000) alcohol abuse or dependence diagnostic criteria and those who did not meet these criteria in order. Analyses were adjusted for covariates of HIV risk behavior to determine whether a recent pattern of problematic alcohol use was associated with risky drug use behaviors or risky sexual behaviors in this clinically important population.

2. Material and Methods

2.1 Participants

Participants were cocaine-dependent methadone patients participating in a randomized controlled trial of a behavioral intervention to promote cocaine abstinence. Data from one of the 240 participants enrolled in the clinical trial were excluded due to incomplete HRBS data, resulting in a final sample of 239 participants in the current study. A detailed description of the clinical trial can be found in (Petry, Alessi, Barry, & Carroll, 2015). Participants were 18 years of age, English speaking, on stable methadone treatment (i.e., same clinic for 3 months and same dose of methadone for 1 month), diagnosed with cocaine dependence based on *DSM-IV-TR* diagnostic criteria, and had at least one cocaine-positive urine sample in the past 3 months. Patients with uncontrolled major psychiatric illness (e.g., active suicidality or psychosis) and those who could not pass an informed consent quiz were excluded from study participation. All study procedures were approved by the UConn Health Institutional Review Board.

2.2 Measures

Questionnaires were administered at study intake to assess participant characteristics, including age, gender, race, ethnicity, income, education, methadone dose, and *DSM-IV-TR* diagnostic criteria for alcohol abuse and dependence. HIV risk behaviors were assessed with the HRBS (Ward et al., 1990). The reliability and validity of the HRBS has been demonstrated in several studies, including good internal reliability indicated by Cronbach's coefficients ranging from $\alpha = .70$ to $.82$ (Darke et al., 1991; Lejuez et al., 2004; Petry, 2001), test-retest correlations ranging from $r = .67$ to $.86$ (Darke et al., 1991; Petry, 2001), and collateral validation showing 82% – 100% agreement between subjects' responses and the

responses of their regular sexual partners (Darke et al., 1991). This 11-item questionnaire assessed past-3-month risk taking in two domains: injection drug use and sexual risk behavior. Each HRBS item had six response options, which were scored from 0 to 5, with higher scores representing greater risk of HIV infection/transmission. The score for the six drug-related items (i.e., “drug scores”) ranged from 0–30, and the score for the five sex-related items (i.e., “sex scores”) ranged from 0–25. The scale also inquires about sexual orientation, but responses are not included in scores.

2.3 Data Analysis

Participants were dichotomized as those who met past year *DSM-IV-TR* diagnostic criteria for alcohol abuse or dependence (i.e., those with alcohol use disorders; $n=43$) and those without alcohol use disorders ($n=196$). Participant characteristics were compared between these two groups using independent t-tests for continuous variables and chi-square tests for categorical variables. A log transformation was applied to income data prior to analyses because the distribution of these data deviated substantially from normality.

Multiple regression analyses were used to examine whether alcohol use disorders were associated with HRBS drug scores or sex scores. The following variables were entered into two models to independently examine drug scores and sex scores: age, gender, race, ethnicity, log income, education, methadone dose, and alcohol use disorders. These variables were selected due to previously demonstrated relations with HIV risk behaviors (e.g., Barry et al., 2008; Brooks et al., 2010; Brooks et al., 2013; Patton et al., 2014; Sheeran et al., 1999; Wu et al., 2010) or because they differed between groups based on alcohol use disorder status.

For HRBS subscale scores that differed based on alcohol use disorder status, responses to the individual items comprising that subscale score were examined. Thereby, these analyses were protected against multiple comparisons as there was no expectation that items would differ between groups unless overall subscale scores did (Rosenthal & Rosnow, 1991). Participants rarely selected HRBS response options associated with the highest HIV risk categories (e.g., item scores of 5), resulting in substantially skewed distributions of residuals. Thus, responses to each item were dichotomized into minimal/no risk (0) versus moderate/high risk (1). Due to the exploratory nature of these analyses, logistic regression with backward elimination was used to identify variables that significantly predicted responses to each question. The baseline and demographic data in Table 1 were entered into each logistic regression model for the individual HRBS items. Variables with Wald statistic p -values $\leq .1$ were removed from the models until only the most significant contributors to the models remained.

3. Results

3.1 Participant Characteristics

Participant characteristics are shown in Table 1. Participants with alcohol use disorders were significantly younger, more likely to be male, less likely to be Hispanic, had a higher annual income, and were maintained on a lower dose of methadone than their counterparts without

an alcohol use disorder. Groups were similar with respect to education, race and sexual orientation.

3.2 HRBS Subscale Scores

Mean past-3-month HRBS drug score was 2.26 ($SD=4.23$) for participants with alcohol use disorders and 2.17 ($SD=4.04$) for participants without alcohol use disorders. Mean past-3-month HRBS sex score was 6.14 ($SD=4.22$) for participants with alcohol use disorders and 4.15 ($SD=3.43$) for participants without alcohol use disorders. The multiple regression model used to predict HRBS drug score was not significant ($F_{6,230}=1.37$, $p=.211$). However, the model used to predict HRBS sex score was significant ($F_{8,227}=3.14$, $p=.002$), and the alcohol use disorders variable was a significant contributor to this model (see Table 2).

3.3 HRBS Sex-related Items

Logistic regression analyses revealed several baseline and demographic characteristics were significantly associated with responses to individual sex-related HRBS items (Table 3). First, age and gender significantly predicted the number of sexual partners participants had in the previous 3 months. Participants with multiple recent partners were more likely to be younger ($M=37$, $SD=11$) than participants with one or no partners ($M=41$, $SD=9$), and a greater percentage of males (21%) than females (10%) reported multiple recent sexual partners. However, alcohol use disorder status was not associated with having multiple recent partners.

Second, race and alcohol use disorder status significantly predicted condom use with regular partners in the previous 3 months. Forty-five percent of Black participants, 59% of White participants, and 86% of those who identified with another racial category reported unprotected sex with regular partners, and a greater percentage of participants with alcohol use disorders (72%) than those without alcohol use disorders (53%) reported unprotected sex with regular partners.

Third, gender and ethnicity significantly predicted condom use with casual partners in the previous 3 months. A greater percentage of males (15%) than females (6%) reported unprotected sex with casual partners, and a greater percentage of non-Hispanic participants (13%) than Hispanic participants (5%) reported unprotected sex with casual partners, but alcohol use disorder status was not related to this risk behavior.

Fourth, methadone dose and alcohol use disorder status significantly predicted transactional sex in the previous 3 months. Participants who engaged in transactional sex were more likely to be on a higher daily dose of methadone ($M=95$ mg, $SD=32$) than participants who did not engage in transactional sex ($M=80$ mg, $SD=32$), and a greater percentage of participants with alcohol use disorders (12%) than participants without alcohol use disorders (3%) engaged in recent transactional sex.

Finally, gender and alcohol use disorder status significantly predicted engaging in anal sex during the previous 3 months. A greater percentage of males (9%) than females (2%) engaged in anal sex, and a greater percentage of participants with alcohol use disorders (14%) than participants without alcohol use disorders (4%) engaged in anal sex.

4. Discussion

The results show cocaine-dependent methadone patients who endorsed past year *DSM-IV-TR* diagnostic criteria for alcohol abuse or dependence were more likely than those without alcohol use disorders to engage in recent HIV risk behaviors. Although analyses of the HRBS subscale scores revealed drug scores were similar between participants with and without alcohol use disorders, sex scores were higher for participants with alcohol use disorders. Further, item-level analysis of the sex-related HRBS items showed alcohol use disorder status was significantly associated with three specific sexual risk behaviors (Table 3). Participants with alcohol use disorders were more likely than participants without alcohol use disorders to have unprotected sex with their regular partners, engage in transactional sex, and have anal sex. Notably, other factors were also significantly associated with risky sexual behavior, including age, gender, race, ethnicity, and methadone dose (see Table 3). For example, male participants were more likely to have multiple sexual partners, engage in unprotected sex, and have anal sex. Even after controlling for these other, primarily non-modifiable (with the exception of methadone dose) variables, alcohol use disorder status had a significant impact on these sexual risk behaviors.

Results from the current study replicate and extend findings from previous studies, which have shown alcohol use is associated with increased HIV risk behavior in PWID and cocaine-using methadone patients (Arasteh et al., 2008; Magura et al., 1998; Matos et al., 2004; Rees et al., 2001; Stein et al., 2001). Not only do the results from this study show alcohol use disorders are associated with a pattern of risky sexual behavior, they reveal relations between alcohol use disorders and responses to specific HRBS sex-related items, thereby increasing our understanding of relations between alcohol use and sexual risk behavior. In particular, cocaine-dependent methadone patients who had alcohol use disorders were more likely than those without alcohol use disorders to engage in some of the highest risk HIV sexual risk behaviors (i.e., transactional and anal sex). These results are consistent with findings from previous studies which have shown cocaine-dependence is associated with risky sexual decision-making (Johnson, Johnson, Herrmann, & Sweeney, 2015), and alcohol use increases individuals' intentions to engage in risky sexual behavior (Johnson et al., 2016; Rehm et al., 2012).

Limitations of the current study include the use of self-report to assess HIV risk behavior and alcohol use, which may have resulted in over- or underreporting of these behaviors. However, previous research has shown self-reported measures of drug use and HIV risk behaviors are reliable and valid (Darke, 1998). Another limitation was that HIV status was not assessed in this study; thus, associations between HIV risk behaviors and HIV status were not examined. Finally, the majority of participants in this study identified as heterosexual (Table 1). It is unclear the extent to which these results may generalize to patients who do not primarily identify as heterosexual. These patients, nevertheless, are representative of cocaine using methadone patients in the New England area.

5. Conclusions

Unsafe sexual and drug use behaviors place PWID at increased risk for contracting HIV. Although methadone maintenance may help reduce this risk, methadone patients who use cocaine and alcohol often continue to engage in HIV risk behaviors. Results from the current study suggest a diagnosis of alcohol abuse or dependence may be a marker for increased risky sexual behavior in cocaine-dependent methadone patients. Thus, research is needed to develop and test strategies to reduce risky sexual behavior and attenuate the spread of HIV within this high-risk population. In particular, such interventions should promote protected sex with regular partners and address unique risks and precautions for transactional and anal sex. Effective interventions aimed at this high risk subgroup may also help reduce the spread of HIV to lower risk populations by decreasing risky sexual behaviors between PWID and their non-drug-using sexual partners.

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Highlights

- Relations between alcohol use disorders and HIV risk behaviors were examined in cocaine-dependent methadone patients.
- Alcohol use disorders were not associated with risky drug use behaviors.
- Alcohol use disorders were associated with risky sexual behaviors, including unprotected sex, transactional sex, and anal sex.

Table 1

Participant Characteristics

Characteristic	Participants with alcohol use disorders (n=43)	Participants without alcohol use disorders (n=196)	Test statistic, p-value
Age, <i>M</i> (<i>SD</i>) years	37.3 (10.22)	40.9 (9.54)	$t = 2.23, p = .027$
Gender, % (n) female	30 (13)	54 (105)	$\chi^2 = 7.68, p = .006$
Race	--	--	$\chi^2 = 1.51, p = .471$
% (n) White	65 (28)	66 (130)	--
% (n) Black	33 (14)	27 (53)	--
% (n) Other	2 (1)	7 (13)	--
Ethnicity, % (n) Hispanic	14 (6)	31 (60)	$\chi^2 = 4.9, p = .027$
Heterosexual, % (n)	93.0 (40)	87.7 (171)	$\chi^2 = 1.00, p = .32$
Income, <i>M</i> (<i>SD</i>) past year USD	\$23,717 (36,999)	\$11,812 (10,363)	$t = -2.87, p = .005^*$
Education, <i>M</i> (<i>SD</i>) years	11.6 (1.82)	11.6 (1.98)	$t = .111, p = .912$
Methadone dose, <i>M</i> (<i>SD</i>) mg per day	68.9 (30.5)	83.4 (32.38)	$t = 2.69, p = .008$

All *p*-values in bold are significant at $\alpha = .05$

* Log10 transformation applied to income data prior to test.

Table 2

Variables in Multiple Regression Model of HRBS Sex Scores

Variable	β	t (p)
Age	-.201	-3.07 (.002)
Gender	-.117	-1.73 (.085)
Race	.036	.52 (.605)
Ethnicity	.011	.16 (.872)
Income	-.033	-.48 (.629)
Education	-.015	-.215 (.830)
Methadone dose	.059	.90 (.386)
Alcohol abuse or dependence	.174	2.59 (.010)

All p -values in bold are significant at $\alpha = .05$

Table 3

Variables Retained in Final Logistic Regression Models of HRBS Sex-related Items

HRBS Questions	HRBS Responses			Model		Variables Retained in Model	
	Minimal or No Risk (<i>n</i> ; %)	Moderate or High Risk (<i>n</i> ; %)		Chi-square (<i>p</i> -value)	Nagelkerke <i>R</i> ²	Participant Characteristic	Wald (<i>p</i> -value)
How many people, including any regular partners, casual acquaintances and clients, have you had sex with in the last 3 months?	None or One (<i>n</i> = 199; 84%)	Two, 3–5 people, 6–10 people, or More than 10 people (<i>n</i> = 38; 16%)		10.5 (.005)	.074	Age Gender	4.74 (.029) 5.30 (.021)
How often, in the last 3 months, have you used condoms when having sex with your regular partner(s)?	No regular partner/sex or Every time (<i>n</i> = 103; 43%)	Often, Sometimes, Rarely, or Never (<i>n</i> = 134; 57%)		20.19 (.000)	.11	Age Race Alcohol abuse or dependence	3.16 (.076) 6.53 (.038) 4.75 (.029)
How often, in the last 3 months, have you used condoms when you had sex with casual partners (acquaintances)?	No casual partner/sex or Every time (<i>n</i> = 212; 89%)	Often, Sometimes, Rarely, or Never (<i>n</i> = 25; 11%)		15.55 (.004)	.13	Gender Race Ethnicity	5.53 (.019) 4.73 (.094) 5.47 (.019)
How often, in the last 3 months, have you used condoms when you have been paid for sex with money or drugs or when you have paid for sex with money or drugs?	No paid sex (<i>n</i> = 226; 95%)	Every time, Often, Sometimes, Rarely, or Never (<i>n</i> = 11; 5%)		8.38 (.015)	.111	Methadone dose Alcohol abuse or dependence	3.96 (.047) 6.68 (.01)
How many times have you had anal sex in the last 3 months?	None (<i>n</i> = 224; 95%)	Once, Twice, 3–5 times, 6–10 times, More than 10 times (<i>n</i> = 13; 5%)		10.73 (.005)	.128	Gender Alcohol abuse or dependence	3.85 (.05) 4.06 (.044)

All *p*-values in bold are significant at $\alpha = .05$

Abbreviations: HRBS = HIV Risk-taking Behavior Scale