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Gender Differences in HIV Sexual Risk Behaviors among Clients of Substance Use Disorder Treatment Programs in the US

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Abstract

This study examined differences in sexual risk behaviors by gender and over time among 1281 patients (777 males and 504 females) from 12 community-based substance use disorder treatment programs throughout the United States participating in CTN-0032, a randomized control trial conducted within the National Drug Abuse Treatment Clinical Trials Network. Zero-inflated negative binomial (ZINB) and negative binomial (NB) models were used in the statistical analysis. Results indicated significant reductions in most types of sexual risk behaviors among substance users regardless of the intervention arms. There were also significant gender differences in sexual risk behaviors. Men (compared with women) reported more condomless sex acts with their non-primary partners (IRR=1.80, 95% CI=1.21–2.69) and condomless anal sex acts (IRR=1.74, 95% CI=1.11–2.72), but fewer condomless sex partners (IRR=0.87, 95% CI=0.77–0.99), condomless vaginal sex acts (IRR=0.83, 95% CI=0.69–1.00), and condomless sex acts within two hours of using drugs or alcohol (IRR=0.70, 95% CI=0.53–0.90). Gender specific intervention approaches are called for in substance use disorder treatment.

Keywords

Sexual risk behavior; Gender difference; Substance use disorders treatment; Condomless sex; Zero inflated negative binomial models

1. Introduction

Behaviors of substance users such as injection practices, risky sexual acts, and sub-optimal rates of adherence to treatment regimens of those who are HIV-infected continue to place substance users at high rates of HIV transmission and acquisition (Khan et al., 2013;

Nicholas et al., 2014; Vlahov, Robertson, & Strathdee, 2010). Although the HIV infections attributed to heterosexual contact have been decreasing in recent years, heterosexual transmission is still the second highest transmission category in the US, after male-to male sexual contact, and before injection drug use (CDC, 2013). At the end of 2010, approximately 11% and 72% of the new infections were attributed to heterosexual contact for men and women, respectively (CDC, 2013). Substance users are more likely than the general population to engage in sexual risk behaviors such as trading sex for drugs or money, vaginal or anal intercourse without using a condom, and sex with multiple partners (Avin et al., 1994; Booth, Kwiatkowski, & Chitwood, 2000; Cooper, 2006; Raj, Saitz, Cheng, Winter, & Samet, 2007). In a study of 26,982 current drug users recruited from 22 cities in the United States, Booth et al. (2000) found that more than 80% reported having not used a condom during sex in the past 30 days. Although sexual risk behaviors often co-occur with drug use, there is a lack of research and evidence on reductions of sexual risk behaviors through participation in substance use disorder treatment (Meader, Li, Des Jarlais, & Pilling, 2010). Research has shown inconsistent results and effective approaches for reducing sexual risk behaviors among drug users continue to be elusive (Metzger, Woody, & O'Brien, 2010).

There have been few recent studies among persons with substance use disorders that have examined gender differences in sexual risk behaviors associated with HIV transmission and acquisitions; furthermore, studies conducted have conflicting findings. Some have found that men have higher risk (Absalon et al., 2006; Do & Meekers, 2009) while others found that women do (Elifson, Klein, & Sterk, 2006; Rowan-Szal, Chatham, Joe, & Simpson, 2000). Yet, others found no gender difference in heterosexual contact with multiple partners (Mackinnon, Lockwood, & Williams, 2004; Muthén & Muthén, 2013), or in risky sexual intercourse (Mackinnon et al., 2004; Rasch et al., 2000). Further study is needed to identify potential gender differences in HIV sexual risk behaviors in order to develop effective HIV prevention intervention strategies for substance users.

The CTN HIV Rapid Testing and Counseling Study (NIDA CTN 0032) was a randomized controlled trial that examined the effectiveness of on-site rapid testing with and without risk-reduction counseling in increasing HIV testing, receiving HIV test results and reducing HIV sexual risk behaviors among clients from 12 geographically diverse community-based substance use disorder treatment programs in the US (Metsch et al., 2012). No significant difference was identified for overall sexual risk behaviors, i.e. condomless intercourse, amongst the three intervention groups at the six month follow-up. Gender differences in specific sexual risk behaviors were not examined. In this study, we conducted a secondary analysis to 1) evaluate gender differences in changes in sexual risk behaviors from the six month follow up to baseline; 2) identify potential gender differences across time for sexual risk behaviors, 3) evaluate whether there were gender differences in intervention effects on sexual risk behaviors of the interventions.

2. Methods

2.1 Parent Study

The parent study, NIDA CTN 0032, is described elsewhere in detail (Metsch et al., 2012). Before being offered HIV testing, participants were stratified by site, gender, and ethnicity

and randomized to one of three conditions: 1) referral for off-site HIV testing; 2) on-site rapid HIV testing with 30 minutes risk-reduction counseling based on the intervention from the RESPECT-2 study (Metcalf et al., 2005) and 3) on-site rapid HIV testing with information only. All eligible participants were receiving or seeking substance use disorder treatment services at the participating sites. Participants inclusion criteria were 1) 18years old, 2) reported negative or unknown HIV status, 3) had not been tested and received results for HIV testing within the past 12 months, and 4) be able and willing to provide informed consent. All study procedures were reviewed, approved and overseen by multiple institutional review boards.

2.2 Assessment of Sexual Risk Behaviors

Audio computer-assisted self-interviews (ACASIs) were used at baseline to obtain participants' demographics and sexual risk behaviors. We adapted ACASI questions used in prior studies that correlate with HIV seroconversion and were well-accepted by participants (Koblin et al., 2006). Questions about risky sex behaviors included number of partners with condomless sex acts and count of condomless sex acts over the past six months. Both partners and sex acts were assessed by whether the sexual partner was a primary partner or non-primary partner, site of penetration, use of protection, use of substances before engaging in sexual intercourse and partners' HIV status. We defined condomless sex acts as vaginal or anal sexual intercourse without condom use. If the sex act started with a condom and then the condom came off during penetration, or if penetration started without a condom and then used a condom, both were counted as condomless sex.

For the "count" of sex behaviors, we asked participants to separately count each distinct sex act. For example, if on one occasion they had both vaginal and anal sex, this would count as two acts. As another example, if on one occasion, the participant was involved in repeated sex acts (say three acts of vaginal sex) with the same partner or with different partners, this would be counted as three times. Count of sexual behaviors in the past six months were separately assessed by the characteristics of the act and/or the partner. These counts of sex acts were cross-classified by the following: the partner type - primary partner or non-primary partner, site of penetration - vaginal or anal, substance use - with or without, and HIV status of the partner- positive, negative and unknown. "Primary" partner was defined as a man/ woman with whom the participant "felt a special emotional commitment" or someone the participant dated or would call his/her boyfriend/girlfriend, spouse, significant other, or life partner. Participants were then asked about the number of times the participant had vaginal or anal intercourse, for example, "in the past six months, how many times did you have vaginal sex or anal sex with your most recent primary partner?", and the number of times he/she had sexual intercourse when high or drunk, for example, "how many of these times were you high on any drugs (including prescription drugs) or drunk or buzzed on alcohol within 2 hours before or during sex?", separately for primary partners and non-primary partners. Participants were also asked about the number of their sexual partners that they believed were HIV-positive, negative, and had an unknown serostatus, for example "of these men, how many did you believe were HIV-positive and had no reason to doubt it? How many actually told you they were HIV-positive and you had no reason to doubt it?" etc. Condomless oral sex was excluded due to its lower HIV transmission risk relative to vaginal

and anal intercourse (Vittinghoff et al., 1999). The ACASI was repeated at the six month follow-up assessment.

2.3 Statistical Analysis

SAS 9.3 was used for all data analyses (SAS Institute, Cary, NC, USA). Descriptive statistics were used to characterize participant race/ethnicity, age, education and other socio-demographics. We assessed bivariate and multivariable association tests of participants' demographics and gender using a Cochran-Mantel-Haenszel analysis.

Sexual risk behaviors, the outcomes used in our analysis were count variables, which were positively skewed with over dispersion and considerable zero-inflation. Based on these considerations, Poisson, negative binomial (NB), zero-inflated Poisson and zero-inflated negative binomial (ZINB) models were examined for the best fit using the Akaike information criterion (AIC) and Bayesian information criterion (BIC). The goodness of fit rankings of AIC and BIC from all models were consistent. Zero-inflated negative binomial models were found to have the best fit to estimate the number of condomless sex acts while negative binomial model was a better fit to estimate the number of partners with which condomless sex acts occurred. Therefore, two types of models were applied accordingly. The statistical approach of ZINB is a mixture model with a logistic part for assessing zero-inflation and a negative-binomial part for the over-dispersed count data.

First, we examined whether there was a significant three way interaction among gender, time, and intervention arms for the sexual risk behaviors outcomes. If the interactions were significant, then stratified results were reported. However, if the interactions were not significant, we checked the main effects of time and gender differences. Predicted probabilities of abstinence from condomless sex acts and the expected number of participants' condomless sex acts partners, counts of different types of condomless sex acts were reported. Analysis were adjusted for covariates including ethnicity, age, education, marital status, income, ever tested for HIV and history of incarceration associated with sexual risk behaviors outcomes with $p < 0.2$ in bivariate analyses. Interpretation of results were based on the values and corresponding 95% confidence intervals (CIs) of the odds ratios (ORs, for participant abstinence from condomless sex acts) and incidence rate ratios (IRRs, level of risk for non-abstinent participants). To protect against the false discovery rate due to multiple comparisons, probability values were adjusted using the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995).

3. Results

3.1 Participant Characteristics

Participant baseline demographics of the study sample ($n=1281$) are presented in Table 1. A total of 777 men and 504 women participated in the study. The 6-month retention rate was 93% ($n=1194$). About 60% of men and 57% of women reported having condomless sex acts at baseline; 38% of men and 17% of women had not been HIV tested before.

3.2 Interactions of Gender, Time and Intervention

There was a significant three-way interaction amongst gender, time and intervention arms ($\chi^2(2)=6.48$, $p=0.039$) for condomless sex acts with primary partner. There was also a significant interaction among gender, time and intervention arms ($\chi^2(1)=4.26$, $p=0.039$) in the zero-inflation portion of the model for condomless anal sex acts. However, when examining intervention arms differences within women and men, none of the simple comparisons amongst the three intervention conditions were statistically significant. There were no significant three-way interactions with any other of the risk behaviors. Further analysis revealed that there were no significant two-way interactions between gender and time, or time and intervention arms.

3.3 Sexual Risk Behavior Change

Significantly more abstinence from sexual risk was reported at 6-month follow-up compared to baseline for all types of sexual risk behaviors except for condomless sex acts with HIV+ positive partners (Table 2). There were significant reductions in number of condomless sex partners (IRR=0.51, 95% CI=0.45–0.57, $p<0.001$), condomless anal sex acts (IRR=0.74, 95% CI=0.63–0.88, $p<0.001$), condomless sex acts with primary (IRR=0.76, 95% CI=0.65–0.90, $p=0.001$) and non-primary partners (IRR=0.61, 95% CI=0.41–0.90, $p=0.014$), condomless vaginal sex acts (IRR=0.77, 95% CI=0.65–0.90, $p=0.002$), condomless sex acts within two hours of using drugs or alcohol (IRR=0.53, 95% CI=0.42–0.68, $p<0.001$), and condomless sex acts with unknown serostatus partners (IRR=0.56, 95% CI=0.39–0.81, $p=0.002$) at 6-month follow-up compared to baseline. However, there were non-significant declines in the number of condomless anal sex acts, condomless sex acts with HIV positive partners or with HIV negative partners.

3.4 Gender Difference

Gender difference of predicated probabilities of abstinence of condomless sex in the past six months are presented in figure 1 while the gender difference of predicted number of condomless sex acts in the past six months are presented in figure 2. Specifically, men showed fewer partners with condomless sex than women (IRR=0.87, 95% CI=0.77–0.99, $p<0.05$). Men also showed greater odds of abstaining from condomless sex acts with primary partners (OR=1.27, 95% CI=1.03–1.57, $p<0.05$), non-primary partners (OR=1.40, 95% CI=1.00–1.97, $p<0.05$) and HIV unknown serostatus partners (OR=1.62, 95% CI=1.25–2.10, $p<0.001$) than women. However, men reported significantly higher rates of condomless sex acts with non-primary partners (IRR=1.80, 95% CI=1.21–2.69, $p<0.01$) and condomless anal sex (IRR=1.74, 95% CI=1.11–2.72, $p<0.05$), while lower rates of condomless vaginal sex acts (IRR=0.83, 95% CI=0.69–1.00, $p<0.05$), and condomless sex acts within two hours of using drugs or alcohol (IRR=0.70, 95% CI=0.53–0.9, $p<0.01$) than did women. No significant gender differences were identified in the overall number of condomless sex acts or condomless sex acts with HIV-negative partners.

4. Discussion

We observed significant reductions in most types of sexual risk behaviors in the forms of increased abstinence and decreased number of condomless sex acts among participants in

substance use disorder treatment. These findings provided evidence that substance use disorder treatment may lead to HIV risk reduction. Several previous studies have shown similar results, for example, Longshore et al. suggested that methadone maintenance treatment is successful in reducing sexual risk behaviors (Longshore, Hsieh, & Anglin, 1994). Another study reported that greater lifetime exposure to substance use disorder treatment was associated with less risky sexual behavior among drug users (Longshore & Hsieh, 1998). It is possible that substance use disorder treatment may influence disengagement from sex-related HIV risk behaviors and raise patient self-efficacy for risk reduction as has been shown in previous studies with a non-substance use disorder treatment control group (Longshore et al., 1994). However, overall, previous studies only demonstrated that substance use disorder treatment is an effective strategy for prevention in reducing risky injection behaviors, and results are less robust for reduction of sexual risk behaviors among IDUs (Sorensen & Copeland, 2000). Furthermore, most studies were only focused on patients in methadone maintenance treatment (Sorensen & Copeland, 2000).

For the most part, gender differences in sexual risk behaviors showed women to have higher levels of risk, than men. First, women had more unprotected sex with primary partners and partners of unknown HIV status than men. Previous studies have reported that women perceive themselves as having less power than men in their sexual relationships (Gollub, Rey, Obadia, & Moatti, 1998; Riehmman, Kral, Anderson, Flynn, & Bluthenthal, 2004; Tortu, Beardsley, Deren, & Davis, 1994; Tortu et al., 1998). In fact, Stuart et al. (2013; 2009) suggested strong connections between substance abuse and intimate partner violence, including physical and sexual violence, among women. It is possible that women felt less comfortable than men asking their partner to wear a condom. The tendency of women to have greater difficulty than men to negotiate condom use or refuse to have condomless sex may be a potential explanation for the gender differences in sexual risk behaviors that we found (CDC, 2012a, 2012b; Iguchi, Bux Jr, Kushner, & Lidz, 2001).

Second, we found that women reported 30% more condomless sex acts within two hours of using drugs or alcohol compared to men in our sample. Rawson et al. (2002) also demonstrated a strong association between drugs and sex among substance use disorder treatment clients with gender disparities in the nature and severity of these problems, however, they found fewer females endorsed the drug-sex association compared to males. Previous studies indicated that women were less likely to use drugs or develop drug related problems than men (Greenfield, Manwani, & Nargiso, 2003). However, substance using women tend to progress to substance use problems more quickly than men, and report more severe substance use problems and more health related consequences from substance use (Brady & Randall, 1999; Fiorentine, Anglin, Gil-Rivas, & Taylor, 1997). Another potential explanation is that substance using women are more likely than men to trade sex for drugs (Celentano, Latimore, & Mehta, 2008). However, information about sexual trading was not collected in our study.

Third, we noticed a seeming contradiction in the comparisons of two particular types of sexual risk behaviors between men and women: condomless sex with non-primary partners and condomless anal sex acts. Men were more likely to abstain from both sexual risk behaviors than women. Yet non-abstinent men reported more of each of these two

condomless sex acts than did women. This suggests there are two separate groups of male drug users, i.e. low sexual risk abstinent men and high sexual risk non-abstinent men. Future studies are needed to identify if these two groups are found in other samples and whether these groups might respond to treatment differently.

Several limitations of this study should be noted. First, reports of HIV risk behaviors are based on a self-report survey. Recall bias or social desirability may influence self-report, although social desirability may be less of a problem when using ACASI than in face-to-face interviews (Ghanem, Hutton, Zenilman, Zimba, & Erbelding, 2005). Second, we do not have a no-treatment control to ascertain the causal impact of substance disorder treatment on the observed decline in sexual risk. In spite of these limitations, this study has important strengths, including the use of a large, geographically and ethnically diverse sample from 12 community-based substance use disorder treatment programs in the US.

Tailoring based on gender was found to be especially successful in behavior interventions that promote condom use (von Sadvoszky, Draudt, & Boch, 2014). Research within NIDA CTN (Calsyn et al., 2009; Greenfield et al., 2011; Tross et al., 2008) also demonstrated that, men and women in gender-specific HIV risk prevention interventions were more likely to reduce their HIV risk behaviors especially when three or more sessions were attended and when results were examined at the six month follow-up. It is suggested that future gender specific intervention approaches need to be developed to promote condom use and reduce sexual risk behaviors in substance use disorder treatment.

This study offers unique findings of associations between substance use disorder treatment and reductions in sexual risk behaviors from a randomized controlled trial among people in substance use disorder treatment programs in the US. It also provides evidence of gender differences in particular types of sexual risk behaviors. Results for men suggest two different types of risk profiles. Future research should confirm the existence of these two profiles and target men with the less abstinent profile with risk prevention interventions.

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Figure 1.
Gender differences of predicated probabilities of abstinence of condomless sex in the last six months

Figure 2.
Gender differences of predicated number of condomless sex acts in the last six months

Table 1

Descriptive of Characteristics Stratified by Gender

	Men	%	Women	%	Total	%
	N=777		N=504		N=1281	
Race/ethnicity **						
Hispanic	77	10	70	14	147	11
Black or African American	166	21	119	24	285	22
White	491	63	267	53	758	59
Other	43	6	48	10	91	7
Age						
18-29	193	25	92	18	285	22
30-39	182	23	124	25	306	24
40-49	240	31	176	35	416	32
50-59	140	18	98	19	238	19
60	22	3	14	3	36	3
Education **						
Less than high school	232	30	121	24	353	28
High school	488	63	325	64	813	63
College or more	57	7	58	12	115	9
Marriage status ***						
Married	123	16	81	16	204	16
Unmarried, living w/partner	66	8	53	11	119	9
Widowed	16	2	33	7	49	4
Divorced or separated	198	25	158	31	356	28
Single	374	48	179	36	553	43
Income ***						
<\$10,001	465	61	352	71	817	65
\$10,001-40,000	248	32	138	28	386	31
>\$40,000	54	7	8	2	62	5
Sex Behavior						
No sex acts	182	23	139	28	321	25
Have sex with condom use	125	16	80	16	205	16
Have sex without condom use	470	60	285	57	755	59
Ever tested for HIV ***						
Never test before	295	38	87	17	382	30
HIV test before	476	62	416	83	892	70
Ever in jail ***						
Never	143	18	162	32	305	24
Jailed before (not in past 6 month)	407	52	265	53	672	52
Jailed in past 6 month	227	29	77	15	304	24

* Note. $p < .05$.

**
 $p < .01$.

 $p < .001$

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Table 2**Sexual Risk Behaviors at Baseline and 6-Months**

		Abstinence (Zero-Inflation Portion of Model)			
		Baseline ^a	6-Months ^a	OR ^c (95% CI)	p ^e
Number of condomless sex acts		30%	39%	1.51 (1.22, 1.87)	<0.001 [^]
By Partner type	Primary	43%	48%	1.22 (1.01, 1.46)	0.037 [^]
	Non-primary	36%	61%	2.87 (1.34, 6.11)	0.007 [^]
By Site of penetration	Vaginal	31%	41%	1.51 (1.22, 1.87)	<0.001 [^]
	Anal	42%	63%	2.37 (1.55, 3.62)	<0.001 [^]
With Substance use		44%	68%	2.69 (2.14, 3.39)	<0.001 [^]
By Partners' HIV status	HIV+	98%	99%	2.08 (0.73, 5.89)	0.169
	HIV–	51%	45%	0.80 (0.65, 0.97)	0.025 [^]
	Unknown	63%	86%	3.57 (2.76, 4.62)	<0.001 [^]
		Level of Risk (Negative Binomial Portion of Model)			
		Baseline ^b	6-Months ^b	IRR ^d (95% CI)	p ^e
Number of condomless partners		2	1	0.51 (0.45, 0.57)	<0.001 [^]
Number of condomless sex acts		45	34	0.74 (0.63, 0.88)	<0.001 [^]
By Partner type	Primary	47	36	0.76 (0.65, 0.90)	0.001 [^]
	Non-primary	7	5	0.61 (0.41, 0.90)	0.014 [^]
By Site of penetration	Vaginal	43	33	0.77 (0.65, 0.90)	0.002 [^]
	Anal	2	1	0.67 (0.43, 1.04)	0.073
With Substance use		25	13	0.53 (0.42, 0.68)	<0.001 [^]
By Partners' HIV status	HIV+	15	7	0.50 (0.05, 4.58)	0.538
	HIV–	36	33	0.90 (0.75, 1.09)	0.288
	Unknown	40	22	0.56 (0.39, 0.81)	0.002 [^]

^aNote. Probabilities of abstinence for condomless sex in the past six months, provided by the Zero-Inflation Portion of the Model

^bEstimated number of condomless sex acts in the past six months, provided by the Negative Binomial Portion of the Model

^cOdds ratio from the logistic part of the zero-inflated negative binomial model which assesses zero-inflation

^dIncidence rate ratio from the negative-binomial part of the zero-inflated negative binomial model which assesses the over-dispersed count data

^e[^] indicate significant with Benjamini-Hochberg procedure