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Sexual Risk Behavior Associated with Transition to Injection Among Young Non-injecting Heroin Users

Mary Ellen Mackesy-Amiti, **Basmattee Boodram**, **Chyvette Williams**, **Lawrence J. Ouellet**, and **Dita Broz**
Division of Epidemiology and Biostatistics, School of Public Health, University of Illinois at Chicago, Chicago, Illinois, USA

Abstract

The aim of this study was to investigate the effects of transitioning from non-injection heroin use to injection drug use on sexual risk behavior. Non-injecting heroin users age 16–30 were enrolled from 2002 to 2005, and were re-interviewed at six-month intervals for up to three years; 561 participants completed at least one follow-up interview. The majority of participants were non-Hispanic (NH) Black (54%), 23% were Hispanic, and 21% were NH white. During follow-up, 154 participants (27.5%) transitioned to injecting drugs. Logistic regression analyses were conducted using generalized estimating equations (GEE) to estimate the effect of transition to injection drug use on changes in sexual risk behavior during follow-up. Transition to injection drug use during follow-up was associated with increased likelihood of sexual risk behavior, especially for men. Harm reduction efforts that focus on preventing initiation or return to injection among non-injecting drug users may also ameliorate HIV sexual risk behaviors.

Keywords

injection drug use; non-injecting; heroin; sexual risk behavior; HIV risk

Introduction

Within the last decade there has been increased attention on sexual risk factors for human immunodeficiency virus (HIV) and, to a lesser extent, hepatitis C (HCV) infections among injection drug users (IDUs). Interventions to combat HIV by targeting injection-related risks in this population--including behavioral interventions, syringe exchange programs, and access to syringes in pharmacies--have led to a substantial decline in HIV incidence in this population (1). Recent studies, however, have highlighted the HIV and HCV risks associated with sexual behavior among male and female IDUs (2–8). For HCV, although the extent of sexual transmission is still being debated, even a low rate of transmission can account for a large number of cases given the high prevalence of this infection (an estimated 4.1million U.S. residents) (9). Injection drug users frequently engage in risky sexual behaviors that increase their susceptibility to infection with HIV, HCV, and sexually transmitted-infections (STIs) through sex with multiple partners, sex without condoms, and exchanging sex for money or drugs, and increase the likelihood of transmitting these viral and bacterial infections to their partners.

In particular, men who have sex with men who also inject drugs are at increased risk for HIV infection (7, 10–12). For women who inject drugs, HIV infection has been associated

Correspondence to: Mary E. Mackesy-Amiti, University of Illinois at Chicago, 1603 W. Taylor St., Chicago, IL 60612, Tel. (312) 355-4892, Fax: (312) 996-1450, mmamiti@uic.edu.

with having a STI (11, 12), having a male sex partner who is an IDU (10, 11), and exchanging sex for money (12). Female IDUs are more likely than male IDUs to have sexual relationships with partners who inject drugs, and these relationships are often with older men who have a greater likelihood of being HCV-infected (13).

Transition to a parenteral route of drug administration from oral or nasal routes greatly increases the potential for acquisition and transmission of HIV and other bloodborne infections because of the efficiency of injection as a mode of HIV transmission. Factors that are associated with transition to injection drug use have been examined in prior studies (14–22), some of which explored sexual risk issues. For example, results from a prospective study of adolescent and young adult drug users in Baltimore indicate that non-blacks (primarily White) were more likely to transition to injecting drugs, and sex trading was associated with transitioning to drug injection for young women (14). Similarly, among aboriginal peoples in Western Canada, sex work was found to be associated with transitioning from non-injection to injection drug use (15). These studies suggest sex trading may precede or, at a minimum, be associated with initiating injection drug use. However, one question that has not been adequately addressed is whether the transition from non-injection drug use to injection drug use is associated with an increase in risky sexual behaviors. That is, does sexual risk behavior increase concurrently with the transition to injection, or does sexual risk behavior precede the transition to injection? In this paper, we use longitudinal data from a sample of young non-injection heroin users to examine the association between transitioning to injecting drugs and increase in sexual risk behaviors.

Methods

Sample recruitment and study procedures

Data for this study come from the Non-Injecting Heroin Use, HIV, and Injection Transitions Study (NIHU-HIT), a prospective study that used an open cohort design with continuous sampling to investigate the incidence and risk factors for transitions to drug injection and the prevalence, incidence, and risk factors for infection with HIV, HBV, and HCV among young NIHU recruited in community-based settings. All participants provided written consent. The University of Illinois at Chicago Institutional Review Board approved the study procedures. Additional study details are described elsewhere (23).

Participants were recruited between June 2002 and January 2005 using a combination of street outreach and coupon-based chain-referral methods. Eligible participants were 16–30 years old, current NIHU, and English or Spanish speakers. Former injection drug users (IDUs) were eligible if they had not injected in the 6 months prior to the baseline interview. Outreach staff recruited potential participants in Chicago neighborhoods with a high prevalence of illicit drug use and drug markets. For the final 6 months, recruitment was restricted to NIHU 16–23 years old to augment the sample size for this group. Each participant was given 3–6 recruitment coupons to pass to peers and compensated $15 for each person who met the eligibility requirements. Potential participants were given an option to enroll in a concurrent study of 15–30 year old IDUs (24), thus minimizing the need to misrepresent their mode of drug use for the purpose of enrolling in this study. Current heroin use (past 3–5 days) was validated using a urine test for opiate metabolites (Biotechnostix, Canada) and project staff examined participants arms and other visible body parts for recent injection marks. Those with fresh marks or who indicated during any of the study interviews that they injected in the 6 months prior to enrollment were excluded from the study.

All participants were offered pre- and post-test counseling and testing for antibodies to HIV and hepatitis C, and for prior or current hepatitis B infection. Those who tested positive were

informed of treatment options and referred for medical, substance abuse and other social services. Those who tested HBV negative were referred for HBV vaccination.

Follow-up data collection was scheduled at 6-month intervals for up to 3 years between December 2002 and August 2006. At each visit, participants completed a 1–2 hour audio-computer-assisted self-interview (ACASI) in a private room. Participants were compensated $30 at baseline and $35 at follow-up. Of the total sample (N=689), we restricted our analysis to those with at least one follow-up interview (N=561, male=352, female=209) for both the baseline and longitudinal analyses. Previous analyses of loss to follow-up (25) indicated that Non-Hispanic (NH) Whites, males, and those who reported an illegal source of income in the 6 months prior to baseline interview were less likely to complete at least one follow-up interview and contributed fewer mean days to follow-up. Additional chi-square and mean analyses were computed to assess associations of loss to follow-up with baseline sexual risk behavior and injection history. Participants with a history of injection completed fewer interviews and contributed fewer mean days to follow-up; participants who reported a sex partner who injected drugs also completed fewer follow-up interviews. Other sexual risk behaviors did not have significant associations with loss to follow-up.

Measures

Participants provided information on socio-demographic characteristics, current and past drug use, and sexual activity.

Socio-demographics—Age was measured as a continuous variable. Race/ethnicity categories were non-Hispanic Black, non-Hispanic White, Hispanic, and other race/ethnicity. Due to the small number of other race/ethnicity (n = 10), this category was combined with Hispanic. High school graduation was used as an indicator of education. Homelessness during the past six months was measured by the questions, “Right now, do you consider yourself homeless,” and “Was there a time during the last 6 months when you considered yourself homeless?”

Heavy alcohol use—As a measure of heavy alcohol use, participants were asked, “Out of the last 30 days, on how many days did you have 5 or more drinks?”

Injection and non-injection drug use—Former drug injection was determined by asking participants, “Have you ever injected drugs, even if you only did it once?” At baseline, non-injection drug use was reported for the past six months, and at each follow-up visit participants were asked about substances used since the last interview, including injection and non-injection use. Substances included alcohol, marijuana, powdered cocaine, rock cocaine (crack), heroin alone, heroin and cocaine together (speedball), Ritalin, heroin and Ritalin mixed together, prescription opiates, amphetamines, Ecstasy (MDMA), tranquilizers or barbiturates, nitrous oxide, other inhalants, PCP, LSD and other hallucinogens, GHB or ketamine, and marijuana with cocaine. Participants were asked their age of first use, and their frequency of use (months, days per month, and times per day) in the past six months for each substance. In the follow-up interviews participants were asked separately about their injection and non-injection use of each substance. Injection drugs included speedball, heroin by itself, cocaine by itself, crystal methadrine, and “any other drug.”

Sexual activity—Participants were asked if they currently had a main sex partner, or if they had had one in the last six months. If they did, they were asked a series of questions about that partner and their sexual activities with that partner, including 1) whether they had vaginal sex in the last six months, 2) how often a condom was used during vaginal sex (7-

point scale, 1=all the time to 7=never), 3) whether they had anal sex in the last six months, 4) how often a condom was used during anal sex, 5) whether the partner had ever injected drugs, and 6) whether the partner had injected drugs in the past 6 months. For male participants with male partners, separate questions were asked about receptive and insertive anal sex.

Participants were then asked for the number of (other) people they had sexual contact with during the last six months. If they had other partners, they were asked questions about their sexual activities with those partners, including whether they had had vaginal sex and anal sex, how often a condom was used during vaginal sex and during anal sex, and whether any of the partners had ever injected or currently injected drugs.

Participants were asked how often in the past six months they had given someone sex for money, heroin, other drugs, and shelter, food, or clothing, and they were asked how often they had used a condom during these exchanges.

Binary indicators were created for past six month behaviors: 1) any unprotected vaginal or anal sex, 2) unprotected vaginal or anal sex with main partner, 3) unprotected vaginal or anal sex with non-main partner, 4) anal sex with any partner, 5) unprotected anal sex with any partner, 6) male unprotected anal sex with a male partner, 7) providing sex in exchange for money, drugs, shelter, food or clothing (trading sex), 8) unprotected trade sex, 9) giving someone money, drugs, etc. in exchange for sex (buying sex), 10) sex with a partner who ever injected drugs, and 11) sex with a current injection drug user.

Analyses

Baseline analysis—We conducted logistic regression analyses on baseline sexual risk behaviors to examine differences between participants who transitioned to injection during the study period and those who did not. Analyses were stratified by gender, and age, race/ethnicity, education, homelessness, and baseline injection history were included as covariates.

Longitudinal analysis—We conducted logistic regression analyses using generalized estimating equations (GEE), regressing sexual risk outcomes on injection drug use, adjusting for baseline injection history, sociodemographic variables, days of heavy drinking, and the lagged effect of injection drug use. The lagged value of the sexual risk outcome was also included. Lagged variables were the past 6-months behaviors reported in the previous (or last available) reporting period. By adjusting for previous sexual behavior, we obtain the effects of current and prior injection on change in sexual risk behavior. Analyses were conducted in Stata 11 using the -xtlogit- procedure, with the population-averaged model option and the Huber-White Sandwich estimate of standard errors, adjusting for clustering within subject. Analyses were repeated with the addition of non-injection drug use variables in a step-wise manner.

Results

Sample

Baseline sociodemographic characteristics of the sample are shown on Table 1. Fourteen percent (n = 78) of the baseline sample reported a prior history of injection drug use. During follow-up, 154 participants (27.5%) transitioned to injecting drugs. Of these, 42 (27%) had a prior history of injection drug use.

Baseline sexual behavior

Prevalence rates of sexual risk behaviors in the last six months prior to baseline, and adjusted odds ratios for associations with injection during follow-up are reported on Table 2. Baseline sexual risk behaviors were significantly associated with cohabitation, race/ethnicity, education, and homelessness (not shown). Most unprotected sex occurred in the context of main partner relationships, and men and women who were cohabiting were more likely to engage in unprotected sex with a main partner (men: AOR=5.43, 95% CI 2.63–11.21; women: AOR=1.98, 95% CI 0.95–4.12). White women were more likely than Black women to report unprotected sex with a main partner (AOR=3.99, 95% CI 1.22–13.01), and were more likely than Black women to have a sex partner who ever injected drugs (AOR = 5.18, 95% CI 1.09–24.64).

Unprotected sex with a non-main partner was more likely among homeless men (AOR=2.07, 95% CI 1.07–4.00), and less likely among White men than Black men (AOR=0.37, 95% CI 0.16–0.84). Homeless men were also more likely to report trading sex for money, drugs, or goods (AOR=3.40, 95% CI 1.39–8.35), and more likely to report buying sex as well (AOR=4.29, 95% CI 1.65–11.17). White men were less likely than Black men to trade sex (AOR=0.13, 95% CI 0.03–0.56), to have unprotected trade sex (AOR=0.07, 95% CI 0.01–0.53), to have anal sex (AOR=0.31, 95% CI 0.15–0.65), and unprotected anal sex (AOR=0.42, 95% CI 0.20 – 0.88), and to have more than one sex partner (AOR=0.49, 95% CI 0.25–0.98).

Black women were more likely to report trading sex compared to non-Black women (AOR = 13.65, 95% CI 2.39 – 78.13). Among women, trading sex increased with age (AOR = 1.18, 95% CI 1.05–1.32) and was less likely among high school graduates (AOR 0.40, 95% CI 0.17–0.91). Unprotected trade sex and buying sex were reported only by Black women. Women who were cohabiting were less likely to have more than one sex partner (AOR = 0.42, 95% CI 0.21–0.84), and more likely to have anal sex (AOR = 2.61, 95% CI 1.31 – 5.22) and unprotected anal sex (AOR = 2.34, 95% CI 1.17 – 4.68).

Among men, transition to injection during the follow-up period was associated with baseline sexual behaviors (see Table 2), including trading sex ($p = .004$), unprotected trade sex ($p = .002$), and having an IDU sex partner ($p = .001$). Among women, transition to injection during the follow-up period was not significantly associated with baseline sexual risk behavior.

Longitudinal analysis

Tables 3 and 4 present the adjusted odds ratios for the effect of injection on change in sexual risk behaviors during follow-up for men and women, and the predicted probabilities of sexual risk behaviors by injection drug use. Due to the low prevalence of trading sex among White and Hispanic men, and zero prevalence of sex trading reported by White women, it was necessary to combine race/ethnicity categories in those analyses so that non-Hispanic Black race/ethnicity was contrasted with all others.

Among men, injection drug use during the follow-up period was associated with increased likelihood of any unprotected vaginal or anal sex ($p = .006$), unprotected sex with non-main partners ($p < .001$), any anal sex ($p = .004$), unprotected anal sex ($p = .001$), trading sex ($p < .001$), buying sex ($p = .001$), and having an IDU sex partner (ever or current. $p < .001$). Among women, injection during follow-up was associated with increased likelihood of trading sex ($p = .025$), and having an IDU sex partner (ever or current, $p < .001$). In all models, the lagged effect of the sexual risk outcome variable was significant ($p<.02$). The lagged effect of injection drug use was significant only for unprotected trade sex among men

(p<.001). The addition of non-injection drug use variables, including crack cocaine, did not have a substantive effect on the estimates for injection drug use (data not shown).

Additional analyses (not shown) were conducted to explore race/ethnicity differences for significant effects. A marginal interaction between injection and race/ethnicity was found for men on unprotected sex with a non-main partner (p = .07) such that the effect of injection was greatest for Hispanic men (OR = 7.79, 95% CI 3.29–18.48). Since trading sex was not reported by any White women we repeated the analysis for non-White women only; the effect of injection on trading sex was significant for non-White women (AOR = 2.27, 95% CI 1.03–5.01). Other outcomes did not vary by race/ethnicity.

Discussion

Transition to injection drug use was associated concurrently with increased likelihood of several risky sexual behaviors. In all the analyses, sexual behavior during the previous reporting period predicted current sexual behavior, while prior injection drug use (the lagged effect) for the most part did not predict changes in sexual behavior.

Among male non-injecting heroin users, trading sex, unprotected trade sex, and having an IDU sex partner at baseline were significantly associated with later injection. There were also borderline effects for unprotected sex with a non-main partner (p = .053), anal sex (p = .072), and unprotected anal sex (p = .069). During follow-up, transition to injection was associated with increased likelihood of unprotected sex with a non-main partner, anal sex and unprotected anal sex, and buying sex, as well as trading sex, unprotected trade sex, and having an IDU sex partner. The results suggest that the relationship between injecting and risky sexual behavior among young men who use heroin is such that men who engage in risky sexual behaviors (especially trading sex) are more likely to initiate or resume injecting, and that transitions from non-injection to injection drug use are also associated with an increased likelihood of risky sexual behavior. With the exception of having an IDU sex partner, the longitudinal associations were stronger than the baseline associations. Men who began injecting drugs were at increased risk for HIV through unprotected sex, including anal sex and trading sex, and through their partnerships with IDU sex partners.

Among female non-injecting heroin users, baseline sexual risk behaviors were not associated with later injection. During follow-up, transition to injection was associated with increased likelihood having an IDU sex partner. Transition to injection, for women, was not associated with unprotected sex. However, because unprotected sex with a main partner is the norm, having an IDU sex partner is likely to increase sexual risk. Injection drug use during follow-up was associated with increased likelihood of trading sex among minority women. Most minority women in the study resided in low-income urban neighborhoods with elevated levels of poverty and unemployment, and where sex work often was visible. In contrast, the majority of NH-White participants lived either in the suburbs or urban neighborhoods not marked by high rates of poverty and where visible sex work was rare.

For women who inject drugs, HIV risk is largely connected to sexual relationships with men who inject drugs; female IDUs who are sex partners of male IDUs are at dual risk for HIV infection through both injection and sexual risk. Although minority women were less likely than White women to transition from non-injection to injection heroin use (25), those who did tended to increasingly engage in high-risk sexual behavior.

The question of why sexual risk behavior increases among heroin users who transition to injection, particularly males, is not addressed in this study, and requires further research. One direction we would like to suggest, is to look at how the social networks of drug users change as they transition from non-injection to injection drug use.

Limitations

As with most studies of drug users, our sample is not necessarily representative of the population, in this case non-injecting heroin users. However, using multiple methods of recruitment increases the variability of the sample, and our sample is demographically mixed.

For low-prevalence outcomes, some cell sizes were small, resulting in wide confidence intervals for some estimates. This is particularly problematic when looking at race/ethnicity effects.

Although socially desirable responding regarding sexual and injection behaviors is probable, the use of computerized self-interviews instead of a face-to-face interview has been shown to minimize this occurrence (26, 27). The extent to which our findings are generalizable to other young NIHU is unknown. However, our use of multiple recruiting methods and the relatively large sample size augment confidence that our findings may be applicable to other young NIHUs.

Conclusion

Harm reduction efforts that focus on preventing initiation or return to injection among non-injecting drug users may also ameliorate HIV sexual risk behaviors. Moreover, interventions targeting young, recent onset IDUs for the prevention of HIV, HCV and STIs should address both injection and sexual risk behaviors at the individual level and the overlapping injection and sexual relationships within social networks. Such programs need to incorporate strategies that account for differences among men and women, as well as variations in risk contexts experienced by different racial or ethnic groups.

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Table 1

Baseline sociodemographic characteristics (N = 561)

	Frequency	Proportion
Sex		
Male	352	62.7
Female	209	37.3
Age (years)		
16–20	116	20.7
21–25	168	29.9
26–30	277	49.4
Mean (sd), Median	24.8 (4.1), 25	
Race/Ethnicity		
NH Black	305	54.4
NH White	117	20.9
Hispanic	129	23.0
Other	10	1.8
High school graduate		
Not applicable (<18 yrs)	15	2.7
No	325	57.9
Yes	221	39.4
Cohabitation		
No	408	72.7
Yes	153	27.3
Homeless past 6 months		
No	455	81.1
Yes	106	18.9
Resided outside of Chicago [a] (past 6 months)		
Yes	157	28.0
No	404	72.0
Ever injected drugs		
Yes	78	14.0
No	481	86.0

[a]Primarily Chicago metropolitan area; 4 lived in other cities in Illinois.

Table 2

Baseline sexual risk behaviors among young non-injecting heroin users and associations with injection drug use during follow-up

	Males					Females				
Past six months:	**N**	**%**	**AOR[a]**	**95%**	**Conf. Int.**	**N**	**%**	**AOR[a]**	**95%**	**Conf. Int.**
Any unprotected sex[b]	330	73%	1.38	0.76	2.49	199	73%	1.34	0.54	3.3
Unprotected sex[b] with main partner	331	65%	1.43	0.81	2.53	199	66%	1.38	0.59	3.23
Unprotected sex[b] with other partner	333	23%	1.91	0.99	3.67	201	19%	2.07	0.85	5.03
Any anal sex	333	38%	1.65	0.96	2.84	195	29%	0.90	0.39	2.09
Unprotected anal sex	331	33%	1.67	0.96	2.91	196	27%	1.04	0.45	2.38
Traded sex for money, drugs, other	346	10%	3.66	1.50	8.96	202	20%	2.35	0.74	7.44
Traded sex, unprotected	335	5%	6.68	2.04	21.87	185	8%	0.79	0.16	3.97
Bought sex	348	8%	2.00	0.83	4.80	205	6%	1.39	0.32	6.00
Current IDU sex partner	343	3%	16.01	3.25	78.87	204	5%	1.26	0.39	4.07
Ever IDU sex partner	344	5%	4.05	1.24	13.28	204	8%	2.68	0.91	7.91
More than 1 sex partner	338	41%	1.45	0.84	2.48	203	39%	0.92	0.44	1.93
MSM anal sex	352	3%	0.14	0.02	0.92			*Not applicable*		

[a] odds ratio for injection drug use during follow-up, adjusted for age, race, education, cohabitation, homelessness, and prior injection drug use

[b] vaginal or anal intercourse

Table 3

Estimated effect of injection drug use on sexual risk behaviors during 36-month follow-up period (GEE), Male Participants

	N	AOR[b]	95% CI	Pr(y|x=0)[c]	Pr(y|x=1)[d]
Any unprotected sex[a]	330	2.07	(1.23–3.48)	0.592	0.721
Unprotected sex[a] with main partner	331	1.30	(0.81–2.10)	0.501	0.555
Unprotected sex[a] with non-main partner	332	3.12	(1.89–5.13)	0.145	0.328
Any anal sex	327	2.25	(1.31–3.85)	0.184	0.313
Unprotected anal sex	329	2.60	(1.47–4.61)	0.149	0.291
Traded/sold sex for money, drugs, goods	341	5.90	(2.66–13.10)	0.028	0.128
Traded/sold sex, unprotected †	332	14.04	(2.09–94.38)	0.003	0.041
Bought sex	344	4.13	(1.80–9.48)	0.037	0.122
Current IDU sex partner	338	11.41	(5.30–24.56)	0.016	0.117
Ever IDU sex partner	339	5.50	(2.55–11.86)	0.046	0.153
More than 1 sex partner	342	1.40	(0.92–2.11)	0.270	0.336
MSM anal sex	345	0.96	(0.10–9.04)	0.027	0.026

[a] vaginal or anal intercourse

[b] adjusted for age, cohabitation, race/ethnicity, education, homelessness, heavy drinking, and lagged effects of injection and sexual risk outcome

[c] Predicted probability of outcome when injection = “no”

[d] Predicted probability of outcome when injection = “yes”

† significant lagged effect of injection drug use (p<.001)

Table 4

Estimated effect of injection drug use on sexual risk behaviors during 36-month follow-up period (GEE), Female Participants

	N	AOR[b]	95% CI	Pr(y|x=0)[c]	Pr(y|x=1)[d]
Any unprotected sex[a]	199	1.25	(0.62–2.53)	0.667	0.705
Unprotected sex[a] with main partner	202	1.36	(0.71–2.63)	0.594	0.650
Unprotected sex[a] with non-main partner	199	1.62	(0.69–3.82)	0.154	0.221
Any anal sex	203	1.10	(0.54–2.27)	0.163	0.174
Unprotected anal sex	203	0.90	(0.40–2.00)	0.153	0.142
Traded/sold sex for money, drugs, goods	203	2.95	(1.31–6.67)	0.111	0.247
Traded/sold sex, unprotected	191	0.78	(0.12–5.13)	0.019	0.015
Bought sex	205	1.88	(0.56–6.28)	0.050	0.089
Current IDU sex partner	204	19.95	(7.67–51.91)	0.031	0.272
Ever IDU sex partner	204	9.12	(3.68–22.56)	0.080	0.276
More than 1 sex partner	206	1.40	(0.76–2.56)	0.281	0.349

[a] vaginal or anal intercourse

[b] adjusted for age, cohabitation, race/ethnicity, education, homelessness, heavy drinking, and lagged effects of injection and sexual risk outcome

[c] Predicted probability of outcome when injection = “no”

[d] Predicted probability of outcome when injection = “yes”