Co-Occurring HIV Risk Behaviors among Males Entering Jail

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Abstract

This paper examines the pattern of HIV risk behaviors among male jail detainees. From multivariate analyses of baseline data from an HIV intervention study of ours, we find that: (1) cocaine use, heroin use and multiple sexual partners; and (2) heavy drinking and marijuana are often co-occurring among this population. From pairwise analyses, we find that (1) heroin and IDU (2) unprotected sexes with main, with non-main, and in last sexual encounter are mostly co-occurring. IDU is found to be associated with middle ages (30-40) and multiple prior incarcerations, and multiple sex partners associated young males with age <30, African American race, and low education. Our findings suggest that efficient interventions to reduce HIV infection in this high-risk population may have to target on these behaviors simultaneously and be demographically adapted.

Keywords: HIV risk, co-occurring behaviors, correctional facilities, male detainees.

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Introduction

In year 2011-2012, over 7 million people passed through the criminal justice system in the United State [1]. It was estimated that about 2% of them were infected with HIV including those unaware of their infection [2–4]. The prevalence of HIV infection within jails and prisons is about 3 to 6 times higher compared to that among non-incarcerated populations [4–8]. The reasons for this increased burden of HIV among populations in correctional settings are multi-factorial and include increased rates of substance abuse, mental illness, poverty and health disparities [9]. Persons who interact with the criminal justice system may be disenfranchised from health services in the community, such as screening programs, making the time of incarceration a public health opportunity to provide HIV prevention and testing services and linkage to care [10–12].

The time period preceding incarceration is characterized by increased substance use and risky sexual behaviors that increase exposure to HIV, viral hepatitis, and other transmitted diseases [13–18]. Release from correctional facilities may also be a time of high-risk of acquiring or spreading infections as persons re-enter their communities and resume risk behaviors [19–21]. Correctional-based HIV counseling and testing programs and prevention interventions may help to decrease their risk behaviors following release from the correctional environment and therefore reduce new HIV infections in this as well as the general population.

Although studies have documented prevalent (direct and indirect) HIV risk behaviors before entering jail (including heavy drinking, substance abuse, sexual promiscuity, and unprotected sex) [19–26] there is limited understanding of the interrelationships between these risk factors. To effectively target prevention interventions to persons at the greatest risk of HIV infection among this population, it is critically important to understand their risk profiles and quantify which risk behaviors are more likely to co-occur. In this paper, co-occurring behaviors are defined as behaviors that occur within certain time period (e.g. a 3 months window) and not necessarily always in the same episode (i.e. concurrently). This definition is consistent with the need of broader

interventions on behaviors that are predictive of (not necessarily determinative of) each other and jointly place an individual at a higher risk of HIV infection.

In this paper, we conduct a secondary analysis of data from a study on HIV counseling and testing in jail [27]. Specifically, we use the baseline data of the study to investigate: 1) whether certain risk behaviors are co-occurring and to what extent, and 2) whether risk behaviors are associated with certain demographic characteristics.

Methods

Prior Study and Data

We previously conducted a two-arm randomized study [27] to assess HIV risk behaviors among males entering the Rhode Island Department of Corrections (RIDOC) jail and compared the efficacy of two methods of HIV counseling and testing (conventional versus rapid HIV testing) with respect to reducing post-release HIV risk behaviors. A total of 264 HIV-negative males met the study enrollment criteria, provided the written informed consent, were recruited within 48 hours of incarceration, and completed the study. The study was approved by the Miriam Hospital institutional review board, the Rhode Island Department of Corrections (RIDOC) Medical Research Advisory Group, and the Office for Human Research Protections of the Department of Health and Human Services. More details can be found at [27].

In this paper, we use only the baseline data of the study that include demographic information and self-reported HIV risk behaviors during 3 months prior to incarceration. The self-reported risk behaviors are collected using a written quantitative behavioral assessment survey on participant's recent drinking, substance use behaviors (cocaine use, heroin use, marijuana use, injection of any drug) and sexual behaviors (multiple sexual partners, unprotected sex at last sexual encounter, unprotected sex with main partner, and unprotected sex with non-main partner). Because only data at the baseline prior to intervention randomization are used in this paper, we do not distinguish

study participants by their study arms in this paper.

Statistical Analyses

We conducted three statistical analyses in this paper, which we outline as follows

Analysis I: The co-occurrence of two risk behaviors (pair-wise analysis) is assessed using logistic regressions where one behavior (Behavior 1) is used as the dependent variable, and the other behavior (Behavior 2) as an predictor variable. The results are shown in Table 1. All regressions are adjusted for the following demographic covariates: age (categorized as < 25; $25 \sim 30$; $30 \sim 40$; and > 40 years), race (Caucasian; Black; Hispanic; others), number of prior incarcerations (dichotomized at median: < 7; ≥ 7), length of incarceration as severity index of crime leading to incarceration (< 2 wks; 2 wks $\sim 1/2$ yr; $> 1/2$ yr), and education (did not finish high school; otherwise).

Pair-wise co-occurring risk behaviors are quantified using odds ratios (ORs), where an OR > 1 (OR < 1) suggests that the existence of one behavior is predictive of the existence (or absence) of the other behavior.

We use the available complete data for assessing risk behaviors, so the analysis sample size varies (range: 73-256 as in Tables 1 & 2). The overall missing data on risk behaviors are moderate ($< 5\%$), if we do not count systematic missingness as missing values (e.g. Missing sexual behaviors for those without sexual partner). Throughout, we make the missing at random (MAR) assumption [28]. That is, we assume that with the same demographic profile, those who provided complete answers to the baseline questionnaire had engaged in similar risk behaviors as those who did not [29].

Analysis II: Multiple co-occurring risk behaviors are assessed using multivariate logistic regressions where one risk behavior (Behavior 1) is used as the dependent variable and other behaviors (Behaviors 2) as predictor variables; see Table 2. Similarly to Analysis I, the co-occurring of Behavior 1 with other behaviors is characterized by ORs, which have similar interpretations except that the ORs in Table 2 are conditional on adjusting for all other behaviors of (Behaviors 2). Again for Analysis II, we adjust for the same set of demographic characteristics as in Analysis I. When heavy drinking, co-

caine, heroin, marijuana and multiple sexual partners are used as dependent variables, we exclude the risky behaviors 'unprotected sex with main partner' and 'unprotected sex with non-main partner', because they only apply to subsets of study participants with sexual partners and including them would reduce the sample size by half and reduce the analysis power. When 'unprotected sex with main partner' and 'unprotected sex with non-main partner' are used as the dependent variables, 'unprotected sex at last sexual encounter' is excluded from predictor variables because the later behavior strongly correlates with and therefore overwhelm the associations of the former two behaviors with other risk factors. IDU is excluded from the analysis because the prevalence of injection drug use is low (overall 8%) leading to sparse data for multivariate analysis and unstable estimates due to collinearity of heroin use and IDU [30].

Analysis III: Further, we examine the associations between HIV risk behaviors and various demographic characteristics using logistic regressions, where each risk behavior is used a dependent variable and predictor variables included: age, race, the number of prior incarcerations, length of incarceration as severity index of crime leading to incarceration, and education. The predictor variables are categorized in the same way as in Analyses I and II. The associations of each risk behaviors and certain demographic profiles are characterized by ORs.

Data are extracted and prepared using Access 2003 [31]. All analyses are conducted using the statistical program R [32]. Analysis lack of fit is assessed using Hosmer-Lemeshow tests. Statistical significance is set at a p-value < 0.05.

Results

Among the 264 male HIV-negative participants, the median age was 30 years (range 18-65); the majority was Caucasian (52% Caucasian, 22% Black, 14% Hispanic, 12% others); 51% did not finish high school; and the median number of lifetime incarcerations was 6 (range 1-200). Within the prior 3 months before incarceration, 103 (39%, data not available (NA) = 1) were heavy drinkers; 27 (10%, NA = 1) used heroin; 100

(38%, NA = 1) used cocaine; 161 (61%, NA = 1) used marijuana; and 22 (8%, NA = 1) had injected any type of drug. For the same time period, 203 (77%) had a main sexual partner and of those 170 (84%, NA = 1) never used a condom; 111 (42%) had a non-main sexual partner and of those 37 (36%, NA = 3) never used a condom; 81 (31%) had both main and non-main sexual partners; 61 (26%, NA = 4) had multiple ($\geq$ 3) recent sexual partners; and 233 (90%, NA = 4) did not use a condom at last sexual encounter.

In our pair-wise analysis (Analysis I), cocaine use is found to highly correlate with heroin use (OR = 5.21 with a 95% confidence interval (CI) of 1.8 - 15), IDU (OR = 6.65, CI = 1.9 - 23), and multiple sexual partners (OR = 2.45, CI = 1.1 - 5.3); see Table 1. Heroin use and IDU are mostly co-occurring, suggesting that injection might be the preferred route of heroin use. Heavy drinking and marijuana use are predictive of each other (OR = 2.88, CI = 1.6 - 5.3). Participants who have unprotected sex with their main and non-main sexual partner(s) are more likely to have unprotected sex at last sexual encounter (OR = 25.7, CI = 9.1 - 73.0 and OR = 88.6, CI = 15 - 200, respectively). Notably, unprotected sex with main partner and with non-main partner(s) is likely to co-occur (OR = 6.43, CI = 1.56 - 78.8). In terms of protective behaviors, participants who report IDU and those with multiple sexual partners are found to be more likely to use condoms at last sexual encounter, though this finding is not statistically significant (p-values = 0.08 and 0.07, respectively).

In our multivariate analysis (Analysis II), we find that (1) cocaine use, heroin use, and multiple sexual partners, and (2) heavy drinking and marijuana use are co-occurring (Table 2). Heavy drinking and marijuana use are highly predictive of each other (OR = 3.40, CI = 1.7 - 7.1). Cocaine use is predictive heroin use (OR = 9.20, CI = 2.7 - 38.7) and multiple ($\geq$ 3) sexual partnerships (OR = 2.56; CI = 1.1 - 6.0).

The analyses that examine the relationships between risk behaviors and demographic covariates (Analysis III) show that male jail detainees with age between 30 - 40 are more likely to abuse cocaine (OR = 8.6, CI = 3.5 - 23.2), heroin (OR = 4.7, CI = 1.2 - 23.7), and IDU (OR = 2.8, CI = 1.2 - 6.9). Younger males with age ¡ 30 are

more likely to abuse marijuana (OR = 3.8, CI = 2.2 - 6.9) and have multiple sexual partners (OR = 2.1, CI = 1.2 - 3.8). African American are more likely to have multiple sexual partners (OR = 3.7, CI = 1.8 - 7.9), but less likely to engage in unprotected sex in last sexual encounter (OR = 0.3, CI = 0.1 - 0.6), with main partner (OR = 0.3, CI = 0.1 - 0.9) and non-main partner(s) (OR = 0.1, CI = 0.03 - 0.4). Having more than 7 prior incarcerations is associated with heavy drinking (OR = 1.8, CI = 1.1 - 3.2), cocaine use (OR = 2.5, CI = 1.4 - 4.6), and IDU (OR = 2.9, CI = 1.1 - 7.7). Finishing high school is associated with less sexual partners (OR = 0.5, CI = 0.3 - 0.9) but more likely to engage in unprotected sex in last sexual encounter (OR = 3.3, CI = 1.6 - 7.2) and with main sexual partner (OR = 3.2, CI = 1.3 - 8.0).

Discussion

Our results indicate that males entering jail have high rates of substance use and sexual risk behaviors that increase their risk of HIV and other infectious diseases. Our study adds to previous literature by demonstrating high risk behaviors among incarcerated populations and by highlighting whether certain risk behaviors are more likely to be co-occurring thus compounding risk for HIV infection.

Particularly from our pairwise and multivariate analyses, we find that cocaine is co-occurring with several other risk behaviors including heroin use, injection drug use, and multiple sexual partners. Cocaine use has been reported to not only increase the probability of HIV transmission, but also the potential of poor health outcomes in those living with HIV infection [22,23,33–35]. Given that there is currently no pharmacotherapy based intervention for cocaine addiction as there is for opiate addiction, our study supports the need of developing behavior-based interventions for cocaine abuse that is appropriate for incarcerated populations in addition to addressing opiate use and risky sexual behaviors. Since jail incarcerations may be as short as several days, behavioral interventions such as contingency management (CM) [36–39] may provide immediate reinforcement for abstinence from cocaine use, and cognitive behavioral in-

terventions that are paired with CM upon release may offer a bridge for continued abstinence following community re-entry [40]. However, these interventions have not been implemented among incarcerated populations [41].

The finding that unprotected sex with main partner is co-occurring with unprotected sex with non-main partner(s) is another important finding, as this suggests that some participants could be involved with concurrent sexual relationships. Concurrent sexual partnerships in incarcerated populations have been reported in several studies [42–46]. Further accounting for concurrent sexual partnerships (and social/sexual networks) in our analyses would strengthen our conclusions, but unfortunately as one limitation of this paper, collecting concurrent behaviors data is not a focus of our original study.

Heavy alcohol use and marijuana use are common substances used by our population and found to be mostly co-occurring. Previous findings with younger incarcerated men [47] suggested that prior to incarceration, the use of marijuana alone and alcohol alone increased the likelihood of multiple sexual partners (i.e. 3 or more) and when in used in combination, sexual HIV-risk behaviors and inconsistent condom use behaviors with female partners increased. Similar finding also can be found in [15, 48]. Comparable to other drugs of abuse, alcohol and marijuana use can impair judgment thereby preventing safer sex behaviors, and hence remain an important domain for intervention.

This paper has several limitations. The risk behavior data were self-reported which might have introduced bias and possibly an underreporting of risk behaviors given the environment in which participants completed the questionnaire. Our findings are not generalizable to incarcerated women or the entire population, because it is known that incarcerated women have a different rate of HIV infection and other transmissible diseases compared to men. The study sample size is limited and study participants are restricted only to those at the RIDOC, which limits our analysis power to identify all co-occurring risk behaviors.

As the U.S. incarceration population continues to grow and disproportionate rates

of HIV infection continue to rise among incarcerated individuals, the implications for intervention are important and imperative. Jails provide a unique opportunity for structural interventions for this high-risk population. The results of this study offer more insight into the risk behaviors of males entering the RIDOC jail, and elucidate the educational, counseling, and intervention needs of men at risk for HIV infection within the criminal justice system.

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Table 1: Pair-wise association among risk behaviors.

Behavior 1	**Behavior 2**								
	Heavy drinking	Cocaine	Heroin	Marijuana	Injection drug	Multiple sexual partners	Unprotected sex at last sexual encounter	Unprotected sex with main partner	Unprotected sex with non-main partner(s)
Heavy drinking	—	1.32 (n=256)	*0.42* (n=256)	**2.88** (n=256)	0.45 (n=256)	1.28 (n=253)	1.06 (n=256)	0.62 (n=196)	0.93 (n=102)
Cocaine	1.34	—	**5.21** (n=257)	1.29 (n=257)	**6.65** (n=257)	**2.45** (n=253)	0.74 (n=227)	0.69 (n=197)	1.00 (n=102)
Heroin	*0.45*	**5.22**	—	0.54 (n=257)	**>30** (n=257)	1.52 (n=253)	0.53 (n=227)	0.56 (n=197)	0.51 (n=102)
Marijuana	**2.89**	1.30	0.60	—	0.56 (n=257)	*1.94* (n=253)	0.52 (n=227)	0.67 (n=197)	0.63 (n=102)
Injection drug	0.47	**6.64**	**>30**	*0.51*	—	2.04 (n=253)	*0.36* (n=227)	0.65 (n=197)	0.63 (n=102)
Multiple sexual partners	1.39	**2.46**	1.42	*2.00*	1.89	—	*0.50* (n=227)	1.02 (n=197)	*0.44* (n=102)
Unprotected sex at last sexual encounter	1.04	0.74	0.46	0.54	*0.32*	*0.51*	—	**25.7** (n=197)	**>30** (n=102)
Unprotected sex with main partner	0.61	0.68	0.49	0.65	0.61	1.00	**24.4**	—	**6.43** (n=73)
Unprotected sex with non-main partner(s)	0.95	0.95	0.47	0.66	0.49	*0.44*	**>30**	**8.62**	—

(a) The table is not symmetric because the analyses are adjusted for the following covariates as predictors of Behavior 1: age, race, prior incarcerations, length of incarceration, and education.

(b) The numbers in parentheses are sample sizes.

(c) **Bold** indicates a p-value < 0.05 and *italic* < 0.10.

Table 2: Multivariate analyses of co-occurring risk behaviors

Behavior 1	**Behaviors 2**					
	Heavy drinking	Cocaine	Heroin	Marijuana	Multiple sexual partners	Unprotected sex at last sexual encounter
Heavy drinking (n=226)	—	1.74	0.55	**3.40**	1.23	1.21
Cocaine (n=226)	1.68	—	**9.20**	0.91	**2.56**	0.95
Heroin (n=226)	0.41	**10.2**	—	0.54	0.91	0.39
Marijuana (n=226)	**3.30**	0.95	0.46	—	1.84	0.57
Multiple sexual partners (n=226)	1.11	**2.38**	1.06	1.91	—	0.56
Unprotected sex at last sexual encounter (n=226)	1.26	0.91	0.54	0.51	0.55	—
Unprotected sex with main partner (n=196)	0.66	0.80	0.56	0.72	1.15	***
Unprotected sex with non-main partner(s) (n=102)	0.90	1.23	0.43	0.63	*0.44*	****

(a) The table is not symmetric because the analyses are adjusted for the following demographic covariates: age, race, prior incarcerations, length of incarceration, and education.

(b) The numbers in parentheses are sample sizes.

(c) **Bold** indicates a p-value < 0.05 and *italic* < 0.10.

(d) *** "Unprotected sex at last sexual encounter" is not included as a predictor variable in the model.