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HIV Risk Behaviors of Male and Female Jail Inmates Prior to Incarceration and One Year Post-Release

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Abstract

Individuals cycling in and out of the criminal justice system are at high risk for contracting HIV/AIDS. Most infections are contracted in the community, not during incarceration, but little is known about the profile of risk behaviors responsible for this elevated infection rate. This study investigated pre-incarceration and post-release HIV risk behaviors in a longitudinal study of 542 male and female inmates in a Northern Virginia jail. Although there was a significant decrease in risky behavior from pre-incarceration to post-incarceration, participants reported high levels of unprotected sexual activity and risky IV drug behaviors at both time points, emphasizing the need for prevention programming among this at-risk population. Gender differences in participants' pre-incarceration and post-release HIV risk behaviors suggest the need for gender-specific interventions to reduce overall HIV risk. Identifying specific HIV risk behaviors of jail inmates is vital to improve treatment and intervention efforts inside and outside of correctional settings.

Keywords

HIV/AIDS risk; Jail inmates; Pre-incarceration; Post-incarceration; Gender differences; Bernoulli mathematical model

Introduction

The continued growth of the HIV/AIDS epidemic merits sustained attention. Members of many distinct populations have been afflicted with the illness, and individuals who cycle in and out of the criminal justice system are at increased risk of HIV/AIDS. Rates of infection have been found to be three to four times higher among incarcerated individuals than in the general population [1]. Present estimates of HIV/AIDS in the incarcerated population place approximately 2% of jail and prison inmates with the disease, and HIV rates of up to 17% have been reported among individuals on probation and parole [2, 3].

Gender differences in the rates of HIV/AIDS among incarcerated individuals are distinctly different from the pattern found in the general public. Although men account for three times as many cases of HIV/AIDS than women in the general public, among incarcerated individuals, women have consistently been found to have higher rates of infection than men [4, 5]. This “risk reversal” requires additional attention in order to understand the unique factors that may lead to heightened risk among women who cycle in and out of the United States correctional system.

Existing studies provide a glimpse of the nature of HIV risk behaviors among male and female prison inmates prior to incarceration, but most have not included jail inmates [5, 6]. Jail inmates represent a particularly useful target for HIV prevention since more jail inmates return to their communities annually (7 million jail inmates versus 650,000 prison inmates) and incarcerated individuals with HIV are most likely to have contracted the disease while in the community rather than while incarcerated [7, 8]. Studies that have included jail inmates have typically focused on specific subgroups of incarcerated individuals (i.e., female inmates, HIV positive inmates), greatly limiting their generalizability; even fewer have focused on post-release risk behaviors, which could provide important information about changes in patterns of risky behaviors [4, 9, 10]. Understanding the HIV risk behaviors of jail inmates when they are *in the community* (both prior to and post-incarceration) is crucial to the formulation of prevention and intervention efforts within jail settings.

Present Study

The aims of the current study are several-fold. First, we aim to provide *more recent* descriptive data on both the pre-incarceration and post-release HIV risk behaviors of jail inmates in order to inform the development of education and intervention programs tailored to inmates’ specific needs. Second, we aim to examine gender differences in patterns of HIV risk behaviors that may account for the prevalence of HIV infection among incarcerated women. Third, we aim to compare inmates’ pre-incarceration HIV risk to their post-release risk behavior.

Methods

Participants

Data were drawn from 542 participants in a larger longitudinal study examining moral emotions and criminal recidivism in a single jail in Northern Virginia [11]. Incoming inmates were eligible to participate if they were (1) either (a) sentenced to a term of 4 months or more, or (b) arrested on at least one felony charge other than probation violation, with no bond or with a bond greater than \$7,000, (2) assigned to the jail’s medium or maximum security “general population” (e.g., not in solitary confinement, not in a separate forensics unit for actively psychotic inmates), and (3) had sufficient language proficiency to complete study protocols in English or Spanish. Data are protected by a Certificate of Confidentiality from DHHS, and the institutional review board for the University approved the full study protocol. Detailed recruitment procedures have been described previously [11]. Data collection within the jail occurred between 2002 and 2007; post-release data are

still being collected. Figure 1 shows the flow of data collection included in this paper's analyses.

The sample was 68% male. They were on average 31 years old ($SD = 9.9$, range: 18–72), had completed 12 years of education ($SD = 2.3$, range: 0–19), and were diverse in terms of race and ethnicity: 44% African American, 32% Caucasian, 12% Latino, 3% Asian, 5% “Mixed,” and 4% “Other.” Female participants were on average 34 years old ($SD = 10.1$, range: 18–69), had completed 12 years of education ($SD = 2.2$, range: 7–19), and were diverse in terms of race and ethnicity: 41% African American, 44% Caucasian, 6% Latino, 2% Asian, 5% “Mixed,” and 3% “Other.”

Measurement

Shortly upon incarceration (Wave 1), participants responded to questions using a touch screen computer that presented the questions both visually and aurally. Most 1 year post-release (Wave 2) assessments (62%) were conducted via telephone; the remainder was conducted in person primarily owing to the participants' reincarceration. HIV risk behaviors prior to incarceration and one year post-release were assessed using portions of the TCU HIV/AIDS Risk Assessment Form (TCU-ARA), which measures HIV risk behaviors in the domains of drug use (e.g., sharing needles, cotton, and rinse water) and sex (e.g., unprotected intercourse) [12].¹

Statistical Analyses

For categorical HIV risk variables, gender and race differences were explored using chi-square tests. Because variables were highly skewed, the nonparametric equivalent of the independent samples *t*-tests (Mann–Whitney *U* tests) was used to explore gender and race differences in frequency of behaviors.

HIV risk is a composite of a variety of risky behaviors, including both IV drug use and unprotected sexual behaviors. To compute an overall measure of HIV risk (cumulative risk), we utilized a modified Bernoulli process mathematical model to express the probability *P* of HIV infection [13]. The Bernoulli model provides an especially useful estimate of HIV risk, as it is expressed in meaningful terms, takes into account the epidemiologic context of the risk behaviors, and allows for the inclusion of multiple relevant behaviors that contribute to overall levels of risk [14]. In this model, *P* represents the cumulative likelihood that a given person becomes infected after engaging in multiple, specific acts of unprotected intercourse and/or sharing needles and drug paraphernalia over a given time period, and is expressed via the equation:

$$P=1-(1-A)(1-D), \quad (1)$$

where *A* is the probability of infection from unprotected vaginal, anal, and oral sex contacts²:

¹Participants who completed both Wave 1 and Wave 2 did not differ significantly in their HIV risk behavior from eligible participants who only completed Wave 1.

²We did not have access to the number of partners with whom each type of sexual act occurred. Thus, the general Bernoulli equation was modified to reflect the frequency of each act, without reference to multiple partners.

$$A = \pi_1 \left[1 - (1 - \alpha_1)^{n1} (1 - \alpha_2)^{n2} (1 - \alpha_3)^{n3} \right], \quad (1a)$$

and D is the probability of infection from IV drug-related activities:

$$D = 1 - (1 - \pi_2 \alpha_4)^{n4}, \quad (1b)$$

Equation 1 parameters are shown in Table 1. The Bernoulli model includes both estimated and measured parameters. Measured parameters ($n1$ – $n4$) were obtained from participants' self-reported risk behaviors (e.g., frequency of sex, frequency of shared needle use). Estimated parameters ($\pi_{1,2}$, α_{1-4}) were approximated from available data regarding the infectivity of specific acts and high- versus low-risk partners. Based upon the work of Pinkerton and Abramson, we estimated that there was a 10% chance that the participant's partner was HIV-positive if the participant reported having unprotected sex with an IV drug user or a person who exchanges sex for drugs or money [13]. For all other participants, we estimated that there was a 5% chance that their partners were HIV-positive. Changes in cumulative HIV risk from pre- to post-incarceration were analyzed with a paired-sample Wilcoxon signed rank test, the nonparametric equivalent of the paired-sample *t*-test.

Results

HIV Testing

At Wave 1, 87% reported having been tested for the virus at some point pre-incarceration. Women (93%) were more likely than men (84%) to have been tested for HIV/AIDS, $\chi^2(1, N = 536) = 9.36, P = 0.002$. There were no race differences for likelihood of HIV testing prior to incarceration.³ Overall, 2% ($n = 11$) of participants indicated that they had tested positive for HIV, 2% of men ($n = 5$) and 4% of women ($n = 6$). Notably, just over 2% ($n = 11$) said that they had been tested, but did not know their HIV status.

In the 12 months following their release from jail, 65% ($n = 193$) of participants reported having been tested for HIV/AIDS. Again, women (76%) were more likely than men (61%) to have been tested for the disease, $\chi^2(1, N = 297) = 6.47, P = 0.011$. African-Americans (76%) were more likely than Caucasians (56%) to have been tested in the year following release from jail, $\chi^2(1, N = 247) = 10.66, P = 0.001$. At this time, three new cases of HIV/AIDS among the sample have been reported (1 woman and 2 men).

Risky Sexual Behaviors

During the assessment of pre-incarceration HIV risk, participants reported their involvement in risky sexual behaviors in the 6 months preceding incarceration. They also reported whether they engaged in risky sexual behavior, along with the frequency of such acts, in the 30 days prior to their incarceration. For the post-release assessment of HIV risk, participants

³Although not a primary aim of the current study, we also explored race differences in jail inmates' pre and post incarceration risk behaviors. Sample size precludes comparisons between all races in the sample, thus race differences are calculated between Caucasian ($N = 215$) and African-American ($N = 259$) participants; full information for statistically significant findings is reported.

reported whether they engaged in risky sexual behaviors in the year immediately following their release from jail, and reported both the occurrence and frequency of their participation in risky sexual behaviors in the month directly preceding the post-release interview (Table 2).

Pre-Incarceration—There was considerable variability in the number of sexual partners reported for the 6 months prior to incarceration. Men ($M = 3$, $SD = 5$, $Md = 1$, range 0–55, $n = 359$) had significantly fewer sexual partners than women ($M = 5$, $SD = 26$, $Md = 1$, range 0–300, $n = 166$), $Z = -2.73$, $P = 0.006$.⁴ Approximately 28% of the sample stated that they had unprotected sex in the 6 months prior to incarceration with a person who was not their spouse or primary partner; men (32%) were significantly more likely to engage in sex with a non-spouse or primary partner than were women (18%), $\chi^2(1) = 11.07$, $P < 0.001$. In contrast, women were more likely to report unprotected sex with an IV drug user during this time period (4% of men, 8% of women), $\chi^2(1) = 5.75$, $P = 0.021$. There was no gender difference for engaging in unprotected sex while trading sex and drugs (10% for both), $\chi^2(1) = 0.06$, $P = 0.790$. African-Americans (3%) were less likely than Caucasians (9%) to engage in unprotected sex with an IV drug user, $\chi^2(1) = 4.913$, $P = 0.027$, but were more likely to do so while trading sex and drugs (16% African-American, 8% Caucasian, $\chi^2(1) = 5.619$, $P = 0.018$). No race differences were observed for engaging in unprotected sex with non-primary partners.

In the 30 days prior to incarceration, men reported significantly fewer ($M = 2$, $SD = 2$, $Md = 1$, range 0–20, $n = 365$) sexual partners than did women ($M = 3$, $SD = 16$, $Md = 1$, range 0–200, $n = 165$), $Z = -2.64$, $P = 0.008$.⁵ For the 30 days prior to incarceration, the percentage of men (19%) who reported sex with a person who was not their spouse or primary partner, was not significantly different from the percentage of women (13%), $\chi^2(1) = 2.57$, $P = 0.109$ (in contrast to the significant 6 month result). Women (7%) again were more likely than men (3%) to report unprotected sex with an IV drug user, $\chi^2(1) = 5.12$, $P = 0.024$. Again there was no difference for engaging in unprotected sex while trading sex and drugs (5% men, 4% women), $\chi^2(1) = 0.15$, $P = 0.696$. Of those who engaged in unprotected sex with these high-risk partners, no gender differences emerged with regard to the *frequency* that participants engaged in risky sexual behaviors in the 30 days prior to incarceration (see Table 4). Only one race difference emerged for the 30 days prior to incarceration; African-Americans (1%) were less likely than Caucasians (8%) to report unprotected sex with an IV drug user, $\chi^2(1) = 12.95$, $P < 0.001$.

Post-Release—In the year following their release from jail, participants ranged in the number of sexual partners reported. In contrast to their pre-incarceration behavior, men ($M = 5$, $SD = 15$, $Md = 1$, range 0–180, $n = 211$) in the sample reported significantly more sexual partners in the first year post-release than did women ($M = 2$, $SD = 2$, $Md = 1$, range 0–20, $n = 83$), $Z = -4.32$, $P < 0.001$.⁶ In the year following their release, 22% had sex without using

⁴One participant reported 300 partners. The same gender difference emerged when that person was dropped from analysis, reducing the range of sexual partners from 0 to 100, $Z = -2.87$, $P = 0.004$.

⁵One participant reported 200 partners. The same gender difference emerged when that person was dropped from analysis, reducing the range of sexual partners from 0 to 65, $Z = -2.77$, $P = 0.006$.

protection with someone who was not their spouse or primary partner; men (25%) were significantly more likely to engage in unprotected sex with a non-spouse or primary partner than were women (13%), $\chi^2(1) = 4.41$, $P = 0.036$. In that same timeframe, 2% of the sample engaged in unprotected sex with a person who uses IV drugs ($\chi^2(1) = 0.67$, $P = 0.413$), and 2% of the sample had unprotected sex while trading sex and drugs ($\chi^2(1) = 2.79$, $P = 0.095$).

In the 30 days immediately preceding the one-year post-release interview, men ($M = 1$, $SD = 2$) and women ($M = 1$, $SD = 1$) did not differ in the number of sexual partners, $Z = -0.32$, $P = 0.98$. Very little risky sexual behavior was reported for the 30 days preceding the interview, with approximately 7% of the sample stating that they had unprotected sex with someone who was not their spouse or primary partner and minimal reports of other risk behavior by either gender (see Table 2). Again when examining frequency of risky behavior for those who reported any such behavior, there were no gender differences (Table 4). No race differences were observed in post-incarceration sexual risk behavior at either time point.

Risky Needle Use

During the assessment of pre-incarceration HIV risk, participants reported their lifetime IV drug use history, IV drug use during the 6 months preceding incarceration, and IV drug use and frequency of use in the 30 days prior to incarceration. For the post-release assessment of HIV risk, participants reported their IV drug use during the year immediately following their release from jail (Table 3), and the occurrence and frequency of use in the month directly preceding the post-release interview (Table 4).

Pre-Incarceration—Regarding pre-incarceration IV drug use, 21% ($n = 111$) of the sample reported that they had ever injected illicit drugs. Of those who reported lifetime IV drug use, 29% stated that they had used dirty needles at least once in their lives. The proportion of women who reported ever using IV drugs was greater than that of men (26 to 18% respectively; $\chi^2(1, N = 542) = 3.91$, $P = 0.048$). Of those who used IV drugs, the proportion of women who ever used dirty needles was more than double that reported by men (47 to 18% respectively, $\chi^2(1) = 10.39$, $P = 0.001$).

In the 6 months prior to incarceration, 12% ($n = 62$) reported that they had injected drugs; this did not differ by gender, $\chi^2(1) = 1.12$, $P = 0.290$ (Table 3). The majority of individuals who reported IV drug use in the 6 months prior to incarceration also indicated a high level of use, with 73% reporting injecting IV drugs one or more times per day. On average, female IV drug users ($M = 2\text{--}3$ times per day) reported injecting drugs significantly more frequently than men ($M = \text{once per day}$), $t(60) = 2.47$, $P = 0.016$.⁷

Unsafe needle injection practices were also common among this group. Of those reporting IV drug use during the 6 months prior to incarceration, 36% reported using dirty needles during this time frame and 66% reported sharing other IV drug materials (including cooker,

⁶Two participants reported 100 and 180 partners. The same gender differences emerged when those participants were dropped from analysis, reducing the range of sexual partners from 0 to 55, $Z = -4.221$, $P < 0.001$.

⁷Specific information regarding type of substance injected is unknown, though opiate and cocaine/crack/freebase were the most highly used substances among this sample.

cotton, or rinse water). Women (48%) were more likely than men (26%) to have used dirty needles, $\chi^2(1) = 4.45$, $P = 0.035$. Women (83%) were also more likely than men (56%) to share other IV drug materials, $\chi^2(1) = 4.43$, $P = 0.035$.

During the 30 days prior to incarceration, 9% ($n = 50$) of participants reported injecting drugs, this did not differ by gender, $\chi^2(1) = 1.59$, $P = 0.207$ (Table 3). Of those who injected with a needle, women (53%) were more likely than men (23%) to have used dirty needles during this timeframe, $\chi^2(1) = 4.41$, $P = 0.036$. Sixty-two percent of participants who used IV drugs in the 30 days prior to incarceration shared their non-needle drug materials, and this behavior did not differ by gender, $\chi^2(1) = 0.20$, $P = 0.655$. Of those participants who reported IV drug use, no gender differences were found regarding IV drug use frequency in the 30 days prior to incarceration (see Table 4).

Only two race differences were observed in pre-incarceration risky drug use. The proportion of Caucasian (34%) participants who reported ever using IV drugs was greater than that of African-Americans (15%), $\chi^2(1) = 21.66$, $P < 0.001$. In the 6 months prior to incarceration, Caucasians (22%) were nearly four times as likely to inject drugs than African-American participants (6%), $\chi^2(1) = 23.17$, $P < 0.001$.

Post-Release—There was very little post-release IV drug use, with less than 8% reporting injecting drugs in the year following release and only one participant reporting use in the 30 days prior to the interview. Of those who injected drugs in the year following release, 91% reported no “dirty” needle use, while 26% shared their drug materials, excluding needles, with others. Tables 3 and 4 provide detailed information regarding participants’ post-release IV drug use. Neither gender nor race differences emerged in participants’ post-release IV drug use behavior.

Cumulative Risk: HIV Risk Changes from Pre-Incarceration to Post-Release

Of the original sample of 542 participants who had pre-incarceration HIV-risk relevant data, 512 provided enough information regarding the number of times that they engaged in unprotected oral, vaginal, and/or anal sex, along with their frequency of IV drug use in the 30 days prior to their incarceration to calculate a risk composite score using the Bernoulli method. Most of participants’ HIV risk was due to their sexual practices. However, among IV drug users, injecting drugs accounted for up to 80% of their total risk.

In the 30 days prior to incarceration, half (50%) of the sample showed no measurable risk for contracting HIV via sexual behaviors or IV drug use, while the risk among the remainder of the sample was wide-ranging. Calculated risk is expressed in terms of the cumulative probability that any one person will become infected with HIV given their behavior (risky sex and IV drug use). Participants’ risk ranged from nearly 0 (negligible risk, measured to the hundred-thousandth place) to 0.24 (24 out of 100 chance of contracting HIV) in the 30 days prior to incarceration ($M = 0.009$, $SD = 0.024$). We found no evidence of gender differences in terms of calculated risk among the full sample, $Z = -0.84$, $P = 0.40$, or among the 50% of participants who showed measurable risk, $Z = -1.07$, $P = 0.29$. No race differences were found for participants’ cumulative pre-incarceration HIV risk.

Post-release HIV risk scores were available for 236 participants. In the 30 days prior to the one-year post-release interview, 67% of the sample displayed no risk for contracting HIV, as measured by their sexual behaviors and IV drug use. The remainder of the sample showed variable risk, ranging from nearly 0 to 0.14 ($M = 0.006$, $SD = 0.016$). Again, we found no evidence of gender differences with regard to HIV risk in the 30 days prior to the post-release interview among the total sample, $Z = -0.49$, $P = 0.63$, nor among participants who showed calculable risk, $Z = -1.55$, $P = 0.12$. Again, no race differences were found for participants' post-release cumulative HIV risk.

We used the same questions and response scales to assess participants' HIV risk at 30 days prior to incarceration and in the 30 days prior to their one-year post-release interview, which allows a direct comparison between cumulative risk scores at the two time points. Of the 222 participants who provided enough information to calculate HIV risk at both pre- and post-incarceration, 40% decreased in overall risk for the disease (39% of men, 41% of women), 37% showed no difference (37% of men, 37% of women), and 23% increased their risk (24% of men, 22% of women). There was only a modest correlation between the scores at the two time points ($r = 0.16$, $P = 0.036$). Overall, participants' cumulative risk of contracting HIV decreased from pre-incarceration ($M = 0.0084$, $SD = 0.018$) to post-release ($M = 0.0058$, $SD = 0.015$), $Z = -2.58$, $P = 0.01$. No gender differences were found with regard to changes in cumulative HIV risk, $Z = -0.35$, $P = 0.73$, nor were there any race differences.

Discussion

This study examined pre-incarceration and post-release HIV risk behaviors of male and female inmates at a Northern Virginia county jail. The goals of the study were to provide descriptive data about jail inmates' HIV risk behaviors while in the community, to explore gender differences in risk behaviors that may account for female inmates' higher prevalence of the disease, and to compare participants' pre-incarceration risk levels to their post-release risk. Overall, participants reported engaging in a variety of IV drug use and sexual behaviors that elevate their risk of HIV contraction above much of the general population. This finding held for participants' pre-incarceration and post-release behaviors. Our findings suggest that there may be gender-specific patterns relevant to HIV risk behavior that may account for the high prevalence of HIV-positive incarcerated females.

A number of general recommendations may help guide HIV prevention programs for jail inmates. In the current sample, jail inmates had access to HIV testing, but were not required to receive it; a substantial number of participants did not know their HIV status. Given the high infection rate among the incarcerated population, mandatory HIV education and prevention efforts in jails should be considered. Prevention programs should not solely focus on individuals when they are incarcerated, as the present data suggest that inmates are at continued risk for HIV once they leave jail. Programs which combine peer-led instructional workshops, individual and group counseling, community outreach, confidential testing, individual case management, and referral and follow up services for *released* inmates, are thought by many to represent the cutting edge of HIV risk reduction efforts [15, 16].

With regard to gender, much of the HIV risk among females in this sample revolved around IV drugs. Female inmates were more likely than male inmates to report ever using IV drugs, and among those who injected drugs, women were more likely than men to report using dirty needles at all time periods studied. Females were also more likely to engage in unprotected sex with an IV drug user. The infectivity rate of HIV via IV drug use is considerably higher than the rate via unprotected sex, and this may partially account for the elevated prevalence of the disease among incarcerated women. For example, there is some evidence that women engage in IV drug use practices as a component of building and maintaining trust in intimate relationships. Initiating IV drug use for the first time, increasing the frequency of use, and/or sharing needles in this context may be done with the purpose of showing trust in a male partner [17, 18]. In addition, there is evidence that women who use IV drugs often depend upon their intimate partners for access to both the drug and the materials necessary in order to get high, giving their partners more control of the drug-using episode [19]. One possible consequence of this context may be a gender specific order of sharing materials, with the male partner using the materials first, followed by the female partner.

Our study examined the understudied area of indirect sharing behaviors aside from needles—that is, the sharing of cooker, cotton, or rinse water used in the process of injecting drugs. The sharing of these materials—which contain blood and other fluids that can carry the HIV virus—can be a major source of infection. Education and prevention efforts regarding indirect sharing behaviors have not been a consistent focus of needle exchange programs, which have been found to be effective in reducing the use of shared needles among non-incarcerated IV drug users [20, 21]. Considering this, interventions for incarcerated women should be sure to focus on the heightened risk associated with these types of IV drug behaviors.

The majority of males' HIV risk behavior was related to unprotected sex with multiple partners. Educational efforts for men may be more beneficial if they focus on increasing knowledge and intentions for the use of condoms. Studies of non-incarcerated individuals have pointed to condom efficacy—the knowledge and ability to request and use of a condom during sexual activity—as a potentially effective intervention for increasing the likelihood of condom use [22]. Outcome research with incarcerated populations has found success with psychoeducational approaches to behavioral change [23].

Half of the sample reported no measurable risk of HIV contraction (via sexual behaviors and IV drug use) in the month before incarceration, as did two-thirds of the sample in the month preceding the one-year post-release interview. On average, participants' cumulative risk of becoming infected with HIV in the month prior to incarceration was 9 out 1000, while it was 6 out of 1000 in the month immediately preceding the post-release interview. These figures may sound inconsequential, but they become quite sobering when compared to the finding that a single sexual encounter with a *known* HIV-positive person carries, on average, a 3 out of 1000 chance of transmission [24]. Our finding, compounded with the fact that 7.65 million people are released from custody annually, provides evidence of the potential impact that this high-risk group could have on the overall community [8].

With regard to changes in HIV risk behavior pre- and post-incarceration, we found significant reductions in risky sexual and IV drug use behaviors. While this could indicate a promising phenomenon, comparisons at these two time points could have been biased by non-random missing data related to HIV risk behaviors (i.e., retention of low-risk participants) and the different modes of data collection that occurred (i.e., computer versus telephone).

It is possible that the inclusion of the negatively charged word “dirty” in the TCU measure of needle sharing inhibited some participants from accurately reporting their needle sharing behaviors. However, evidence from the study suggests that participants were straightforward in responding to questions. Participants’ Positive Impression Management (PIM) scores on the Personality Assessment Inventory (PAI) were substantially lower than community norms at both time points, showing little evidence of social desirability bias [25]. Boyle and Lennon found a median 0.73 stability coefficient for the PAI across a 28-day interval; in the present study, positive impression management scores were strongly correlated ($r = 0.60$) [26]. Participants also acknowledged a broad range of risky, illegal and socially undesirable behavior in the course of both assessments. Further, self-reports of HIV infection (2%) were virtually identical to seroprevalence studies of jail inmates [2].

Future research should include larger samples of female inmates to enhance the sensitivity of comparisons with male inmates; our smaller sample size for women compromised our ability to detect potentially significant differences in reported behaviors by gender. In addition, larger, more diverse samples would allow for comparisons between racial and ethnic groups to distinguish patterns of risk behaviors; in the present study, we were able to only compare risk behaviors between African-Americans and Caucasians.

The creation of standard ways to measure and index levels of risk would greatly aid research on HIV risk. The present study employed a Bernoulli process model to provide a comprehensive estimate of HIV risk, including both sexual behaviors and IV drug use. The Bernoulli model is not free of criticisms. Namely, it has been argued that the model relies too heavily upon uncertain parameters, as wide ranges of infectivity parameters have been documented for various acts of HIV risk [27]. Nonetheless, we believe that this model provides a more holistic view of risk, incorporating a variety of behaviors and associated levels of risk, and is more easily interpreted than many indexes currently in use in the literature.

The period of incarceration represents an ideal opportunity for education and intervention with this high-risk group. Owing to their confinement, many inmates are clean and sober for the first time in years. Others receive much needed and long overdue psychotropic medication, which may alleviate psychological pain associated with engaging in risky sex and drug use. Captive and available, thinking more clearly, and faced with the undeniable consequences of their actions, inmates may be especially receptive to intervention efforts while incarcerated. Understanding the specific HIV risk behaviors relevant to this population will be useful to correctional systems, public policy makers, and educators in planning intervention efforts both within and outside of jail settings.

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References

1. Collica K. The prevalence of HIV peer programming in American prisons: an opportunity wasted. *J Correct Health Care*. 2007; 13(4):278–88.
2. Maruschak, LM. Bureau of Justice Statistics Bulletin. Washington, DC: US Department of Justice; 2010. HIV in prisons, 2007–2008.
3. Belenko S, Langley S, Crimmins S, Chaple M. HIV risk behaviors, knowledge, prevention education among offenders under community supervision: a hidden risk group. *AIDS Educ Prev*. 2004; 16(4):367–85. [PubMed: 15342338]
4. McClelland GM, Teplin L, Abram KM, Jacobs N. HIV and AIDS risk behaviors among female jail detainees: implications for public health policy. *Am J Public Health*. 2002; 92(5):818–25. [PubMed: 11988453]
5. Abiona TC, Balogun JA, Adefuye AS, Sloan PE. Pre-incarceration HIV risk behaviours of male, female inmates. *Int J Prison Health*. 2009; 5(2):59–70.
6. Werb D, Kerr T, Small W, Li K, Montaner J, Wood E. HIV risks associated with incarceration among injection drug users: implications for prison-based public health strategies. *J Public Health*. 2008; 30(2):126–32.
7. Spaulding A, Stephenson B, Macalino G, Ruby W, Clarke JG, Flanigan TP. Human immunodeficiency virus in correctional facilities: a review. *Clin Infect Dis*. 2002; 35(3):305–12. [PubMed: 12115097]
8. Re-Entry Policy Council. Report of the re-entry policy council: chartering the safe and successful return of prisoners to the community. New York, NY: Council of State Governments; 2005.
9. Clements-Nolle K, Marx R, Pendo M, Loughran E, Estes M, Katz M. Highly active antiretroviral therapy use, HIV transmission risk behaviors among individuals who are HIV infected, were recently released from jail. *Am J Public Health*. 2008; 98(4):661–6. [PubMed: 18309132]
10. Beckwith CG, Liu T, Bazerman L, Delong AK, Desjadrins SF, Poshkus MM, Flanigan TP. HIV risk behavior before, after HIV counseling, testing in jail: a pilot study. *J Acquir Immune Defic Syndr Hum Retrovirol*. 2010; 53(4):485–90.
11. Tangney JP, Mashek D, Stuewig J. Working at the social-clinical-community-criminology interface: the George Mason University inmate study. *J Soc Clin Psychol*. 2007; 26(1):1–21. [PubMed: 21572973]
12. Simpson, DD. Institute of Behavioral Research. Fort Worth, TX: Texas Christian University; 1997. The measurement of HIV risk behavior.
13. Pinkerton SD, Abramson PR. Evaluating the risks: a Bernoulli process model of HIV infection, risk reduction. *Eval Rev*. 1993; 17(5):504–28.
14. Holtgrave DR, Leviton LC, Wagstaff DA, Pinkerton SD. Cumulative probability of HIV infection: a summary risk measure for HIV prevention intervention studies. *AIDS Behav*. 1997; 1(3):169–72.
15. Collica K. Levels of knowledge, risk perceptions about HIV/AIDS among female inmates in New York state: can prison-based HIV programs set the stage for behavior change? *Prison J*. 2002; 82(1):101–24.
16. Klein S, Gieryc S, O'Connell D, Hall J, Klopff L. Availability of HIV prevention services within New York state correctional facilities during 1999–2000: results of a survey. *Prison J*. 2002; 82(1):69–83.
17. MacRae R, Aalto E. Gendered power dynamics, HIV risk in drug-using sexual relationships. *AIDS Care*. 2000; 12(4):505–15. [PubMed: 11091783]

18. Logan TK, Cole J, Leukefeld C. Women sex, HIV: social, contextual factors, meta-analysis of published interventions, implication for practice, research. *Psychol Bull.* 2002; 128(6):851–85. [PubMed: 12405135]
19. Burack, JH.; Bangsberg, D. Epidemiology and HIV transmission in injection drug users. The AIDS Knowledge Base (Internet). 1998 May. (cited 2011 April 8). Available from: <http://hivinsite.ucsf.edu/InSite?page=kb-07-04-01>
20. Koester SK, Booth R, Wiebel W. The risk of HIV transmission from sharing water, drug mixing containers and cotton filters among intravenous drug users. *Int J Drug Policy.* 1990; 1(6):28–30.
21. Vlahov D, Junge B, Brookmeyer R, Cohn S, Riley E, Armenian H, Beilenson P. Reductions in high-risk drug use behaviors among participants in the Baltimore needle exchange program. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1997; 16(5):400–6. [PubMed: 9420320]
22. Scholes D, McBride CM, Grothaus L, Civic D, Ichikawa LE, Fish LJ, Yarnall KS. A tailored minimal self-help intervention to promote condom use in young women: results from a randomized trial. *AIDS.* 2003; 17(10):1547–56. [PubMed: 12824793]
23. Bauserman RL, Richardson D, Ward M. HIV prevention with jail, prison inmates: Maryland's prevention case management program. *AIDS Educ Prev.* 2003; 15(5):465–80. [PubMed: 14626467]
24. Klatt, EC. Pathology of AIDS, version 21 (monograph online). Savannah, GA: Mercer University School of Medicine; 2010. (cited 2011 Apr 8). Available from: <http://library.med.utah.edu/WebPath/TUTORIAL/AIDS/HIV.html>
25. Tangney JP, Stuewig J, Adams LM, Hastings M, Kendall S. Pre-incarceration HIV risk of jail inmates with psychopathic versus borderline personality features: differential mediation. *Personality Disorders: Theory, Research, and Treatment.* 2011 manuscript under review.
26. Boyle GJ, Lennon TJ. Examination of the reliability and validity of the Personality Assessment Inventory. *J Psychopathol Behav Assess.* 1994; 16(3):173–87.
27. Downs AM, DeVincenzi I. Probability of heterosexual transmission of HIV: relationship to the number of unprotected sexual contacts. *J Acquir Immun Defic Syndr Hum Retrovirol.* 1996; 11(4):388–95.
28. Varghese B, Maher JE, Peterman TA, Branson BM, Steketee RW. Reducing the risk of sexual HIV transmission: quantifying the per-act risk for HIV on the basis of choice of partner, sex act, and condom use. *Sex Transm Dis.* 2002; 29(1):38–43. [PubMed: 11773877]
29. Kaplan EH, Heimer R. A model-based estimate of HIV infectivity via needle sharing. *J Acquir Immune Defic Syndr.* 5:1116–8. [PubMed: 1403641]

Fig. 1.
Consort diagram of study participants

Table 1

Bernoulli HIV risk equation parameters

Symbol	Description	Model parameter estimates	Source of estimate
Estimated parameters			
π_1	Probability that a sex partner is infected	0.10 (high-risk partner) 0.05 (low-risk partner)	Holtgrave et al. [14]
π_2	Probability that a non-sexual injection partner is infected	0.33	Kaplan and Heimer [29]
α_1	Per contact probability of HIV transmission for vaginal sex	0.001	Varghese et al. [28]
α_2	Per contact probability of HIV transmission for anal sex	0.005	Holtgrave et al. [14]
α_3	Per contact probability of HIV transmission for oral sex	0.0001	Holtgrave et al. [14]
α_4	Per contact probability of HIV transmission for syringe sharing	0.0067	Kaplan and Heimer [29]
Measured parameters			
n1	Number of acts of unprotected vaginal sex	All measured parameter values were derived from individual-level self-reported risk behavior	
n2	Number of acts of unprotected anal sex		
n3	Number of acts of unprotected oral sex		
n4	Number of acts of syringe sharing		

Table 2

Participants' pre- and post-incarceration risky sexual behaviors

Variable	Pre-incarceration		χ^2 -statistic (<i>P</i> -value)	Post-incarceration		χ^2 -statistic (<i>P</i> -value)
	Men % (N)	Women % (N)		Men % (N)	Women % (N)	
6 months (pre)/12 months (post)						
Unprotected sex						
Non-spouse/primary partner						
Yes	32 (118)	18 (30)	11.07** (<0.001)	25 (52)	13 (11)	4.41* (0.036)
No	68 (253)	82 (137)		75 (159)	87 (71)	
IV drug user						
Yes	4 (13)	8 (14)	5.75* (0.021)	3 (6)	1 (1)	0.67 (0.413)
No	97 (358)	92 (153)		97 (205)	99 (81)	
Trading sex/drugs						
Yes	10 (38)	10 (16)	0.06 (0.790)	3 (7)	0 (0)	2.79 (0.095)
No	90 (334)	90 (152)		97 (204)	100 (82)	
30 Days						
Unprotected sex						
Non-spouse/primary partner						
Yes	19 (67)	13 (22)	2.57 (0.109)	8 (13)	4 (3)	1.40 (0.237)
No	81 (289)	87 (145)		92 (148)	96 (73)	
IV drug user						
Yes	3 (9)	7 (11)	5.12* (0.024)	0 (0)	0 (0)	N/A
No	97 (350)	93 (157)		100 (162)	100 (76)	
Trading sex/drugs						
Yes	5 (18)	4 (7)	0.15 (0.696)	<1 (1)	0 (0)	N/A
No	95 (340)	96 (158)		>99 (160)	100 (75)	

* (**) Indicates statistical significance at 0.05 (0.01)

Table 3

Participants' pre- and post-incarceration IV drug use

Variable	Pre-incarceration		χ^2 -statistic (<i>P</i> -value)		Post-incarceration		χ^2 -statistic (<i>P</i> -value)	
	Men % (N)	Women % (N)			Men % (N)	Women % (N)		
6 months (pre)/12 months (post)								
Injected drugs								
Yes	11 (39)	14 (23)		1.12 (0.290)	8 (16)	8 (7)		0.06 (0.811)
No	89 (333)	86 (146)			92 (197)	92 (77)		
Dirty needles								
Yes	26 (10)	48 (11)		4.45* (0.035)	13 (2)	0 (0)		0.96 (0.328)
No	74 (29)	52 (12)			87 (14)	100 (7)		
Dirty "works"								
Yes	56 (22)	83 (19)		4.43* (0.035)	38 (6)	0 (0)		3.55 (0.061)
No	44 (17)	17 (4)			62 (10)	100 (7)		
30 Days								
Injected drugs								
Yes	8 (31)	11 (19)		1.59 (0.207)	100 (0)	1 (1)		N/A
No	92 (338)	89 (149)			0 (211)	99 (82)		
Dirty needles								
Yes	23 (7)	53 (10)		4.41* (0.036)	N/A	<1 (0)		N/A
No	77 (24)	47 (9)			N/A	>99 (1)		
Dirty "works"								
Yes	58 (18)	68 (13)		0.20 (0.655)	N/A	<1 (0)		N/A
No	42 (13)	32 (6)			N/A	>99 (1)		

* Indicates statistical significance at 0.05

Table 4

Participants' frequency of HIV risk behavior

Variable	Pre-incarceration (30 days prior to incarceration)			Post-incarceration (last 30 days preceding interview)		
	Men>Mean (SD)	Women Mean (SD)	Z-statistic (P-value)	Men Mean (SD)	Women Mean (SD)	Z-statistic (P-value)
Sexual behaviors						
Unprotected sex						
Non-spouse/primary partner	3 (3)	3 (3)	-0.14 (0.890)	8.31 (8.65)	7.67 (6.43)	-1.40 (0.162)
IV drug user	7 (10)	11 (15)	-0.96 (0.339)	0	0	N/A
Trading sex/drugs	3 (3)	5 (6)	-0.59 (0.553)	0	0	N/A
IV drug use						
Injected drugs	74 (170)	87 (111)	-1.87 (0.063)	2	0	N/A
Dirty needles	15 (27)	6 (11)	1.44 (0.161)	0	0	N/A
Dirty "works"	11 (15)	23 (28)	-1.31 (0.191)	0	0	N/A

Note: Descriptives and Z-statistics (Mann-Whitney U tests) represent participants who reported engaging in unprotected sex and/or IV drug use as shown in Tables 2 and 3.

* (**) Indicates statistical significance at 0.05 (0.01)