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Gender Differences in HIV Risk Behaviors Among Persons Involved in the U.S. Criminal Justice System and Living with HIV or at Risk for HIV: A “Seek, Test, Treat, and Retain” Harmonization Consortium

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Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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Abstract

The U.S. female criminal justice (CJ) population is rapidly growing, yet large-scale studies exploring gender-specific HIV risk behaviors in the CJ population are lacking. This analysis uses baseline data on adults with a CJ history from eight U.S. studies in an NIH-funded “Seek, Test, Treat, Retain” harmonization consortium. Data were collected using a standardized HIV risk behavior assessment tool and pooled across studies to describe participants’ characteristics and risk behaviors. Multilevel mixed-effects logistic regression models were used to test for gender-based behavior differences. Among 784 HIV-positive (21.4% female) and 5521 HIV-negative (8.5% female) participants, HIV-positive women had higher odds than HIV-positive men of engaging in condomless sexual intercourse (AOR 1.84 [1.16–2.95]) with potentially sero-discordant partners (AOR 2.40 [1.41–4.09]) and of sharing injection equipment (AOR 3.36 [1.31–8.63]). HIV risk reduction interventions targeting CJ-involved women with HIV are urgently needed as this population may represent an under-recognized potential source of HIV transmission.

Keywords

HIV/AIDS; Sexual risk behaviors; Injection drug use risk behaviors; Criminal justice system; Women and gender differences

Introduction

The U.S. has the highest incarceration rate in the world, with 612–716 per 100,000 of the national population in prison [1–3]. Due to large-scale criminalization of commercial sex workers and persons with substance use disorders (SUDs) in the U.S., incarcerated individuals frequently have a history of sexual and injection drug use (IDU) behaviors that place them at risk for blood-borne and sexually transmitted infections (STIs) [4, 5]. Indeed, the prevalence of HIV infection is at least four times higher in incarcerated populations than analogous non-incarcerated populations [6]. At year-end 2010, 1.5% of U.S. prisoners were known to have HIV or AIDS [7].

Women are now the fastest growing correctional population in the U.S. [8]. During 2013–2015, women constituted 9.3% of prisoners [9], 14% of jail detainees, and 25% of probationers [10]. Due to circumstances related to substance use, poverty, and gender-based violence, women with a CJ history appear to carry a greater risk of acquiring HIV in their lifetime than non-CJ-involved women [11–14]. In addition, unlike the general population where men constitute three times more HIV cases than women, incarcerated women have a higher prevalence of HIV infection than incarcerated men (1.9 vs. 1.4%, respectively) [7, 15, 16]. Although CJ-involved women are more likely than men to experience socioeconomic hardship, which can increase their likelihood of engaging in unsafe sexual and IDU practices

[11, 17–19], most HIV risk behavior studies in CJ-involved populations have focused on men [20–26]. The few studies among women or assessing gender-based differences in HIV risk behaviors have typically been small and yielded mixed results [16, 27–30].

The present study is an analysis of multi-site, cross-sectional HIV risk behavior data collected as part of a large consortium of studies that included persons involved with the U.S. CJ system [31]. Our objective is to describe gender-specific sexual and IDU risk behaviors among CJ-involved persons with or at risk for HIV during their time in the community (either prior to or after incarceration, including time under community supervision). We aim to use our findings to inform the design of targeted, gender-specific interventions to mitigate the risk of HIV/STI transmission within this high-risk population and to their community contacts.

Methods

Setting

Data for this analysis were derived from eight separate studies within the NIH-funded Seek Test Treat and Retain (STTR) consortium (<https://sttr-hiv.org/cms>). The consortium's goal is to integrate data from multiple studies to address research questions related to the HIV care continuum among vulnerable populations that require larger sample sizes than the individual studies provided [31]. The consortium has integrated data from numerous independent STTR research studies on multiple domains including: demographic information, substance use, CJ status, antiretroviral therapy (ART) adherence, and HIV risk behaviors. This paper analyzes the eight studies that focused on CJ populations and administered a standardized HIV risk behavior assessment tool at baseline (April 2011–August 2015).

Study Population

While eligibility criteria varied between the eight studies included in the analysis (Supplementary Table I), all participants were ≥18 years old, male or female, confirmed HIV-positive or negative, and previously or currently involved in the CJ system. Six studies recruited from CJ-based settings (prisons and jails [$n = 3$], detention centers [$n = 1$], and community supervision [$n = 2$]). All but 25 participants from the two studies with community recruitment had a past or current history of CJ involvement. To reduce study sample heterogeneity, these 25 participants were excluded (Fig. 1). Persons missing information on age ($n = 11$), risk behaviors ($n = 325$), or HIV status ($n = 16$); identified as transgender or refused to report gender ($n = 29$); or refused to answer key HIV risk behavior questions ($n = 484$) were also excluded. In studies with predominantly HIV-negative subjects (BRIGHT 1 and STT), HIV-positive subjects were excluded ($n = 19$). After exclusions, a total of 784 HIV-positive and 5521 HIV-negative participants were eligible for analysis.

Baseline Characteristics and Risk Behavior Assessment

Information on age, race/ethnicity, education, homelessness, health insurance, ART adherence (per the Visual Analog Scale [32]), and use of alcohol and illicit drugs was collected by self-report during each study's baseline interview. Except for age, race/ethnicity, and education, participants were asked to report characteristics and behaviors

during a specific reference period, which varied by study and in some cases by behavior within study (i.e., 30, 90, or 180 days prior to incarceration for current detainees or those recently released from incarceration, or the previous 30 or 90 days for participants in the community at the time of the interview and with no recent history of incarceration, per Supplementary Table D). In studies where the baseline survey was administered in the community, CJ supervision status was collected by self-report (STRIDE 1, STRIDE 2, and STTPCOIP-Prison) or formal CJ documentation (BRIGHT 1 and BRIGHT 2). HIV status was determined by serology, either documented in CJ medical records or performed at baseline.

The risk behavior assessment questionnaire was derived from an extensive assessment developed by Fisher et al. [33] and adapted by Springer (co-author) for use in her NEW HOPE study [34] and the broader STTR consortium [35]. This questionnaire elicited information regarding participants' sexual and IDU risk behaviors during each study's reference period. Participants were asked about their engagement in vaginal or anal intercourse, condom use, number of sexual partners, and the HIV status of each partner during the reference period. If participants had injected drugs, they reported whether they had shared a needle, cooker, or other IDU equipment, and the HIV status of the persons with whom they had shared.

Statistical Analysis

HIV-positive and negative participants were analyzed separately as there was virtually no heterogeneity of HIV status within any single study. Each study was also examined separately with risk behaviors stratified by gender. Gender patterns in HIV risk behaviors were fairly consistent across studies when grouped by HIV status. Therefore, data were pooled across studies to describe participant characteristics and HIV risk behaviors using simple frequencies. For studies with a reference period longer than 30 days, frequency of substance use was assumed to be consistent across the reference period and scaled to 30-days to facilitate comparisons. The substance use frequency was scaled to 30 days by dividing by the appropriate number (for example, 90-day use was divided by three). "Any sexual intercourse" was defined as any vaginal or anal intercourse (including anal insertive intercourse among men). Since the number of participants reporting high-risk behaviors with persons whose HIV status was either unknown or sero-discordant was very small, these two categories were combined for analyses.

To test for risk behavior differences between men and women, we performed individual participant data metaanalysis to combine information across the studies [36, 37]. We implemented this individual participant data metaanalysis using multilevel mixed-effects logistic regression models with participants nested within studies and standard errors adjusted for within-study correlation. Studies with too few participants (1 man or woman) reporting the behavior of interest were excluded. We generated forest plots using the "ipdforest" command in Stata (version 14.0) [38].

Ethics

All studies received approval from their respective Institutional Review Boards and, if applicable, Department of Corrections Research Advisory Committees. Additional protections were provided by the Office of Human Research Protections (OHRP) at the Department of Health and Human Services, and Certificates of Confidentiality (CoC) were obtained.

Results

HIV-Positive Participant Characteristics

The HIV-positive sample was 78.6% male and 21.4% female (Table 1). Over 75% were African American. Men and women were comparable regarding mean age (44.6 ± 11.0 and 44.2 ± 10.1 years, respectively). Women had lower educational attainment than men, with 59.5% of women (compared to 41.4% of men) not having attained a high school diploma whereas 16.7% of men but only 8.3% of women had attended college at some point in time. At least one third of the sample reported being homeless before incarceration or recently homeless, and many lacked health insurance. At the time of the interview, 57.0% of men and 47.6% of women were in jail, with a small proportion in prison (4.5 and 2.4%, respectively). Otherwise, all but 8.1% of men were on probation, parole or both, whereas 21.4% of women were not under any CJ supervision. More men (65.0%) than women (51.8%) were currently on ART, among which adherence was 89.5 and 85.7%, respectively.

Sexual Risk Behaviors Among HIV-Positive Participants

Approximately one-quarter of the sample reported having multiple sexual partners during the reference period (Table 1). Among those with at least one sexual partner, the majority of both men and women (81.0 and 96.2%, respectively) reported vaginal intercourse whereas a comparable minority (17.3 and 14.3%, respectively) reported anal receptive intercourse (Table 2). Among those reporting vaginal intercourse, 32.4% of men and 50.0% of women did not use condoms. Adjusting for age and study (Fig. 2), the odds of engaging in vaginal intercourse without a condom were significantly higher for women than men (adjusted OR [AOR] 2.42, 95% CI 1.48–3.97). Among those reporting anal receptive intercourse, 50.7% of men and 33.3% of women did not use condoms, although an AOR for this comparison was not estimable due to the small number of individuals in each study who reported condomless anal receptive intercourse.

Among those who reported any sexual intercourse during the reference period, 36.8% of men and 48.6% of women did not use condoms. Women had significantly higher odds of reporting any condomless sexual intercourse (AOR 1.84, 95% CI 1.16–2.95) and more than twice the odds of having condomless sexual intercourse with a partner who was HIV-negative or whose HIV status was unknown (AOR 2.40, 95% CI 1.41–4.09). Specifically, while 14.3% ($n = 57$) of men and 17.0% ($n = 18$) of women reported condomless intercourse with a partner of unknown HIV status, the proportion of women who reported condomless intercourse with an HIV-negative partner was twice the proportion of men who did so (15.1% [$n = 16$] vs. 7.5% [$n = 30$]; not shown in Table 2 since numbers were too small to estimate odds ratios). Among individuals who reported multiple sexual partners,

approximately half reported not using condoms, with no significant gender-related differences (AOR 1.31, 95% CI 0.61–2.79).

Drug Injection Risk Behaviors Among HIV-Positive Participants

Although a higher proportion of men (72.5%) than women (58.9%) reported having ever injected drugs, women reported a higher frequency of crack/cocaine and opioid use during the reference period (Table 1). Among the 20% of participants who reported IDU during the reference period, 23.5% of men and 39.4% of women shared IDU equipment (Table 2). The adjusted odds of sharing were 3.36 times greater for women compared to men (95% CI 1.31–8.63; Fig. 2). The proportion of HIV-positive women who reported sharing with someone of unknown HIV status (24.2%, $n = 8$) or HIV-negative status (18.2%, $n = 6$) was twice the proportion of HIV-positive men who reported these potentially sero-discordant sharing patterns (12.6% [$n = 15$] and 8.4% [$n = 10$], respectively; data not shown). Due to the small number of individuals in each study who reported sharing IDU equipment, an AOR for sharing with a person of unknown or negative HIV status was not estimable.

HIV-Negative Participant Characteristics

The HIV-negative sample was 91.5% male, with comparable ages for men (34.6 ± 26.0 years) and women (37.9 ± 10.6 years; Table 1). The majority was African American, with 10% being Hispanic/Latino and one-quarter being white. Although more women (37.3%) than men (29.6%) lacked a high school diploma, there were more female than male college graduates (15.3 vs. 9.8%). Among HIV-negative individuals with available housing status data (BRIGHT 1 participants only), approximately 25% reported homelessness. Half of men but only 27.4% of women did not have health insurance. At the time of the interview, all HIV-negative participants were either in a correctional facility or under CJ supervision in the community. The majority of men (66.0%) were in jail with another 26.3% on probation, whereas the majority of women (68.3%) were on probation with another 20.4% in jail.

Sexual Risk Behaviors Among HIV-Negative Participants

A higher proportion of HIV-negative men than women (40.8 vs. 27.0%) reported having multiple sexual partners during the reference period (Table 1). Among participants with at least one sexual partner, the vast majority of both men and women reported vaginal intercourse (88.0 and 92.2%, respectively; Table 3). More than 75% of those who had vaginal intercourse did not use condoms, with no significant gender differences (AOR 1.14, 95% CI 0.86–1.53; Fig. 3). More women (15.7%) than men (3.1%) engaged in anal receptive intercourse, and the majority of both women (77.8%) and men (81.0%) did so without using condoms. An AOR for this comparison was not estimable.

Among those who reported any sexual intercourse during the reference period, large proportions of both men (69.2%) and women (74.1%) did not use condoms (AOR 1.01, 95% CI 0.78–1.31). One-quarter of all HIV-negative individuals reported condomless sexual intercourse with a partner of unknown or positive HIV status. Specifically, 24.0% ($n = 990$) of men and 24.4% ($n = 84$) of women reported condomless intercourse with a partner of unknown HIV status (data not shown). Only a few (0.1% [$n = 6$] men and 0.6% [$n = 2$] of women) reported condomless intercourse with a partner known to be HIV-positive. Women

compared to men had 1.25 times greater adjusted odds of having condomless sexual intercourse with a partner of unknown or positive HIV status, although this estimate was not quite statistically significant (95% CI 0.96–1.63). While a higher proportion of men (40.8%) than women (27.0%) reported having multiple sexual partners, rates of condomless intercourse among men (63.4%) and women (71.1%) with multiple partners were comparable.

Drug Injection Risk Behaviors Among HIV-Negative Participants

The proportion of HIV-negative participants who had ever injected drugs was low overall, though higher for women than men (28.9 vs. 14.2%; Table 1). During the reference period, women reported a lower frequency of all substance use except crack/cocaine. Approximately half of the less than 8% who had injected drugs during the reference period had shared IDU equipment, with no significant gender differences (Table 3; Fig. 3). Twenty percent ($n = 7$) of women and 24.7% ($n = 71$) of men had shared IDU equipment with someone of unknown HIV status, while none of the women and only 0.7% ($n = 2$) of the men had shared equipment with an HIV-positive person (data not shown). An AOR for potentially sero-discordant sharing was not estimable.

Discussion

This study is one of the first large-scale assessments of gender-related differences in HIV risk behaviors among CJ-involved persons. HIV-positive women reported engaging in more high-risk sexual and IDU behaviors than HIV-positive men, whereas risk behaviors among HIV-negative men and women were comparable. These findings reflect current literature on the syndemic of CJ-involvement, sexual and substance use-related HIV risk behavior, and gender-based violence suggesting that gender can influence one's HIV risk [11, 12, 15, 16, 39–41].

It should first be noted that a substantial proportion of the sexually active men in our HIV-positive sample reported recently engaging in anal receptive (17.3%) and anal insertive (27.4%) intercourse. While a comparable proportion of HIV-positive women (14.3%) also reported anal receptive intercourse, more of the men (50.7%) than women (33.3%) engaged in this behavior without condoms. Likewise, half of the men who reported anal insertive intercourse did not consistently use condoms. Although we were unable to test for gender differences in the prevalence of condomless anal intercourse due to small numbers, these proportions suggest that HIV-positive men who engage in any form of anal intercourse are more likely to expose their partners to HIV compared to their female counterparts who engage in anal receptive intercourse [42]. This finding would be consistent with patterns in the general U.S. population where male-to-male sexual contact is estimated to account for at least 67% of new HIV cases [43].

Nevertheless, despite the high prevalence of condomless anal intercourse in HIV-positive men, HIV-positive women still had higher odds overall of reporting condomless sexual intercourse of any kind as well as with potentially sero-discordant partners. This suggests that CJ-involved women may expose their sexual partners to HIV more often than their male counterparts. Thus, the risk of female-to-male sexual transmission involving the CJ

population may be under-recognized. In contrast, among our HIV-negative participants, there were no statistically significant gender-based differences in sexual risk behaviors; nearly one-quarter of HIV-negative men and women were at risk of acquiring HIV through condomless sexual intercourse with potentially sero-discordant partners.

Women are often found to be vulnerable to experiencing extradyadic relationships (where sexual relations are not confined to the primary sexual relationship), powerlessness to negotiate condom use, and high-risk sexual encounters including with partners who inject [39, 44, 45]. Low-income women who engage in commercial sex work to support themselves, a drug habit, or a partner's drug habit are also at elevated risk of acquiring or transmitting HIV, particularly if subjected to violent sexual assault [39, 40, 44–47]. In this study, the lack of condom use reported by HIV-positive women may be, to some extent, a manifestation of coercive sexual encounters during which partner disclosure and condom negotiation efforts may be unsuccessful [48–50]. It is also conceivable that women who believe their health status already is compromised may be less motivated to risk initiating a condom use negotiation that could precipitate a violent encounter [50]. Substance use, even without injection, may also increase HIV risk by promoting condomless sexual encounters while under the influence of illicit drugs or alcohol [22].

In this study, HIV-positive women were also significantly more likely than HIV-positive men to share IDU equipment. Gender inequality dynamics in social networks, including power imbalances in intimate partner relationships, often lead to scenarios wherein men prepare shared drugs using common supplies and inject themselves first, after which they either inject a female partner with the used syringe or give her the syringe to inject herself [51–56]. These social dynamics, combined with fear of HIV-related stigma or backlash from HIV status disclosure, could make it difficult for an HIV-positive woman to avoid sharing IDU equipment. Also due to such IDU sharing dynamics, HIV-negative women may be at higher risk for HIV infection via injection than men despite no reportable gender-based differences in IDU equipment sharing [57].

Among men, having knowledge of one's HIV-positive status has been associated with a reduction in HIV-associated risk behaviors [22, 58], but little is known about behavioral changes after sero-conversion among women. For the CJ population, our findings that HIV-positive women engage in more high-risk behaviors than HIV-positive men suggests at least two possible interpretations: (1) men and women who acquire HIV demonstrate similar reductions in high-risk behaviors, but women begin at a higher risk level than their male counterparts, or (2) HIV-positive women do not demonstrate a risk behavior reduction after diagnosis to the same extent as men. Risk behaviors such as condomless sexual intercourse can be a symbol of trust and commitment between sexual partners or an effort to achieve a pregnancy [30]. Similarly, some individuals who share injection needles with friends or family do not consider themselves to have shared IDU equipment since they view this type of sharing as low-risk [59]. The risk of HIV transmission during such practices is significantly reduced if the sero-positive individual achieves viral suppression [60]. However, the women in our study demonstrated worse ART engagement rates in the community compared to men; only half of women (compared to 65% of men) were on ART, among whom adherence was relatively high but still below the UNAIDS goal of 90% [61].

This is concerning particularly from a community prevention standpoint, but is consistent with previous literature showing that CJ-involved women and women who use drugs are less likely than men to engage and be retained in HIV care [62, 63]. These patterns are possible manifestations of the diminished autonomy and socioeconomic freedom among CJ-involved women compared to men [17–19], higher prevalence of untreated mental illness and SUDs among CJ-involved women [64], and relatively few HIV risk reduction and treatment enrollment efforts targeting women.

In order to appropriately target CJ-involved individuals at risk for either contracting or exposing others to HIV, gender-specific interventions are required to equip CJ-involved women with the skills and resources to reduce high-risk behavior [27, 65]. In particular, interventions using SUD treatment as HIV prevention [57, 66, 67] and addressing relationship power dynamics, gender-based violence [65, 68–70], and post-incarceration community reintegration challenges [71–73] should be further explored for their potential to influence CJ-involved women's likelihood of engaging in high-risk behavior after release.

Study Limitations

This study was limited by the sample's heterogeneous nature, including variations between studies regarding geography, study site, and recruitment criteria. Lack of heterogeneity in HIV status within studies restricted our ability to make statistical comparisons between HIV-positive and HIV-negative populations. The data also lacked granularity regarding psychiatric illness, sexual orientation, and experiences with interpersonal violence, which may have contributed to the observed behavioral patterns. Finally, these findings may not be generalizable to the international setting where the epidemics of HIV, substance use, and incarceration may be different [74]. Nevertheless, these findings provide meaningful insight into potential gender-based differences in HIV risk behaviors that could be targeted for intervention.

Conclusions

Recently, attention has been drawn to how women are uniquely vulnerable to HIV infection, particularly if CJ-involved [39, 40]. Our findings suggest that the factors that make women initially vulnerable to HIV infection may perpetuate the risk of infection to their sexual and IDU partners. To reduce HIV transmission, gender-specific interventions are urgently needed to improve ART adherence and condom use and reduce IDU equipment sharing [71–73, 75–80].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.
Consort diagram

Fig. 2.

Individual participant data meta-analysis of risk behaviors in HIV-positive women compared to men. Multilevel logistic regression models are adjusted for age (years) and study; odds ratio (OR) and 95% confidence interval (CI) is for females, with male as the reference category, **a** Any condomless sexual intercourse; **b** condomless vaginal intercourse; **c** any condomless sexual intercourse with partner of unknown or negative HIV status; **d** any condomless sexual intercourse among participants with 2 partners; **e** any sharing of drug injection equipment

Fig. 3.

Individual participant data meta-analysis of risk behaviors in HIV-negative women compared to men. Multilevel logistic regression models are adjusted for age (years) and study; odds ratio (OR) and 95% confidence interval (CI) is for females, with male as the reference category, **a** Any condomless sexual intercourse; **b** condomless vaginal intercourse; **c** any condomless sexual intercourse with partner of unknown or positive HIV status; **d** any condomless sexual intercourse among participants with 2+ partners; **e** any sharing of drug injection equipment

Table 1

Description of HIV-positive and HIV-negative samples of individuals

	HIV+ (STRIDE 1, STRIDE 2, NEW HOPE, STTCOIP-Jail, STTCOIP-Prison, BRIGHT 2)		HIV- (BRIGHT 1, STT)	
	Male	Female	Male	Female
N (%)	616 (78.6%)	168 (21.4%)	5051 (91.5%)	470 (8.5%)
Age	44.6 ± 11.0	44.2 ± 10.1	34.6 ± 26.0	37.9 ± 10.6
Race/ethnicity				
Black/African American	467 (75.8%)	133 (79.2%)	3059 (60.6%)	245 (52.1%)
Hispanic or Latino	94 (15.3%)	23 (13.7%)	516 (10.2%)	47 (10.0%)
White	42 (6.8%)	9 (5.4%)	938 (18.6%)	131 (27.9%)
American Indian or Alaska Native	4 (0.6%)	1 (0.6%)	80 (1.6%)	10 (2.1%)
Asian	1 (0.2%)	0 (0.0%)	7 (0.1%)	0 (0.0%)
Native Hawaiian or Other Pacific Islander	0 (0.0%)	0 (0.0%)	3 (0.1%)	0 (0.0%)
Some other race	1 (0.2%)	0 (0.0%)	38 (0.8%)	2 (0.4%)
Two or more races	7 (1.1%)	1 (0.6%)	255 (5.0%)	28 (6.0%)
Education				
Middle school (Jr. high) or less	47 (7.6%)	25 (14.9%)	171 (3.4%)	22 (4.7%)
Some high school, no diploma	208 (33.8%)	75 (44.6%)	1323 (26.2%)	153 (32.6%)
High school grad, GED equivalent	192 (31.2%)	42 (25.0%)	2485 (49.2%)	193 (41.1%)
Junior (2-year) college	40 (6.5%)	6 (3.6%)	184 (3.6%)	17 (3.6%)
Technical, trade, vocational school	26 (4.2%)	4 (2.4%)	392 (7.8%)	13 (2.8%)
Some college, no degree	82 (13.3%)	14 (8.3%)	387 (7.7%)	65 (13.8%)
College graduate or post-college	21 (3.4%)	0 (0.0%)	106 (2.1%)	7 (1.5%)
Homelessness (self-reported ^a)				
Yes	232 (37.7%)	56 (33.3%)	385 (22.4%)	98 (26.2%)
No	370 (60.1%)	109 (64.9%)	1126 (65.6%)	240 (64.2%)
Unsure	12 (1.9%)	2 (1.2%)	205 (11.9%)	36 (9.6%)
Health Insurance				
Not insured	154 (25.0%)	33 (19.6%)	2688 (53.2%)	129 (27.4%)
Insured	449 (72.9%)	133 (79.2%)	2301 (45.6%)	338 (71.9%)
Unsure	13 (2.1%)	2 (1.2%)	55 (1.1%)	3 (0.6%)
Number of sex partners				
None	211 (34.3%)	62 (36.9%)	924 (18.3%)	126 (26.8%)
One	235 (38.2%)	66 (39.3%)	2064 (40.9%)	217 (46.2%)
Two or more	169 (27.4%)	40 (23.8%)	2063 (40.8%)	127 (27.0%)
Ever injected drugs over lifetime ^b	177 (72.5%)	56 (58.9%)	719 (14.2%)	136 (28.9%)
Number of days an illicit substance or alcohol was used during a 30-day reference period ^c				
Alcohol	7.4 ± 9.6	4.8 ± 8.3	8.5 ± 71.7	3.2 ± 7.2
Binge alcohol ^d	4.5 ± 9.7	2.5 ± 7.4	8.1 ± 76.9	2.1 ± 6.6
Marijuana	6.4 ± 11.5	3.4 ± 8.6	10.5 ± 74.5	6.0 ± 46.8

	HIV+ (STRIDE 1, STRIDE 2, NEW HOPE, STTCOIP-Jail, STTCOIP-Prison, BRIGHT 2)		HIV- (BRIGHT 1, STT)	
	Male	Female	Male	Female
Crack/cocaine	7.1 ± 11.7	10.3 ± 12.9	2.3 ± 34.7	2.5 ± 7.3
Opioid	10.5 ± 13.5	14.1 ± 13.9	3.0 ± 32.1	2.8 ± 8.1
Stimulants	0.6 ± 3.6	0.2 ± 1.7	1.7 ± 37.2	0.3 ± 2.2
Other	0.8 ± 4.1	1.2 ± 5.3	1.8 ± 34.6	1.2 ± 3.5
Criminal justice supervision status at time of interview				
Prison	28 (4.5%)	4 (2.4%)	0 (0.0%)	0 (0.0%)
Jail	351 (57.0%)	80 (47.6%)	3335 (66.0%)	96 (20.4%)
Probation	62 (10.1%)	23 (13.7%)	1328 (26.3%)	321 (68.3%)
Parole	103 (16.7%)	15 (8.9%)	315 (6.2%)	42 (8.9%)
Both probation and parole	10 (1.6%)	1 (0.6%)	72 (1.4%)	10 (2.1%)
Other	9 (1.5%)	7 (4.2%)	0 (0.0%)	0 (0.0%)
No supervision	50 (8.1%)	36 (21.4%)	0 (0.0%)	0 (0.0%)
Taking antiretroviral therapy (ART)	397 (65.0%)	87 (51.8%)	—	—
% Adherence to ART ^c	89.5 ± 20.4	85.7 ± 23.9	—	—

Values shown are mean ± SD unless otherwise specified

^aHousing status data during a 30 or 90-day reference period were not available for harmonization in the STT study, resulting in missing data for 66.0 and 20.4% of HIV-negative males and females, respectively

^bLifetime injection drug use data were not collected for the STTCOIP-Jail and STTCOIP-Prison studies, such that all but one (BRIGHT 2) of the studies reporting this variable for HIV-positive individuals used recruitment inclusion criteria based on opioid dependence

^cFor studies with a longer reference period, frequency of substance use was scaled down to 30-days to facilitate comparisons

^dBinge alcohol was defined as having five or more drinks on one occasion in BRIGHT 1, BRIGHT 2, STT, STTCOIP-Jail, and STTCOIP-Prison studies, and as six or more drinks on one occasion in NEW HOPE, STRIDE 1, and STRIDE 2 studies

^eAntiretroviral therapy (ART) adherence was measured among those taking ART using the Visual Analog Scale of ART adherence. These data were not collected for the STTCOIP-Jail and STTCOIP-Prison studies

Table 2

Sexual and injection drug use risk behaviors among HIV-positive participants

	Male	Female	Adjusted OR (95% CI) ^a
Sexual Risk Behaviors, N (%)	616 (78.6%)	168 (21.4%)	
Among those who reported any sexual intercourse during reference period, N (%):	405 (65.7%)	106 (63.1%)	–
Any vaginal sexual intercourse	328 (81.0%)	102 (96.2%)	–
Condomless vaginal intercourse, among those who reported vaginal intercourse	105 (32.4%)	51 (50.0%)	2.42 (1.48–3.97)^b
Any anal receptive sexual intercourse	70 (17.3%)	15 (14.3%)	–
Condomless anal receptive intercourse, among those who reported anal receptive intercourse	35 (50.7%)	5 (33.3%)	*
Any anal insertive sexual intercourse	110 (27.4%)	–	–
Condomless anal insertive intercourse, among those who reported anal insertive intercourse	56 (51.4%)	–	–
Any condomless sexual intercourse	147 (36.8%)	51 (48.6%)	1.84 (1.16–2.95)^b
Any condomless sexual intercourse with partner of unknown or negative HIV status	84 (21.1%)	33 (31.1%)	2.40 (1.41–4.09)^c
Among those who reported >1 partner during reference period:	169 (27.4%)	40 (23.8%)	–
Any condomless sexual intercourse	79 (47.3%)	21 (53.8%)	1.31 (0.61–2.79)
Drug Injection Risk Behaviors, N (%)	616 (78.6%)	168 (21.4%)	
Among those who reported injecting drugs during reference period, N (%):	122 (19.8%)	35 (20.8%)	–
Shared works or cooker	28 (23.5%)	13 (39.4%)	3.36 (1.31–8.63)^d

* Not estimated due to insufficient numbers (at least one cell with n = 1) in each individual study

^a Estimates were generated using individual participant data meta-analysis implemented using mixed-effects logistic regression; models are adjusted for age (years) and study. Odds ratio (OR) and 95% confidence interval (CI) is for females, with males as the reference category. Bold text indicates statistical significance at the p = 0.05 level

^b STRIDE 1 study was excluded due to insufficient numbers

^c STRIDE 1 and STTCOIP-Prison studies were excluded due to insufficient numbers

^d STRIDE 1, STTCOIP-Prison, BRIGHT 2 studies were excluded due to insufficient numbers

Table 3

Sexual and injection drug use risk behaviors among HIV-negative participants

	Male	Female	Adjusted OR (95% CI) ^a
Sexual Risk Behaviors, N (%)	5051 (91.5%)	470 (8.5%)	
Among those who reported any sexual intercourse during reference period, N (%):	4127 (81.7%)	344 (73.2%)	–
Any vaginal sexual intercourse	3607 (88.0%)	317 (92.2%)	–
Condomless vaginal intercourse, among those who reported vaginal intercourse	2774 (76.9%)	251 (79.2%)	1.14 (0.86–1.53)
Any anal receptive sexual intercourse	126 (3.1%)	54 (15.7%)	–
Condomless anal receptive intercourse, among those who reported anal receptive intercourse	102 (81.0%)	42 (77.8%)	*
Any anal insertive sexual intercourse	409 (10.0%)	–	–
Condomless anal insertive intercourse, among those who reported anal insertive intercourse	328 (80.2%)	–	–
Any condomless sexual intercourse	2827 (69.2%)	255 (74.1%)	1.01 (0.78–1.31)
Any condomless sexual intercourse with partner of unknown or positive HIV status	994 (24.1%)	85 (24.7%)	1.25 (0.96–1.63) ^b
Among those reporting > 1 partner during reference period:	2063 (40.8%)	127 (27.0%)	–
Any condomless sexual intercourse	1288 (63.4%)	91 (71.7%)	1.24 (0.83–1.86)
Drug Injection Risk Behaviors, N (%)	5051 (91.5%)	470 (8.5%)	
Among those who reported injecting drugs during reference period, N (%):	292 (5.8%)	37 (7.9%)	–
Shared works or cooker	146 (50.3%)	16 (43.2%)	1.03 (0.46–2.27)

* Not estimated due to insufficient numbers (at least one cell with n = 1) in each individual study

^aEstimates were generated using individual participant data meta-analysis implemented using mixed-effects logistic regression; models are adjusted for age (years) and study. Odds ratio (OR) and 95% confidence interval (CI) is for females, with males as the reference category

^bPrimarily comprised of individuals reporting condomless sexual intercourse with a partner of unknown HIV status; only 0.1% of men and 0.6% of women reported condomless sexual intercourse specifically with a partner known to be HIV-positive