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The Association between *Trichomonas* Infection and Incarceration in HIV-seropositive and at-risk HIV-seronegative Women

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Abstract

Background—The prevalence of *Trichomonas vaginalis* is higher among incarcerated women than in the general community. We sought to determine whether a history of incarceration itself was independently associated with trichomoniasis.

Methods—The HIV Epidemiology Research Study (HERS) is a prospective cohort study of 871 HIV-seropositive and 439 high-risk seronegative women in 4 urban centers (Bronx, NY; Detroit, MI; Providence, RI; Baltimore, MD). All participants enrolled between April 1993 and January 1995, with interviews and physical exams conducted at baseline and at follow-up visits every 6 months up to 7 years.

Results—Of 1310 subjects, 427 (33%) reported being incarcerated on at least one occasion. In addition, 724 (55%) were found to have an STI on at least one occasion during the study; baseline

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rates were 21% for *T. vaginalis*, 4.3% for *C. trachomatis*, 0.6% for *N. gonorrhea*, and 8% for syphilis. Incarceration was associated with the detection of trichomonas infection (between-subject OR 2.4, 95%CI 1.85 to 3.14, $p<0.01$; within-subject OR 1.56, 95%CI 1.26 to 1.92, $p<0.01$). The association with incarceration remained significant after adjusting for age, race, HIV status, enrollment risk group, number of sexual partners, marital status, education, bacterial vaginosis (BV), vaginal candidiasis, drug use (crack, cocaine, heroin), alcohol use, health insurance, receipt of public assistance, employment status, visit number and study site.

Conclusions—A history of incarceration was independently associated with the detection of trichomonas infection in a cohort of high-risk women. These data have implications for increased STI prevention, screening and treatment upon entry to jail as well as in the communities most affected by incarceration.

Keywords

trichomonas; incarceration; sexually transmitted infections; HIV; jail

Introduction

Trichomonas vaginalis is the most common curable sexually transmitted infection (STI) in the United States, with approximately 7.4 million cases detected annually. [1] Complications from trichomonas infection include pelvic inflammatory disease, infertility, preterm labor, and an increased risk of HIV acquisition and transmission.[2-6] Many individuals with trichomoniasis are asymptomatic, which makes identifying and treating infected individuals difficult and increases the risk of transmission to others.

There are several clearly identified risk factors for trichomonas, such as younger age, African-American race, illicit substance use and having multiple sexual partners.[7, 8] Many of these characteristics are also common to incarcerated individuals. Indeed, women entering correctional facilities have prevalence rates of gonorrhea, chlamydia and syphilis that are similar to the STD clinic population and at least 3-5 times higher than the general female population.[7, 9-11] *T. vaginalis* testing in the incarcerated setting has been limited to date, although several studies have reported high rates of trichomonas infection, 22-47%, [12-15] relative to 16-29% in the STD clinic setting [16-18] and 3.1% in the general female population.[8]

Although universal screening of inmates for STIs is essential to public health surveillance, and 76% of federal and state correctional facilities perform routine or mandatory screening for syphilis, only 20% do so for chlamydia, and 17% for gonorrhea.[19] Trichomoniasis is currently not a nationally reportable condition and hence data on *Trichomonas vaginalis* prevalence in incarcerated individuals as well as in the community are relatively scarce. A recent study of incarcerated women showed that universal rather than targeted screening identified 5 times more cases of trichomoniasis.[20] Trichomoniasis has been receiving increased attention in recent years due to the association between trichomonas infection and HIV acquisition,[21, 22] similar to the associations between other non-ulcerative STIs and HIV.[23] The recently released STD treatment guidelines from the Centers for Disease Control [24] include specific recommendations for screening persons in correctional facilities, including screening all adolescent females and adult women under age 35 for gonorrhea and chlamydia at intake, as well as universal syphilis screening based on local prevalence. Although no specific recommendation is made with regard to trichomonas screening in correctional facilities, “screening for *T. vaginalis* can be considered in those at high risk for infection (i.e. women who have new or multiple partners, have a history of STDs, exchange sex for payment and use injection drugs)”.

The data collected in the HIV Epidemiology Research Study (HERS) provide a unique opportunity to explore the relationship between incarceration and trichomonas infection. This cohort is of particular interest as the women involved in the study are at risk for transmitting or acquiring HIV, emphasizing the potential role of correctional institutions in primary and secondary STI and HIV prevention. Also, trichomoniasis is commonly seen in HIV-infected women.[25-27] As part of the HERS, high-risk women were routinely screened for STIs and detailed information was collected regarding demographics, substance and alcohol use, sexual behaviors and incarceration. Using data from the HERS, we sought to determine whether high rates of trichomonas infection in these women are explained by available risk factors for STIs and whether recent incarceration adds additional information independent of these known risk factors.

Materials and Methods

Recruitment and Testing

The HERS recruited 871 HIV-seropositive women and 439 high-risk HIV-seronegative women from four sites in the United States (Bronx, NY; Baltimore, MD; Detroit, MI; Providence, RI) from April 1993 through January 1995, with ongoing data collection until 2001, described in detail elsewhere.[28] Women who were enrolled in the HERS were 16-55 years of age were either known to be HIV-infected and/or reported one or more of the following: (1) a history of injection drug use, (2) having >5 sexual partners in their lifetime, (3) engaging in sex with a male injection drug user or a person with either known or suspected HIV infection or (4) trading sex for drugs or money. Each woman was classified by her most likely risk for HIV, heterosexual or IDU, and the HIV-seropositive and –seronegative cohorts were balanced by risk. Participants were interviewed and underwent physical exams at baseline and every six months thereafter for up to seven years, which included a pelvic exam and collection of genital tract, blood and urine specimens. Study visits were scheduled in advance and data from non-study visits, such as an unscheduled appointment for a new medical issue, were not included.

The primary outcomes in the current study were the longitudinal presence of an STI as defined by a positive test for syphilis, chlamydia, gonorrhea or trichomonas at each study visit. Routine testing for syphilis (by serum rapid plasma reagin test and confirmed by fluorescent treponemal antibody absorption test), *C. trachomatis* (by direct fluorescent antibody or culture, subsequently by PCR) and *N. gonorrhea* (by culture, subsequently by PCR) were completed for the first four visits and if suspected thereafter, and testing for *Trichomonas species* (by saline wet mount and/or Pap smear, then by culture starting at visit 4) were continued throughout the study. If more than one testing method was used, such as saline wet mount and culture for trichomonas, any single positive result was considered positive.

Data Analysis

Separate longitudinal regression analyses were performed for each STI using longitudinal binary outcomes with the exception of gonorrhea (which was uncommon and therefore combined with chlamydia as a single longitudinal binary outcome). The primary exposure variable was a reported history of incarceration at each study visit, which was assessed by the question, “Have you been in jail or prison.... in the past twelve months?” (at baseline) or “... since your last study visit?” (for follow-up visits).

Additional variables that were defined for inclusion in the analysis were age, marital status (single, married, separated, or divorced/widowed), race (White, African American, Other (includes Hispanic, Asian, Native American)), education level (defined as years of

education), the presence of vaginal candidal infection (as detected by culture, Pap smear and/or KOH prep), the presence of bacterial vaginosis (BV) or intermediate vaginal flora (as defined by the Nugent score), condom use (a binary variable-always or not always), number of sexual partners in the past 6 months (0 to 1, 2 to 4, and 5), heavy alcohol use (a binary variable defined as 14 drinks per week or >4 drinks at one time[29, 30] using baseline visit data only due to complex coding of this variable), crack, cocaine or heroin use in the past 6 months, and three socioeconomic measures: currently employed, receiving public assistance (welfare, food stamps), and having health insurance.

Data from all 1310 women were analyzed using multivariable regression methods for longitudinal binary outcomes. All models included variables for baseline HIV status, HIV risk group (injection drug or heterosexual risk), visit number and study site due to the fact that they were structural components of the HERS study design. Analyses for chlamydia, gonorrhea and syphilis were limited to the first four visits as routine testing for these infections was not continued beyond the fourth study visit. However, for trichomonas, analyses included up to 13 study visits since routine screening for trichomonas was continued throughout the course of the study.

The longitudinal models for trichomonas and gonorrhea/chlamydia were fit using generalized estimating equations with an independent working correlation structure. Independent correlation structure results in consistent parameter estimates with time-varying covariates. Robust standard errors were used to calculate 95% confidence intervals for the parameter estimates. Pooled logistic regression analysis was used to evaluate new syphilis infection, since treponemal tests are persistently positive in syphilis after the first infection. Pooled logistic regression[31] is appropriate here since it is asymptotically equivalent to Cox proportional hazard regression modeling with time-varying covariates when the probability of a positive test is low. With only 20 new cases of syphilis during follow up this condition is satisfied.

An initial longitudinal model was created with only incarceration, HIV status, risk group, study site and visit number as a basic model for the association between incarceration and each STI. A second model was generated with all known risk factors for STIs excluding incarceration to determine whether these data were consistent with known predictors of infection. Lastly, the final model included all the covariates from the first and second models. For time-varying covariates that were not susceptible to influence by the outcome (incarceration, drug use, public assistance, employment, health insurance), the baseline value (for the between-subject or cross-sectional effect) and change from baseline (for the within-subject or longitudinal effect) were included as separate covariates. Incorporation of two effects avoids confounding of the longitudinal effects with cross-sectional effects, since these two sources of information could potentially be at odds. [32] For other time-varying covariates that may be impacted by the outcome (e.g. condom use, number of partners, bacterial vaginosis), baseline values were used for the final model, since their inclusion may result in biased parameter estimates. Of note, only the results of the first and third models are presented in the results section, except for syphilis where no models were run beyond the first model due to small number of outcomes. All statistical analyses were conducted using SAS software version [9.2] (SAS Institute Inc., Cary, NC, USA).

Results

Baseline characteristics- Table 1

The baseline characteristics of this cohort are described in Table 1 and are separated into those who did report incarceration in the 12 months prior to enrollment and those who did. Overall, the mean age of participants was 35 years and over one-half were African-

American. Two thirds (871, 66%) were HIV infected at the time of enrollment, 147 (17%) of whom had a baseline CD4 count <200 cells/mm³. The mean education level was less than high school (11.5 years), and approximately one-quarter of the cohort was married. Those reporting recent incarceration had higher baseline rates of trichomonas, BV, drug use, heavy alcohol use, and sexual partners but lower rates of condom use, employment, and health insurance.

Cumulative characteristics

Recent incarceration was reported by 185 (14%) of participants at baseline, and by 435 participants (33%) throughout the study. Of the women who were incarcerated, nearly one-half (205, 48%) were incarcerated more than once. During the first four visits of the study, there were 115 episodes of chlamydia in 104 subjects, 26 episodes of gonorrhea in 26 subjects, and 20 incident syphilis infections. Of these, 10 were co-infections with trichomonas and gonorrhea, 31 co-infections with trichomonas and chlamydia, 2 coinfections with gonorrhea and chlamydia, and 1 visit where a woman tested positive for gonorrhea, chlamydia and trichomonas. During the first 13 visits, there were 1877 episodes of trichomonas in 624 subjects, of whom 382 (61%) had more than one visit with documented trichomonas infection. Figure 1 shows rates of infection with trichomonas by study visit in women who did and did not report recent incarceration.

The majority of those who had one or more partner reported inconsistent condom use at some time during the study (67%). Of all participants, 67% reported some type of illicit substance during the study. Vaginal candidiasis and BV were commonly detected in participants, with 87% and 80% respectively testing positive on at least one occasion.

Initial model with trichomonas as outcome

In the initial longitudinal analysis examining trichomonas positivity as a function of incarceration, baseline HIV status, study site, visit number and risk group, trichomonas infection was positively associated with incarceration. The cross-sectional or between-subject odds of trichomonas detection was 2.41 times higher (CI 1.85 to 3.14, $p<0.001$) among those who had been recently incarcerated at baseline compared to those who had not, and the within-subject or longitudinal odds of trichomonas was 1.56 times higher (CI 1.26 to 1.92, $p<0.001$) among those who remained incarcerated or who were newly incarcerated at follow-up compared to baseline.

Adjusted trichomonas model- Table 2

The cross-sectional effect of incarceration remained statistically significant in the final model, even after adjusting for all known risk factors and patient characteristics, although the effect was attenuated compared to the first model (between-subject effect, adjusted odds ratio=1.37, 95% CI 1.01 to 1.84, $p = 0.04$, Table 2). The longitudinal, within-subject effect of incarceration change from baseline was marginally significantly associated with trichomonas detection (adjusted odds ratio =1.22, CI 0.98 to 1.52, $p=0.07$). The strongest predictor of trichomonas infection was Black compared to White race (OR 2.50, CI 1.86 to 3.37, $p<0.01$); other significant predictors were lower level of education, younger age, higher number of sexual partners, presence of BV or intermediate vaginal flora and within- and between-subject effects for drug (crack, cocaine, and/or heroin) use, receiving public assistance, and being uninsured.

Models with chlamydia/gonorrhea and syphilis as outcomes

Infection with chlamydia or gonorrhea as a combined outcome was not significantly associated with incarceration (between-subject effect, adjusted OR 1.13, CI 0.61 to 2.08,

p=0.69; within-subject effect adjusted OR 1.39, CI 0.62 to 3.09, p=0.42). In the multivariable model, age was inversely correlated with infection (adjusted OR 0.95 per year, CI 0.92 to 0.98, p<0.01). Compared to white participants, black participants had 1.97 (95% CI 1.05 to 3.70, p=0.03) times the odds of infection. Other covariates included in the model (baseline HIV status, study site, enrollment risk group, number of visits, education, presence of BV, vaginal candidiasis, alcohol use, substance use, marital status, condom use, and number of male sexual partners in the past 6 months) were not significantly associated with infection with chlamydia or gonorrhea.

Since only 20 individuals newly tested positive for syphilis after the first visit, the covariates used in the pooled logistic regression was limited to design variables (baseline HIV status, study site, enrollment risk group), incarceration, age and race. Neither incarceration (between-subject adjusted OR 2.81, 95%CI 0.57 to 13.80, p=0.18; within-subject adjusted OR 0.73, CI 0.13 to 4.08, p=0.72) nor the other covariates were significantly associated with the outcome.

Discussion

Our analysis of a multicenter observational cohort of 1310 HIV-infected and high-risk HIV-uninfected women demonstrates a significant association between incarceration and the detection of trichomonas infection. To our knowledge, ours is the first study to report an independent relationship between incarceration and trichomonas infection after controlling for multiple well-characterized risk factors for STIs.

The rate of incarceration in this cohort was remarkably high. Thirty-three percent of women, or 435 individuals, were incarcerated at some time during the course of the study. Of these, 205 were incarcerated more than once. These statistics reflect a rate of incarceration in the United States that has been growing dramatically over the last two decades, where currently 1 in every 100 adults in the US is in jail or prison.[33] Although fewer women than men are incarcerated, the rate of incarceration has been increasing for women at a greater rate (4.6% increase between 2005 to 2006) than that for men (2.7% over the same time period).[34] Minority women are disproportionately affected, with an incarceration rate for non-Hispanic Black females that was over 2 times higher than for Hispanic women and 3.5 times higher than for Whites in 2008.[35] Therefore, health interventions in the correctional setting could have a large impact on women, and minority women in particular.

The high incarceration rate and the high prevalence of trichomonas infection in this cohort allow for a thorough analysis of their association. Although trichomonas infection in inmates has not been systematically studied, and sampling and testing methods have varied among published studies, several researchers have reported very high rates of trichomonas infection among incarcerated women. In Georgia, screening for trichomoniasis by wet mount for symptomatic women entering prison revealed an 8.2% infection rate.[36] In pregnant inmates tested with culture for *T. vaginalis*, 26% tested positive in a Rhode Island study[13] and 47% tested positive in a New York study.[14] A recent study in San Francisco using nucleic acid amplification testing (NAAT, a more sensitive testing method that was until recently only available in research settings) revealed a rate of trichomonas infection among incarcerated women at 32%.[15]

The implication of the association we have identified between recent incarceration and trichomonas infection may indicate that incarceration is a marker of an individual at high risk for an STI, consistent with other researchers findings.[37, 38] This is also supported by Table 1, which indicates that recently incarcerated women have higher rates of risk factors for STIs, including higher numbers of sexual partners, higher rates of drug and alcohol use

and less condom use than those who had not been recently incarcerated. It is unlikely that trichomoniasis is acquired during incarceration itself through sexual or non-sexual transmission [12],[39] and we hypothesize that other unmeasured confounders surrounding both trichomonas infection and incarceration explain this association. Although many of the risk factors for STIs, such as substance use and multiple sexual partners, may precede incarceration, additional risk for acquiring STIs may occur during or after incarceration. Incarceration is disruptive to families and communities, and spouses or partners of incarcerated individuals often seek new partnerships while their original partner is incarcerated [40, 41], increasing the overall risk of STIs. In addition, the period immediately following release from prison is a critically vulnerable time period, where former inmates may engage in risk-taking behavior, including substance use and new or concurrent sexual partners, which may increase the risk of STIs.[42, 43] The finding of a significant between-subject but not within-subject association between trichomoniasis and incarceration underscores that although a clear relationship exists between incarceration and trichomonas infection, it does not have a definite causal or temporal direction.

Concurrency of sexual partners, or having more than one sexual partner that overlap in time, is associated with incarceration as well as youth, crack cocaine use, male gender, Black race/ethnicity and being unmarried.[44, 45] Sexual network structures, in addition to segregation, socioeconomic disparities, and substance use,[45] have been cited as reasons to explain some of the large discrepancies in rates of STIs between Blacks and Whites. Our study highlights this racial disparity, as the adjusted OR for having trichomonas infection in Blacks when compared to Whites was 2.43, after controlling for many other covariates including incarceration. Substance use also plays an important role in trichomonas infection, with adjusted ORs ranging from 1.18 to 1.62 for crack, cocaine, and heroin use for both between-subject and within-subject effects.

Our findings suggest that jails and prisons could play an important public health role in screening and treatment of STIs such as trichomoniasis and indirectly, in the primary and secondary prevention of HIV. Trichomonas infection is associated with a 2.7 increased odds of acquiring HIV[46] and women who are co-infected with HIV and *T. vaginalis* are more likely to shed HIV in the genital tract, potentially increasing HIV transmission to others. Treatment of trichomoniasis in HIV-infected women significantly decreases vaginal shedding of HIV.[47] The HERS cohort is a group of women who are HIV-infected or at high risk for HIV, one-third of whom were incarcerated at least once during the study, underscoring the opportunity incarceration provides to engage high-risk, medically underserved patients. Given the incomplete understanding of the epidemiology of trichomoniasis in the incarcerated population, and the likely increased availability of improved molecular testing for *T. vaginalis* in the near future, further study of trichomoniasis in this group is needed, including assessment of the cost-effectiveness of screening in jails and prisons. In addition, our study finds that trichomonas infection was associated with a history of incarceration, highlighting that community providers should routinely inquire about incarceration as part of a patient's social history, which may then prompt screening for STIs including trichomoniasis as well as other conditions associated with incarceration.[48]

The impact of jail-based screening strategies on a community has been demonstrated in several studies. In San Francisco, Barry and colleagues developed a chlamydia screening and treatment program in the jail system. After this program was instituted, a significant decline in rates of chlamydia was detected among young women seen at a local clinic that serves a community with high incarceration rates.[49] These findings suggest that treatment of chlamydia in jail may prevent subsequent transmission of this STI in the community. In addition, in North Carolina, researchers found a correlation between the rates of chlamydia

and gonorrhea infection and the rates of incarceration on a county level.[50] These studies highlight the close links between STIs, incarceration, and the communities most affected by incarceration.

The fact that chlamydia, gonorrhea, and syphilis were not significantly associated ($p>0.05$) with incarceration in this study may be due to several different factors. Overall, the absolute number of these infections in this cohort was relatively small, likely related in part to the older age of the cohort, with a mean age of 35. Due to low incidence of infection and some of the resource-intensive methods of screening that were being used at the time of the study (particularly gonorrhea and chlamydia cultures), our data on these infections are limited to the first four study visits. However, the fact that age was a strong predictor of chlamydia and gonorrhea infection is consistent with other investigators' findings.[7, 51]

Our study has several limitations. The HERS collected data from participants from 1993-2001, making it a somewhat dated cohort. The data regarding incarceration are based on self-report by study subjects and were not confirmed with the respective local departments of corrections. It is unknown whether or not participants were tested or treated for STIs while incarcerated. Data on drug use, alcohol use, sexual partners and condom use were also based on self-report. In several other known risk factors for STIs and incarceration, such as trading sex for money or drugs, were not measured or were measured inconsistently, and could not be used. Alcohol use was a problematic variable in its coding (due to an optional open question where subjects could describe which drinks they typically consume) and therefore only baseline values were used, which did not allow us to assess the affect of changes in alcohol use over time. In addition, some of the STI testing methods used in the study are no longer used in routine clinical practice as they have been supplanted by more sensitive tests that are easier to perform. Therefore, given the above and the fact that testing was not continued throughout the study for all STIs, the prevalence of STIs presented in this study likely underestimates the true prevalence of STIs in this cohort.

Conclusion

In summary, we have demonstrated that an independent association exists between trichomonas infection and incarceration in a cohort of women with high-risk sexual behavior. Potential explanations for these findings include disruption of the social or family unit by incarceration and the high-risk behaviors that may result, including the development of new sexual networks. These hypotheses require future study. In the meantime, the immediate implications of our analysis are the critical roles that correctional facilities and those providing medical care after incarceration can have in terms of surveillance and control of trichomonas infection. Women entering jails and prisons should be universally screened for STIs, especially trichomonas, including timely treatment and partner notification for those with positive results. Such efforts may further impact primary and secondary HIV prevention, both in the incarcerated population and those communities most affected by incarceration.

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Figure 1.

Table 1

Baseline and demographic characteristics of the HERS study participants

	No Incarceration in past 12 months N= 1125	Incarcerated in past 12 months N=125	All Subjects (n=1310)
Age(years) (mean, (range))	35.4(16-56)	33.8(19-52)	35 (16-56)
Race/Ethnicity			
White	261(23%)	56(30%)	317(24%)
African American	212 (58%)	111(60%)	763(58%)
Other (Hispanic, Asian, Native American)	652 (19%)	18(10%)	230(18%)
Education (years) (mean, (range))	11.5 (1-18)	11.1(4-19)	11.5(1-19)
Marital status			
Married	317(29%)	27(15%)	344(26%)
Separated	120(11%)	27(15%)	147(11%)
Divorced/widowed	207(19%)	32(18%)	239(18%)
Single	465(42%)	95 (53%)	560(43%)
HIV infected at enrollment	755(67%)	116(63%)	871(66%)
Sexually Transmitted Infections			
Chlamydia	45 (4%)	6 (4%)	51(4%)
Gonorrhea	6((0.6%)	1(0.6%)	7 (<1%)
Syphilis	84 (8%)	15(8%)	99 (8%)
Trichomonas	224(20%)	47(26%)	271(21%)
Candida (vaginal)	441(40%)	93(52%)	534(41%)
Bacterial Vaginosis (BV)			
Intermediate	180(17%)	31(17%)	211(17%)
Positive for BV	526(49%)	100(56%)	626(50%)
CD4 count group			
HIV-infected			
<200	128(17%)	19(17%)	147(17%)
200-500	376(51%)	53 (47%)	429(50%)
>500	233 (31%)	41(36%)	274(32%)
HIV-uninfected			
200-500	7(2%)	0	7(2%)
>500	352(98%)	69(100%)	421(98%)
Inconsistent condom use (=not always)	479(43%)	93(52%)	572(44%)
Number of sexual partners in past 6 mo			
0-1	875(78%)	111(61%)	996(76%)
2-4	195(17%)	46(25%)	241(18%)
5	49 (4%)	24(13%)	73(6%)
14 drinks per week	138(12%)	41(22%)	179(14%)
Substance use (past 6 months)			

	No Incarceration in past 12 months N= 1125	Incarcerated in past 12 months N=125	<i>All Subjects</i> (n=1310)
Crack	242(22%)	67(36%)	309(33%)
Cocaine	347(31%)	96(52%)	443(34%)
Heroin	320(28%)	100(54%)	420(32%)
Other drugs (including tranquilizers, amphetamines, other opiates)	161(27%)	49(40%)	210(29%)
Currently employed	221(20%)	20(11%)	241(18%)
Receiving public assistance	727(65%)	103(56%)	830(63%)
Have health insurance	895 (80%)	103(56%)	998(76%)

Table 2

Results of the Multivariable Longitudinal Regression Analysis Examining Trichomonas Positivity as a Function of Incarceration and Other Selected Predictors

	<i>Adjusted odds Ratio</i>	<i>95%CI</i>	<i>P value</i>
Incarceration (between-subject effect)¹	1.37	1.01-1.84	0.04*
Incarceration (within-subject effect) ²	1.22	0.98-1.52	0.07
Race			
Black	2.50	1.86-3.37	<0.01*
Other Races	1.12	0.72-1.75	0.62
White	reference	--	--
Age (years) ¹	0.98	0.96-0.99	<0.01*
Education (years) ¹	0.93	0.89-0.97	<0.01*
Marital status ¹			
Married	0.98	0.77-1.25	0.87
Separated	1.16	0.84-1.61	0.36
Divorced/widowed	0.99	0.75-1.31	0.95
Single	reference	--	--
HIV-infected at enrollment	1.11	0.89-1.38	0.36
Candida ¹	1.03	0.84-1.26	0.79
Bacterial Vaginosis ¹			
Positive	1.73	1.36-2.20	<0.01*
Intermediate	1.87	1.39-2.52	<0.01*
Negative	reference	--	--
Number of sexual partners in past 6 mo ¹			
0-1	0.67	0.46-0.96	0.03*
2-4	0.81	0.56-1.19	0.28
5	reference	--	--
Suboptimal condom use ¹	0.91	0.74-1.11	0.35
14 drinks per week	1.19	0.92-1.53	0.19
Substance Use (between-subject effect) ¹			
Crack	1.57	1.20-2.07	<0.01*
Cocaine	1.32	0.97-1.79	0.07
Heroin	1.43	1.07-1.91	0.02
Substance Use (within-subject effect) ²			
Crack	1.62	1.29-2.04	0.01*

	<i>Adjusted adds</i>	95%CI	<i>P value</i>
	<i>Ratio</i>		
Cocaine	1.18	0.94-1.47	0.16
Heroin	123	0.96-1.57	0.10
Receipt of public assistance			
Between-subject	123	1.02-1.49	0.03*
Within-subject	1.06	0.91-1.24	0.46
Employment			
Between-subject	0.96	0.74-1.25	0.76
Within-subject	0.93	0.77-1.13	0.47
Health Insurance			
Between-subject	0.59	0.46-0.76	<0.01*
Within-subject	0.68	0.56-0.83	<0.01*

¹ Baseline measure

² Change from baseline measured at every study visit

Analysis also adjusted for HIV status, enrollment risk group, study site, and number of visits