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Prevalence and Predictors of Sexually Transmitted Infections in Hazardously-Drinking Incarcerated Women

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Abstract

Incarcerated women are at high risk for sexually transmitted infections (STI). Left untreated, these infections can have severe adverse health effects. This study presents prevalence rates of Trichomonas, Chlamydia, and Gonorrhea, and factors related to having an STI in a sample of 245 hazardously-drinking incarcerated women who reported heterosexual intercourse in the previous 3 months. Vaginal swabs were collected following the self-report baseline assessment. Participants averaged 34.1 (± 8.9) years of age; 174 (71.3%) were non-Hispanic Caucasian, 47 (19.3%) were African-American, 17 (7.0%) were Hispanic, and 6 (2.5%) were of other racial or ethnic origins. Twenty-three percent of participants tested positive for Chlamydia, Trichomonas, or Gonorrhea. Being African-American, more frequent sex with a casual partner, and reporting more than one male partner were significantly positively related to STI, while more frequent sex with a main partner was inversely related. Due to the high rates of infection in this population, jail admission provides a public health opportunity to access a concentrated group of STI-infected women. STI testing targeted at specific demographic factors, for instance younger age, will miss infected women. Risky sexual partnerships, as well as the benefit of maintaining stable main partnerships may be important topics during STI prevention interventions.

Keywords

prevalence; sexually transmitted infections; incarceration; women

Introduction

Trichomonas (TV), Chlamydia (CT), and Gonorrhea (GC) are three of the most frequently occurring sexually transmitted infections (STI) among women, who are affected by STI at higher rates than men (Centers for Disease Control and Prevention November 2009; Datta et al. 2007; Plitt et al. 2005). Despite nearly 913,000 cases of CT and nearly 163,000 cases of GC in women reported to the Centers for Disease Control (CDC) in 2009 (Centers for Disease Control and Prevention 2010), these numbers likely underestimate the actual occurrence and prevalence of STI in the general female population. Recent estimates suggest the actual number of new CT cases may be roughly three times higher, and GC cases may be close to four and a half times higher, while TV cases, which are not reported to the CDC, may number as many as 7.4 million (Weinstock, Berman, and Cates 2004).

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Although many cases of CT, GC, and TV are asymptomatic, women face serious health consequences if infections are not diagnosed and treated. Pelvic inflammatory disease (PID), ectopic pregnancy, and infertility are long-term concerns associated with both CT and GC (Centers for Disease Control and Prevention 2007 2010). Untreated TV can lead to preterm delivery and low infant birth weight, and women infected with TV are more likely to have a concurrent STI. Importantly, those infected with TV may be at increased risk of acquisition and transmission of HIV (Allsworth, Ratner, and Peipert 2009; Centers for Disease Control and Prevention 2007; McClelland et al. 2007; Shafir, Sorvillo, and Smith 2009). Given the prevalence of TV in the general population, and the relative dearth of public health attention to this infection, this association is particularly alarming (Van der Pol 2007).

Incarcerated women are among the sub-populations of women at highest risk for STIs. STI prevalence data from women entering jails in thirty eight states in 2008 indicate CT positivity of 8.5% and GC positivity of 2.6% (Centers for Disease Control and Prevention November 2009), both much higher than general population estimates. Data collected as part of clinical trials at adult correctional facilities found CT prevalence at intake between 2.5–13% and GC prevalence of 2.3–10% (Hardick et al. 2003; Mertz et al. 2002; Willers et al. 2008), with TV rates ranging from 22–47% (Shuter et al. 1998; Willers et al. 2008).

African American women shoulder a disproportionate burden of STI in non-incarcerated samples (Allsworth, Ratner, and Peipert 2009; Centers for Disease Control and Prevention 2009; Datta et al. 2007; Gollub et al. 2010; Helms et al. 2008; Plitt et al. 2005; Sutton et al. 2007), but among incarcerated female populations, racial disparities are less consistent. No significant racial differences were found in TV (Freeman et al. 2010; Shuter et al. 1998; Willers et al. 2008), or CT and GC rates (Willers et al. 2008) in studies of incarcerated women. However, racial differences have been noted in other studies, with one report finding ethnic or racial minorities at increased risk for CT and GC (Mertz et al. 2002), while another reported white race to be a risk factor for CT and GC (Hardick et al. 2003) in detained women.

STIs are correlated with age in the general population and among detained women. CT and GC are found in the highest prevalence among detained women under 25 years old (Hardick et al. 2003; Mertz et al. 2002). The opposite is true of TV however, with older age significantly associated with infection (Freeman et al. 2010), consistent with findings from community samples (Helms et al. 2008; Sutton et al. 2007).

In addition to demographics, the behavioral characteristics often found in incarcerated female populations are important factors in prevalent STIs. Women who have high numbers of lifetime sexual partners (Sutton et al. 2007), or a main plus a casual partner (Gollub et al. 2010) have higher risk for TV infection. Commercial sex work, which is frequent among incarcerated women (Fickenscher et al. 2001) has also been associated with STI infection (Willers et al. 2008). Additionally, compared to jailed adult men, jailed women are less likely to report always use using a condom, and more likely to report never using condoms (Freudenberg et al. 2007).

Elevated rates of substance use (Freudenberg et al. 2007; Hogben, St. Lawrence, and Eldridge 2001; Henderson 1998) have also been reported in incarcerated populations. Women have a higher prevalence than male detainees of illicit drug use, substance use disorders, and arrests for drug related charges (Freudenberg et al. 2007; Binswanger et al. 2010). Cocaine use is associated with increased TV risk in pregnant detained women (Shuter et al. 1998) and poly-substance-using, non-incarcerated, African-American women (Miller et al. 2008). Additionally, exchanging drugs for sex may increase risk for STI.

Hazardous drinking, defined as four or more drinks in a day, or more than seven drinks per week for women (National Institute on Alcohol Abuse and Alcoholism 2005), occurs frequently among incarcerated women (Caviness et al. 2009; Freudenberg et al. 2007). Approximately one-third of incarcerated women have lifetime history of alcohol use disorders (Teplin, Abram, and McClelland 1996; Grella and Greenwell 2007; Jordan et al. 1996), and high rates of women are under the influence of alcohol at the time of arrest (El-Bassel et al. 1995; Greenfeld and Snell 1999). Given the strong connection between alcohol consumption and risky sexual behavior (Logan, Cole, and Leukefeld 2002; Thompson, Kao, and Thomas 2005; Stein et al. 2009; Stein et al. 2010; Barta et al. 2008; Kiene et al. 2009), drinking, especially at hazardous levels, may be an important risk factor for STIs. The extant literature suggests sexual encounters with new or casual partners are riskier when alcohol is consumed prior to sex (Barta et al. 2008; Kiene et al. 2009). Alcohol is also often used with other drugs, including cocaine, the most frequently used illicit drug among female arrestees (National Institute of Justice (U.S.) 2003), which also increases risky sexual behavior and STI prevalence (Miller et al. 2008; Shuter et al. 1998).

Although prevalence rates of STI in incarcerated women have been previously examined, to our knowledge prior studies did not look at partner type or multiple risky sexual behaviors. Additionally, few studies have looked at TV, GC, and CT prevalence in the same cohort. Finally, we are not aware of other studies that have examined STI prevalence among hazardous drinkers. This investigation had two purposes. First, we estimated the prevalence of GC, CT, and TV infection in a sample of hazardously drinking, heterosexually active, incarcerated women. Second, we examined factors associated with STI in this high risk population, including partner type and multiple types of sexual risk.

Methods

Study Site

No county jails exist in the geographically small state of Rhode Island; instead all inmates are housed by the Rhode Island Department of Correction (RI DOC) at the Adult Correctional Institute (ACI). The ACI operates as a unified, centralized and comprehensive state correctional system, and encompasses all jail, prison and rehabilitative services, including community corrections (probation/parole). However, the Women's Facility at the ACI functions like jails throughout the nation, with the majority of women returning to the community within 30 days of commitment (Hebert et al. 2008).

Participants

All newly incarcerated women over a 40-month period from February 2004 to June 2007 were eligible for screening. Participants were eligible if they: 1) spoke English, 2) had reliable contact information, 3) were likely to be released in the next 14 days, 4) endorsed having unprotected heterosexual sex at least three days in the previous three months, and 5) endorsed hazardous alcohol consumption, defined by NIAAA binge criteria, at least three times in the past three months, or a score of 8 or above on the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al. 1993). After a check for comprehension, participants provided written informed consent to participate.

During the enrollment period 1,616 women were approached for screening, 1,415 agreed to be screened. A total of 396 met alcohol and sexual risk criteria but 115 of those women were ineligible for other reasons (i.e. sentenced, living out of state); 281 were eligible. A total of 245 agreed to participate and enrolled in a randomized clinical trial of a brief intervention to reduce alcohol use and HIV risk (Stein et al. 2010). Of those ineligible, 467 did not meet hazardous alcohol criteria, 212 did not meet sexual risk criteria and 340 met neither

hazardous alcohol nor sexual risk criteria. The trial protocol was approved by the Miriam Hospital Institutional Review Board, the Office for Human Research Protection, and the RI DOC's Medical Research Advisory Group. Additionally, a Certificate of Confidentiality was obtained from the federal government to further protect the information collected from study participants.

Study Design and Procedure

Screening was conducted confidentially, without compensation, in a private room without surveillance, beginning with informed verbal consent. During the consent process, it was stressed that refusal to be screened would have no negative impact on services the women would normally receive, their disciplinary status or regular scheduled medical visits. If verbal consent was given, the screening questions were read to the inmate and answers recorded by the research assistant (RA).

Eligible women were invited to participate in the study. Study participants provided written informed consent and were enrolled in the protocol. After completion of the consent process, the RA read aloud the survey questions and recorded answers for the 45-minute baseline survey. In addition to the survey, respondents were also asked to give two vaginal swabs to test for Trichomonas and Gonorrhea and Chlamydia. Both swabs were collected at the same time after the survey. If a participant tested positive for any of the STIs, she was treated free of charge, either at the ACI, or by the research team. Participants were paid $20, in the form of a money order mailed to them upon release from the ACI, for time spent completing the baseline survey.

Measures

Sexually transmitted infection (STI)—The primary outcome was a dichotomous indicator scored 1 if the participant tested positive for TV, CT, or GC on a biological assay. C. trachomatis and N. gonorrhoeae testing was performed using DNA amplification of endocervical swabs (Becton Dickinson BDProbe Tem™ ET; Becton, Dickinson and Company, Franklin Lakes, New Jersey). Trichomonas vaginalis testing was performed using sterile cotton swab collection and InPouch™ culture (Biomed Diagnostics, White City, Oregon). Tests were collected during the baseline assessment. Both testing methods have shown excellent sensitivity and specificity; CT and GC sensitivity has a range from 89–100% and specificity has a range of 96–100% (Borchardt and Smith 1991; Sood et al. 2007; Gaydos et al. 2004; Van Dyck et al. 2001).

Time Line Followback (TLFB)—Participants were asked to recall their past 90-day sexual and alcohol history at baseline, using the Timeline Followback method (Sobell and Sobell 1996). This calendar-based assessment procedure uses prompts of important dates, (e.g., birthdays or holidays) to elicit recall of behavioral health data. Respondents were asked to recall days they consumed alcohol and how many drinks on each day. They were also asked to recall vaginal or anal sex on each day with both main and casual (partner other than main) male partners and whether they used a condom for each encounter. Using the TLFB data, we constructed summary measures of days of heavy (≥ 4 drinks/day) alcohol use, days sexually active with main and casual partners, and days unprotected sex with main and casual partners.

Other Measures of Sexual Risk Taking—The baseline questionnaire included the scored items from the Risk Assessment Battery (Metzger, Woody, and Navaline 1993). Participants were asked to report the number of males with whom they had sex and whether they had exchanged sex for money or drugs during the 3-months prior to incarceration (commercial sex work).

Lifetime History of STI—Participants were asked if they had ever been told by a health care provider that they had Trichomonas, Chlamydia, or Gonorrhea. Responses were coded yes/no for the three individual items.

Substance Use—Cocaine and opiate use were assessed using an adaptation of the Addiction Severity Index (McLellan et al. 1992). Separate dummy variables were generated to indicate any use of cocaine or any use of opiates (either heroin or other opiates) in the 90 days prior to baseline.

Data Analysis

Analytical Methods—This is a secondary analysis of baseline data collected during the afore-mentioned randomized control trial (Stein et al. 2010). We used descriptive statistics to summarize the characteristics of the full study sample and by STI status. To facilitate comparisons with multivariate models, we present the unadjusted effect on the odds of testing STI+ for each background characteristic. For descriptive analyses, we also constructed dichotomous indicators, coded 1 if the participant reported any sex with main and casual partners, respectively, in the 90 days prior to baseline. Several of the variables used to describe sexual behaviors of participants in this sample were derived from the same Timeline Followback questions (e.g., having any casual partners, frequency of sex with casual partners, and frequency of unprotected sex with casual partners); other variables were highly co-linear (e.g., engaging is commercial sex work, having sex with casual partners, and having multiple male partners). We relied on stepwise forward selection to identify the indicators of sexual risk-behaviors most strongly associated with STI in this cohort. Background characteristics (age, race/ethnicity, days of heavy alcohol use, living with sex partner, lifetime history of STI, and recent use of cocaine or opiates) were entered as covariates prior to stepwise selection of sexual risk-taking indicators. Measures significant at the .05 level, based on the likelihood ratio chi-square test, were included in the final model. Model fit was assessed using the Hosmer-Lemeshow goodness of fit statistic (Hosmer and Lemeshow 2000).

Results

Participants averaged 34.0 (± 8.8) years of age; 174; 174 (71.3%) were non-Hispanic Caucasian, 47 (19.3%) were African-American, 17 (7.0.0%) were Hispanic, and 6 (2.5%) were of other racial or ethnic origins. Hispanics and all other ethnic minorities were combined for subsequent analyses (Table 1). Three women reported being HIV-positive. During the 90 days prior to baseline, participants reported consuming four or more drinks on 39.6 (± 30.4) days, and 166 (67.8%) and 103 (42.2%) said they had used cocaine or opiates within the past 90 days, respectively. Half (n = 122) said they were currently living with a sex partner at the time of assessment and 116 (47.4%) reported a lifetime history of testing positive for CT, TV, or GC.

On average, participants reported having sex on 39.2 (± 28.3) of the 90 days prior to baseline assessment (Table 1). The mean number of days on which participants were sexually active with a main partner was 31.7 (± 27.8) days and they had unprotected sex with main partners on an average of 31.4 (± 28.1) days; participants used condoms on 3.7% of the days on which they were sexually active with main partners. On average, participants were sexually active with casual partners on 9.1 (± 20.7) days, and had unprotected sexual intercourse with casual partners on 5.7 (± 15.8) days. Participants reported using condoms on 60.1% of the days on which they were sexually active with casual partners. One-hundred-four (42.6%) said they had had two or more male sex partners, and 66 (27.1%) said they had engaged in commercial sex work.

Fifty-six (23.0%) of participants tested positive for CT, TV, or GC. STI-specific prevalence rates were 2.9%, 20.5%, and 2.5% for CT, TV, and GC, respectively. Five (2.0%) participants tested positive for multiple STIs.

Results of bivariate analyses indicated that testing STI+ was associated significantly with race/ethnicity (LR2 = 10.48), df = 2, < .01); African-Americans were significantly more likely to test STI+ than either non-Hispanic Caucasians (OR = 2.02 $p < .05$) or those in other racial/ethnic groups (OR = 12.47, $p < .05$) (Table 1). The estimated odds of testing STI+ was 6.14 ($p = .08$) times higher among non-Hispanic Caucasians than among those of other racial or ethnic origins. Recent cocaine use, reporting a lifetime history of STI, being sexual activity with casual partners, reporting multiple male partners, and engaging in commercial sex work were all associated positively with testing STI+. Being sexually active with main partners was associated with a lower likelihood of testing STI+ (Table 1).

Because prior studies have reported different patterns of association, we explored the bivariate relationship between age and each of the STIs for which participants were tested. Younger age was associated with a higher likelihood of testing positive for all three STIs; however, the association was not statistically significant for TV (OR = 0.95, 95% CI 0.69; 1.31, $p = .76$), CT (OR = 0.68, 95% CI 0.31; 1.50, $p = .337$) or GC (OR = 0.44, 95%, 95% CI 0.17; 1.15, $p = .096$). Results regarding associations with CT or GC should be interpreted cautiously because only 7 and 6 participants, respectively, tested positive for these specific STIs in this cohort.

Consistent with bivariate analyses, STI+ was associated significantly with race/ethnicity after adjusting for other covariates entered in the final model; African-Americans had the highest adjusted odds of testing STI+ Table 2. After adjusting for other background characteristics and indicators of sexual risk taking, neither recent cocaine use nor self-reported lifetime history of STI were associated significantly with testing STI+. After entering all demographic characteristics and measures of substance use, stepwise forward selection was used to identify the most salient behavioral correlates of testing STI+. Testing STI+ was positively and significantly associated with frequency of sexual activity with casual partners (OR = 1.46, $p < .05$) and with reporting multiple male partners (OR = 2.27, $p < .05$). Testing STI+ was inversely and significantly associated with frequency of sexual activity with main partners (OR = 0.67, $p < .05$).

Discussion

In this sample of hazardously drinking, heterosexually active, incarcerated women, the prevalence rates were 2.9% for CT, 20.5% for TV, and 2.5% for GC. These results are comparable to other incarcerated female samples (Hardick et al. 2003; Mertz et al. 2002; Willers et al. 2008; Shuter et al. 1998), but have not to our knowledge, been reported from a single sample in which associations with multiple sexual and other behaviors and partner type have been analyzed. These TV and GC rates were nearly 10 times higher than rates in non-incarcerated samples of women (Allsworth, Ratner, and Peipert 2009; Sutton et al. 2007; Datta et al. 2007). Prevalence of CT was similar to general population estimates (Datta et al. 2007).

Age was not significantly related to having a STI. Of note, only adults (18 years or older) were enrolled in the clinical trial, and the mean age of study participants was 34 years. CT and GC infections are most frequently found in samples of adolescents and emerging adults (Centers for Disease Control and Prevention November 2009), and we were surprised to find high rates of CT and GC in our cohort, although TV has been reported in other older incarcerated samples. It is possible that regardless of age, women in this sample were

engaging in risky sexual activity most frequently associated with younger women and perhaps living in neighborhoods or having greater social contact with high-risk males. Given that CT and GC infection in young women aged 15–24 years is greater than six and five times more prevalent, respectively, than in women aged 30–34 years (Centers for Disease Control and Prevention 2010), our findings may be especially concerning for younger incarcerated women in our region, but suggest that all incarcerated women should be screened (Kraut-Becher et al. 2004; Barry et al. 2009).

Belonging to a racial or ethnic minority group was significantly related to STI in our sample, which is consistent with some findings in incarcerated women (Bonney et al. 2008; Mertz et al. 2002), but inconsistent with others (Shuter et al. 1998; Willers et al. 2008; Freeman et al. 2010; Hardick et al. 2003). These findings are similar however, to those found in non-incarcerated women in the general population (Centers for Disease Control and Prevention 2009; Allsworth, Ratner, and Peipert 2009; Buhi, Marhefka, and Hoban 2010) and drug-using samples of women (Gollub et al. 2010; Plitt et al. 2005). Given the well-documented disparities in access to sexual health care across racial and ethnic groups (Parrish and Kent 2008; Mayberry, Mili, and Ofili 2000; Kang-Kim et al. 2008), these findings are particularly worrisome. Prevention, testing, and treatment efforts need to be cognizant of differential access and work harder to reach this important underserved population.

Consistent with previous literature, increased sex with casual partners, and having multiple male partners were associated with testing STI positive (Sutton et al. 2007; Gollub et al. 2010; Willers et al. 2008). Commercial sex work did not enter the final stepwise model, however, due to the high co-linearity between having multiple male partners and commercial sex work. Thus, it is possible that STI risk is also related to commercial sex work, as suggested by the bivariate findings.

Interestingly, more frequent sex with a main partner reduced the odds of STI in this sample. We speculate that sex with a steady partner indicated a more stable, committed partnership, thereby perhaps lowering the risk of contact with higher risk partners. Of note, living with a sex partner was not protective. A similar explanation for complementary findings was suggested for a sample of STI clinic patients tested for recurrent Chlamydial infections (Rietmeijer et al. 2002). Despite any shielding effect main sexual partnerships may have, study participants with main partners still had high rates of STI, suggesting that their main partners may have other concurrent partnerships that introduced STIs into the primary relationship.

Similar to findings from previous work (Shuter et al. 1998; Miller et al. 2008), recent cocaine use was bivariately associated with STIs. This is especially relevant given the high percentage of incarcerated women who use cocaine regularly (Freudenberg et al. 2007). Cocaine use did not remain significant in the final, stepwise model. It is possible that cocaine use and risky sexual behavior are linked in a causal pathway to STI acquisition, and therefore the addition of sexual risk to the full model attenuates the association between cocaine use and STI. Interestingly, alcohol use was not associated with STIs. This population was recruited specifically for hazardous alcohol consumption, and all drank heavily, thus it is possible that alcohol consumption did not vary enough to test this relationship adequately. It is also possible that alcohol use increases sexual activity, but is not related to increases in unsafe sexual behavior, a result we have found in previous studies (Anderson and Stein 2011).

This study had important strengths. First, we included TV, which is often overlooked in the study and testing of STIs (Van der Pol 2007). Second, this study found high rates of CT and GC in a population older than those typically considered high risk. This has important

implications for targeted screening and testing in jails as infected women may be missed if screening is based on age alone. Our study demonstrated the feasibility of utilizing self-collected vaginal swabs, which, if implemented beyond research studies, would reduce the time required by jail staff for widespread screening. Finally, our findings indicated that jails could provide an important contact point with medical personnel that may be otherwise unavailable to this underserved population.

This study also had important limitations. We included only hazardously drinking jailed women who were sexually active with male partners. Despite heavy alcohol use in jailed women (Caviness et al. 2009; Freudenberg et al. 2007), results found here may not generalize to non-drinking women, women who are not sexually active, lesbians, and men. Second, self-report can be subject to recall and social acceptability biases. When possible, interviewing techniques were used to minimize error and bias (Schroder, Carey, and Vanable 2003). We note the high co-linearity among some indicators used to describe participants' sexual behaviors. The use of stepwise selection in multiple logistic regression models allowed us to identify the strongest correlates of testing STI+ in this cohort, but this does mean that other measures of sexual-risk taking were not associated with STI. Finally, we used in-person pen and paper interviews to collect data related to sexual risk behaviors. Although evidence is compelling that computer-assisted interviewing is preferable when asking for sensitive personal information such as sex risk (Fairley et al. 2010; Richens et al. 2010), we were unable to bring computers into the prison setting.

Findings from this study highlight the high prevalence rates of STI in a sample of hazardously drinking, heterosexually active incarcerated women, especially among racial and ethnic minorities, cocaine users, and those with multiple, risky male partnerships. STIs increase risk for PID and pregnancy complications, and increase susceptibility and transmission of HIV (Centers for Disease Control and Prevention 2007 2007; McClelland et al. 2007). Comprehensive screening and treatment during incarceration should be offered. Due to the high rates of infection in this population, and their rapid release to the community after arrest (Hebert et al. 2008), jail admission provides a public health opportunity to access a concentrated group of STI-infected women, and through treatment, follow up, and partner notification, perhaps reduce STIs in a high risk, vulnerable population.

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References

Allsworth JE, Ratner JA, Peipert JF. Trichomoniasis and other sexually transmitted infections: results from the 2001–2004 National Health and Nutrition Examination Surveys. Sexually Transmitted Diseases. 2009; 36(12):738–44. [PubMed: 19734826]

Anderson BJ, Stein MD. A behavioral decision model testing the association of marijuana use and sexual risk among young adult women. AIDS and Behavior. 2011; 15(4):875–884. [PubMed: 20358274]

Barry PM, Kent CK, Scott KC, Goldenson J, Klausner JD. Is jail screening associated with a decrease in Chlamydia positivity among females seeking health services at community clinics?-San francisco, 1997–2004. Sexually Transmitted Diseases. 2009; 36(2 Suppl):S22–8. [PubMed: 18418298]

Barta WD, Portnoy DB, Kiene SM, Tennen H, Abu-Hasaballah KS, Ferrer R. A daily process investigation of alcohol-involved sexual risk behavior among economically disadvantaged problem drinkers living with HIV/AIDS. AIDS and Behavior. 2008; 12(5):729–40. [PubMed: 18071894]

Binswanger IA, Merrill JO, Krueger PM, White MC, Booth RE, Elmore JG. Gender differences in chronic medical, psychiatric, and substance-dependence disorders among jail inmates. American Journal of Public Health. 2010; 100(3):476–82. [PubMed: 19696388]

Bonney LE, Clarke JG, Simmons EM, Rose JS, Rich JD. Racial/ethnic sexual health disparities among incarcerated women. J Natl Med Assoc. 2008; 100(5):553–8. [PubMed: 18507208]

Borchardt KA, Smith RF. An evaluation of an InPouch TV culture method for diagnosing Trichomonas vaginalis infection. Genitourin Med. 1991; 67(2):149–52. [PubMed: 2032710]

Buhi ER, Marhefka SL, Hoban MT. The State of the union: sexual health disparities in a national sample of US college students. Journal of American College Health. 2010; 58(4):337–46. [PubMed: 20159757]

Caviness CM, Hatgis C, Anderson BJ, Rosengard C, Kiene SM, Friedmann PD, Stein MD. Three brief alcohol screens for detecting hazardous drinking in incarcerated women. Journal of Studies on Alcohol and Drugs. 2009; 70(1):50–4. [PubMed: 19118391]

Center for Disease Control and Prevention. CDC Fact Sheet: Gonorrhea. Atlanta, GA: U.S. Department of Health and Human Services; 2007.

Center for Disease Control and Prevention. CDC Fact Sheet: Trichomoniasis. Atlanta, GA: U.S. Department of Health and Human Services; 2007.

Center for Disease Control and Prevention. Trends in reportable sexually transmitted diseases in the United States, 2007. Atlanta, GA: U.S. Department of Health and Human Services; 2009.

Center for Disease Control and Prevention. CDC Fact Sheet: Chlamydia. Atlanta, GA: U.S. Department of Health and Human Services; 2010.

Center for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2009. Atlanta: U.S. Department of Health and Human Services; 2010.

Center for Disease Control and Prevention. Sexually Transmitted Disease Surveillance, 2008. Atlanta, GA: U.S. Department of Health and Human Services; Nov. 2009

Datta SD, Sternberg M, Johnson RE, Berman S, Papp JR, McQuillan G, Weinstock H. Gonorrhea and chlamydia in the United States among persons 14 to 39 years of age, 1999 to 2002. Annals of Internal Medicine. 2007; 147(2):89–96. [PubMed: 17638719]

El-Bassel N, Ivanoff A, Schilling RF, Gilbert L, Chen D-R. Correlates of problem drinking among drug-using incarcerated women. Addictive Behaviors. 1995; 20(3):359–369. [PubMed: 7653317]

Fairley CK, Sze JK, Vodstrcil LA, Chen MY. Computer-assisted self interviewing in sexual health clinics. Sexually Transmitted Diseases. 2010; 37(11):665–8. [PubMed: 20975481]

Fickenscher A, Lapidus J, Silk-Walker P, Becker T. Women behind bars: health needs of inmates in a county jail. Public Health Rep. 2001; 116(3):191–6. [PubMed: 12034907]

Freeman AH, Katz KA, Pandori MW, Rauch LM, Kohn RP, Liska S, Bernstein KT, Klausner JD. Prevalence and correlates of Trichomonas vaginalis among incarcerated persons assessed using a highly sensitive molecular assay. Sexually Transmitted Diseases. 2010; 37(3):165–8. [PubMed: 20023598]

Freudenberg N, Moseley J, Labriola M, Daniels J, Murrill C. Comparison of health and social characteristics of people leaving New York City jails by age, gender, and race/ethnicity: implications for public health interventions. Public Health Reports. 2007; 122:733–743. [PubMed: 18051666]

Gaydos CA, Theodore M, Dalesio N, Wood BJ, Quinn TC. Comparison of three nucleic acid amplification tests for detection of Chlamydia trachomatis in urine specimens. J Clin Microbiol. 2004; 42(7):3041–5. [PubMed: 15243057]

Gollub EL, Armstrong K, Boney T, Mercer D, Chhatre S, Fiore D, Lavalanet A, Mackey K. Correlates of Trichomonas prevalence among street-recruited, drug-using women enrolled in a randomized trial. Subst Use Misuse. 2010; 45(13):2203–20. [PubMed: 20482337]

Greenfeld, LA.; Snell, TL. Women offenders. Washington, DC: U.S. Department of Justice; 1999.

Grella CE, Greenwell L. Treatment needs and completion of community-based aftercare among substance-abusing women offenders. Women's Health Issues. 2007; 17:244–255. [PubMed: 17544296]

Hardick J, Hsieh YH, Tulloch S, Kus J, Tawes J, Gaydos CA. Surveillance of Chlamydia trachomatis and Neisseria gonorrhoeae infections in women in detention in Baltimore, Maryland. Sexually Transmitted Diseases. 2003; 30(1):64–70. [PubMed: 12514445]

Hebert MR, Clarke JG, Caviness CM, Ray MK, Friedmann PD, Stein MD. Feasibility of gaining access to women in jail for health interventions. Women and Health. 2008; 47(3):79–93.

Helms DJ, Mosure DJ, Metcalf CA, Douglas JM Jr, Malotte CK, Paul SM, Peterman TA. Risk factors for prevalent and incident Trichomonas vaginalis among women attending three sexually transmitted disease clinics. Sexually Transmitted Diseases. 2008; 35(5):484–8. [PubMed: 18360314]

Henderson DJ. Drug abuse and incarcerated women. A research review. J Subst Abuse Treat. 1998; 15(6):579–87. [PubMed: 9845871]

Hogben M, StLawrence JS, Eldridge GD. Sexual risk behavior, drug use, and STD rates among incarcerated women. Women and Health. 2001; 34(1):63–78.

Hosmer, DW.; Lemeshow, S. Applied Logistic Regression. New York: Wiley; 2000.

Jordan BK, Schlenger WE, Fairbank JA, Caddell JM. Prevalence of psychiatric disorders among incarcerated women. II. Convicted felons entering prison. Archives of General Psychiatry. 1996; 53(6):513–9. [PubMed: 8639034]

Kang-Kim M, Betancourt JR, Ayanian JZ, Zaslavsky AM, Yucel RM, Weissman JS. Access to care and use of preventive services by Hispanics: state-based variations from 1991 to 2004. Med Care. 2008; 46(5):507–15. [PubMed: 18438199]

Kiene SM, Barta WD, Tennen H, Armeli S. Alcohol, helping young adults to have unprotected sex with casual partners: findings from a daily diary study of alcohol use and sexual behavior. Journal of Adolescent Health. 2009; 44(1):73–80. [PubMed: 19101461]

Kraut-Becher JR, Gift TL, Haddix AC, Irwin KL, Greifinger RB. Cost-effectiveness of universal screening for chlamydia and gonorrhea in US jails. J Urban Health. 2004; 81(3):453–71. [PubMed: 15273268]

Logan TK, Cole J, Leukefeld C. Women, sex, and HIV: social and contextual factors, meta-analysis of published interventions, and implications for practice and research. Psychological Bulletin. 2002; 128(6):851–85. [PubMed: 12405135]

Mayberry RM, Mili F, Ofili E. Racial and ethnic differences in access to medical care. Med Care Res Rev. 2000; 57(Suppl 1):108–45. [PubMed: 11092160]

McClelland RS, Sangare L, Hassan WM, Lavreys L, Mandaliya K, Kiarie J, Ndinya-Achola J, Jaoko W, Baeten JM. Infection with Trichomonas vaginalis increases the risk of HIV-1 acquisition. J Infect Dis. 2007; 195(5):698–702. [PubMed: 17262712]

McLellan AT, Kushner H, Metzger D, Peters R, Smith I, Grissom G, Pettinati H, Argeriou M. The Fifth Edition of the Addiction Severity Index. J Subst Abuse Treat. 1992; 9(3):199–213. [PubMed: 1334156]

Mertz KJ, Voigt RA, Hutchins K, Levine WC. Findings from STD screening of adolescents and adults entering corrections facilities: implications for STD control strategies. Sexually Transmitted Diseases. 2002; 29(12):834–9. [PubMed: 12466728]

Metzger, D.; Woody, G.; Navaline, H. The Risk Assessment Battery: validity and reliability. Presented at the 6th Annual Meeting of the National Cooperative Vaccine Development Groups for AIDS; Alexandria, VA. 1993.

Miller M, Liao Y, Gomez AM, Gaydos CA, D'Mellow D. Factors associated with the prevalence and incidence of Trichomonas vaginalis infection among African American women in New York city who use drugs. J Infect Dis. 2008; 197(4):503–9. [PubMed: 18275272]

National Institute of Justice (U.S.). 2000 arrestee drug abuse monitoring: annual report. Washington, DC: U.S. Department of Justice; Office of Justice Programs; 2003.

National Institute on Alcohol Abuse and Alcoholism. Helping Patients Who Drink Too Much: A Clinician's Guide. U.S. Department of Health and Human Services; 2005.

Parrish DD, Kent CK. Access to care issues for African American communities: implications for STD disparities. Sexually Transmitted Diseases. 2008; 35(12 Suppl):S19–22. [PubMed: 18946368]

Plitt SS, Garfein RS, Gaydos CA, Strathdee SA, Sherman SG, Taha TE. Prevalence and correlates of chlamydia trachomatis, neisseria gonorrhoeae, trichomonas vaginalis infections, and bacterial

vaginosis among a cohort of young injection drug users in Baltimore, Maryland. Sexually Transmitted Diseases. 2005; 32(7):446–53. [PubMed: 15976603]

Richens J, Copas A, Sadiq ST, Kingori P, McCarthy O, Jones V, Hay P, Miles K, Gilson R, Imrie J, Pakianathan M. A randomised controlled trial of computer-assisted interviewing in sexual health clinics. Sex Transm Infect. 2010; 86(4):310–4. [PubMed: 20551234]

Rietmeijer CA, Van Bemmelen R, Judson FN, Douglas JM Jr. Incidence and repeat infection rates of Chlamydia trachomatis among male and female patients in an STD clinic: implications for screening and rescreening. Sexually Transmitted Diseases. 2002; 29(2):65–72. [PubMed: 11818890]

Saunders JB, Aasland OG, Babor TF, De La Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction. 1993; 88:791–804. [PubMed: 8329970]

Schroder KE, Carey MP, Vanable PA. Methodological challenges in research on sexual risk behavior: II. Accuracy of self-reports. Annals of Behavioral Medicine. 2003; 26(2):104–23. [PubMed: 14534028]

Shafir SC, Sorvillo FJ, Smith L. Current issues and considerations regarding trichomoniasis and human immunodeficiency virus in African-Americans. Clin Microbiol Rev. 2009; 22(1):37–45. [PubMed: 19136432]

Shuter J, Bell D, Graham D, Holbrook KA, Bellin EY. Rates of and risk factors for trichomoniasis among pregnant inmates in New York City. Sexually Transmitted Diseases. 1998; 25(6):303–7. [PubMed: 9662764]

Sobell, LC.; Sobell, MB. Timeline Followback User's Guide: A Calendar Method for Assessing Alcohol and Drug Use. Toronto, Ontario, Canada: Addiction Research Foundation; 1996.

Sood S, Mohanty S, Kapil A, Tolosa J, Mittal S. InPouch TV culture for detection of Trichomonas vaginalis. Indian J Med Res. 2007; 125(4):567–71. [PubMed: 17598943]

Stein MD, Anderson BJ, Caviness CM, Rosengard C, Kiene S, Friedmann P, Clarke JG. Relationship of alcohol use and sexual risk taking among hazardously drinking incarcerated women: an event-level analysis. Journal of Studies on Alcohol and Drugs. 2009; 70(4):508–515. [PubMed: 19515290]

Stein MD, Caviness CM, Anderson BJ, Hebert M, Clarke JG. A brief alcohol intervention for hazardously-drinking incarcerated women. Addiction. 2010; 105(3):466–475. [PubMed: 20402990]

Sutton M, Sternberg M, Koumans EH, McQuillan G, Berman S, Markowitz L. The prevalence of Trichomonas vaginalis infection among reproductive-age women in the United States, 2001–2004. Clin Infect Dis. 2007; 45(10):1319–26. [PubMed: 17968828]

Teplin LA, Abram KM, McClelland GM. Prevalence of psychiatric disorders among incarcerated women. I. Pretrial jail detainees. Arch Gen Psychiatry. 1996; 53(6):505–12. [PubMed: 8639033]

Thompson JC, Kao TC, Thomas RJ. The relationship between alcohol use and risk-taking sexual behaviors in a large behavioral study. Prev Med. 2005; 41(1):247–52. [PubMed: 15917018]

Van der Pol B. Trichomonas vaginalis infection: the most prevalent nonviral sexually transmitted infection receives the least public health attention. Clin Infect Dis. 2007; 44(1):23–5. [PubMed: 17143810]

Van Dyck E, Ieven M, Pattyn S, Van Damme L, Laga M. Detection of Chlamydia trachomatis and Neisseria gonorrhoeae by enzyme immunoassay, culture, and three nucleic acid amplification tests. J Clin Microbiol. 2001; 39(5):1751–6. [PubMed: 11325985]

Weinstock H, Berman S, Cates W. Sexually transmitted diseases among American youth: incidence and prevalence estimates 2000. Perspectives on Sexual and Reproductive Health. 2004; 36(1):6–10. [PubMed: 14982671]

Willers DM, Peipert JF, Allsworth JE, Stein MD, Rose JS, Clarke JG. Prevalence and predictors of sexually transmitted infection among newly incarcerated females. Sexually Transmitted Diseases. 2008; 35(1):68–72. [PubMed: 18090178]

Table 1

Baseline Characteristics by STI Status and Unadjusted Effects on the Odds of Testing STI+.

	COHORT (n = 244)	**STI− (n = 188)**	**STI+ (n = 56)**	
	Mean (± SD) or n (%)	***Mean (± SD) or n (%)***	***Mean (± SD) or n (%)***	**OR (95% CI)[a]**
Years of Age	34.0 (± 8.8)	34.3 (± 8.9)	33.1 (± 8.6)	0.87 (0.64; 1.17)
Race/Ethnicity				
African-American	47 (19.3%)	30 (16.0%)	17 (30.4%)	2.02* (1.02; 4.06)
Other Racial/Ethnic Minority	23 (9.4%)	22 (11.7%)	1 (1.8%)	0.16 (0.02; 1.24)
Caucasian	174 (71.3%)	136 (72.3%)	38 (67.9%)	[REF]
Days Heavy Alcohol Use/90 Days	39.6 (± 30.4)	40.1 (± 30.7)	37.7 (± 29.7)	0.92 (0.68; 1.25)
Recent Cocaine Use (Past 90 Days)	166 (68.0%)	120 (63.8%)	46 (82.1%)	2.65* (1.26; 5.57)
Recent Opiate Use (Past 90 Days)	103 (42.2%)	72 (42.0%)	24 (42.9%)	1.03 (0.56; 1.89)
Lives with Sex Partner (Yes)	122 (50.0%)	97 (51.6%)	25 (44.6%)	0.75 (0.41; 1.36)
Lifetime History of STI	116 (47.5%)	83 (44.2%)	33 (58.9%)	1.83* (1.00; 3.35)
Days Sexually Active/90 Days	39.2 (± 28.2)	39.6 (± 28.0)	37.8 (± 29.2)	0.93 (0.69; 1.26)
Any Main Partners (Yes)	215 (88.1%)	170 (90.4%)	45 (80.4%)	0.43* (0.19; 0.98)
Days with. Main Partner/90 Days	31.7 (± 27.8)	34.2 (± 28.0)	23.2 (± 25.6)	0.64** (0.45; 0.90)
Days Unprotd. with Main Partner/90 Days	31.4 (± 28.1)	34.0 (± 28.4)	22.8 (± 25.3)	0.63** (0.45; 0.89)
Any Casual Partners (Yes)	101 (41.4%)	66 (35.1%)	35 (62.5%)	3.11** (1.67; 5.76)
Days with Casual Partner/90 Days	9.1 (± 20.7)	6.2 (± 16.1)	19.0 (± 29.9)	1.66** (1.27; 2.18)
Days Unprotd. with Casual Partner	5.7 (± 15.8)	4.2 (± 12.9)	10.9 (± 22.3)	1.42** (1.09; 1.85)
Multiple Male Partners (Yes)	104 (42.6%)	67 (35.6%)	37 (66.1%)	3.55** (1.89; 6.65)
Sex Work (Yes)	66 (27.1%)	40 (21.3%)	26 (46.4%)	3.23** (1.72; 6.06)

[a]Unadjusted (bivariate) effects on the odds of testing STI+. Continuous variables were standardized to zero mean and unit variance prior to estimating odds-ratios and give the expected change in the odds of testing STI+ for a 1 standard deviation increase in the corresponding predictor. 95% CI estimates and tests of significance were based on robust Huber-White variance estimators.

Table 2

Multiple Logistic Regression Models Estimating the Association of Background Characteristics, Substance Use, and Sexual-Risk Taking Behaviors with the Likelihood of Testing STI+ (n = 244).

Entered Covariates[a]	OR (95% CI)[b]
Years of Age[c]	0.85 (0.59; 1.23)
Race/Ethnicity[d]	
African-American	2.50 * (1.11; 5.65)
Other Ethnic Minority	0.20 (0.02; 1.67)
Non-Hispanic Caucasian [REF]	[1.00]
Self-Reported Lifetime History of STI (Yes)	1.14 (0.54; 2.38)
Lives with Sex Partner	1.46 (0.73; 2.94)
# Days Heavy Alcohol Use/90 Days[c]	0.70 (0.48; 1.02)
Used Cocaine (Yes)	1.81 (0.76; 4.28)
Used Opiates (Yes)	1.84 (0.67; 5.07)
Stepwise Forward Selection	
Any Main Partners (Yes)	NS
Days Sex with Main Partners/90 Days[c]	0.67 * (0.47; 0.94)
Days Unprotd. Sex with Main Partner/90 Days[c]	NS
Any Casual Partners (Yes)	NS
Days Sex with Casual Parnter/90 Days[c]	1.46 * (1.05; 2.04)
Days Unprotd. Sex with Casual Partner/90 Days[c]	NS
Multiple Male Partners (Yes)	2.27 * (1.03; 5.024)
Commercial Sex Work (Yes)	NS

* P < .05;

** p < .01

[a] Background characteristics (age, ethnicity, lifetime history of STI, living with sex partner, frequency of heavy alcohol use, and current use of cocaine and opiates) were entered as covariates prior to stepwise to selection of sex-risk indicators. The reported coefficients and 95% CI estimates were adjusted for all variables entered in the final model.

[b] Reported 95% confidence interval estimates were based on robust Huber-White variance estimators. The likelihood ratio test was used to identify the most salient sex-risk predictors during stepwise selection.

[c] All continuous covariates were standardized to zero mean and unit variance prior to estimation.

[d] A likelihood-ratio difference test for the effect of ethnicity was statistically significant (LR2 = 10.13, df = 2, p = .006) in Model 1. Relative to other ethnic minorities Non-Hispanic Caucasians and African-Americans were estimated to be 5.11 (95%CI 0.64; 40.88, p = .125) and 12.77 (95%CI 1.49; 109.73, p = .020) times more likely to test STI+, respectively.