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The Achilles' Heel of HIV Treatment for Prevention: History of Sexually Transmitted Co-Infections among People Living with HIV/AIDS Receiving Antiretroviral Therapies

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Abstract

Background—Antiretroviral therapies (ART) offer promising new avenues for HIV prevention. Unfortunately, people infected with HIV who have co-occurring sexually transmitted infections (STI) are more infectious than suggested by the amount of virus in their peripheral blood. We examined the history of STI co-infections in people living with HIV.

Methods—People living with HIV/AIDS completed confidential computerized interviews that assessed history of STI, sexual behaviors, and STI knowledge.

Results—Among 414 men and 156 women currently receiving ART, 53% had been diagnosed with at least one STI since testing HIV positive; 24% women, 19% men, and 11% transgender persons had been diagnosed with an STI in the past year. History of STI was associated with younger age, greater STI knowledge, substance use, and ART non-adherence.

Conclusions—Aggressive strategies for detecting and treating STI in people receiving ART will be necessary to achieve protective benefits.

Introduction

HIV prevention priorities have shifted over the past decade, from reducing the risks of uninfected individuals contracting HIV, to treating persons already infected. (1) The rationale for targeting prevention to HIV positive persons is in part based on the potential for reducing HIV infectiousness with antiretroviral therapy (ART). (2–3) Mathematical models project that implementation of universal HIV testing and treatment could have a significant impact on HIV incidence at the population level. (3–5) Although using HIV treatments for prevention poses significant challenges for generalized HIV epidemics in resource constrained countries (6–8), treatment for prevention is being implemented in the United States and Canada. For example, the San Francisco Health Department currently offers ART to all persons who test HIV positive. Similar initiatives are underway in the Bronx New York, Washington DC, and Vancouver British Columbia. The potential for ART to reduce infectiousness and prevent new HIV infections led the Swiss Federal AIDS Commission to state that people living with HIV/AIDS who have effectively suppressed HIV replication, as

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demonstrated by repeated undetectable viral load test results, can be considered non-infectious; alleviating concerns about HIV transmission.(9–10) Research suggests that this policy shift has indeed resulted in less protected sexual behavior among men and women who are familiar with the Swiss policy and have undetectable viral loads. (11)

Although the potential for ART to prevent HIV infections is theoretically compelling, there are at least two behavioral factors that will undermine the use of HIV treatments for prevention; poor adherence to ART regimens and co-occurring sexually transmitted infections (STI).(12) Specifically, poor treatment adherence results in non-suppressive therapeutic levels of ART and therefore unchanged infectiousness. Even worse, non-adherence can lead to resistant virus that can subsequently be transmitted to others.(13–14)

Less obvious is the role of co-occurring STI in the infectiousness of genital secretions. Sexually transmitted co-infections increase HIV viral shedding in the genital tract, resulting in significant increases in HIV infectiousness. (15) Local inflammation activates HIV replication in the genital immune compartment independent of HIV in peripheral blood, such that a person can have a clinically monitored undetectable blood viral load while they are highly infectious in their genital tract. (15–16) Thus, people with HIV and STI co-infections are more infectious than they can possibly know from routine monitoring of blood plasma viral load. (17) A recent review of research on the correspondence between HIV concentrations in blood and semen found only moderate concordance; the mean correlation between blood plasma viral load and semen viral load was r = .44, accounted for at least in part by sexually transmitted co-infections.(17)

The overall median point-prevalence of confirmed STI in people living with HIV/AIDS is 12.4%, and the most common STI in people with HIV are those that cause HIV shedding, specifically Syphilis (median 9.5% prevalence), gonorrhea (9.5%), Chlamydia (5%), and Trichamoniasis (18.8%)(18). Although STI are frequently detected at the time of HIV diagnosis, reflecting the role of STI in HIV transmission, exposure to sexually transmitted pathogens persists long after HIV diagnosis. In addition, STI prevalence among individuals receiving HIV treatment is not appreciably different from their untreated counterparts. (19) Sexually transmitted co-infections have significant implications for people receiving ART, especially when ART is administered with the intent of preventing HIV transmission.

The purpose of the current research was to examine the history co-occurring STI in a community sample of people living with HIV/AIDS who are receiving ART. We examined STI diagnoses during the time since testing HIV positive and STI diagnoses in the 12 months prior to assessment. To determine factors associated with STI co-infections, we compared persons who had been diagnosed with an STI since testing HIV positive to those who had not been diagnosed with an STI on demographic, behavioral, and health characteristics. We hypothesized that people living with HIV/AIDS and receiving ART who have a history of STI diagnoses would demonstrate a pattern of continued substance use and sexual behaviors that maintain risks for new STI, greater infectiousness, and HIV transmission.

Methods

Participants

People living with HIV/AIDS (N = 713) were recruited through community sampling to participate in a single session survey. We used targeted venue and snowball sampling techniques to identify individuals in and out of care. Recruitment relied on responses to brochures placed in waiting rooms of HIV service providers and infectious disease clinics throughout Atlanta, Georgia as well as an explicit systematic approach to word-of-mouth chain recruitment. Specifically, participants were given recruitment brochures and encouraged to refer their HIV-infected friends to the study. These procedures were designed to extend recruitment beyond any one service setting in order to achieve a broad community sample.

Interested persons contacted our research program to schedule an assessment appointment. The study entry criteria were age 18 years or older and proof of positive HIV status using a photo ID with either a matching ART prescription bottle, HIV clinic card, positive HIV test result, lab report, or any other proof of positive HIV status. Participants received $25 for completing the computerized interview (approximately 1 hour). Data were collected between December 2009 and March 2011. All study procedures were approved by the university institutional review board.

Measures

For the purposes of the current study, measures included STI history, demographic characteristics, substance use, STI knowledge, and sexual behavior. Measures were administered using audio-computer assisted structured-interviews (ACASI) to reduce demand characteristics and socially-evoked response biases. (20–21)

STI History—Participants reported whether they had been diagnosed with gonorrhea, Chlamydia, Syphilis, genital herpes, or Trichomoniasis in two separate time frames. First, we asked participants if they had ever been diagnosed with each STI. Participants who had been diagnosed with an STI were asked the approximate date of their last diagnosis. We used the date of STI diagnoses and date of their HIV positive diagnosis to determine whether each STI had been diagnosed since testing HIV positive. Specifically, we defined having been diagnosed with an STI after HIV if the difference in dates was one month or greater. We also used the dates to determine if the diagnosis had occurred within the previous 12 months of the assessment session. We used the same format to assess the occurrence of genital ulcers, genital pain, and unexplained genital discharge to detect potentially undiagnosed STI symptoms. We did not, however, include these non-specific symptoms in our definition of having contracted an STI.

Demographic and health characteristics—Participants were asked their gender (including whether they were transgender), age, years of education, income, ethnicity, and employment status. We assessed HIV related symptoms using a previously developed and validated measure concerning experience of 14 common symptoms of HIV disease.(22) Participants also indicated their most recent CD4 cell count and viral load. We asked

participants whether they were currently being treated with ART and those who were receiving treatment indicated if they had missed any of their ART in the past week. Participants also responded to a single item rating scale for assessing medication adherence. The adherence rating scale asked individuals to indicate the point along a continuum showing how much of their ART they have taken in the past month. (23–24) For the computerized administration we adapted the response format by using a 100 point slide bar tool anchored by 0%, 50% and 100%. The specific instructions read as follows "We would be surprised if most people take 100% of their medications. Below, 0% means you have taken no HIV medications the past month, 50% means you have taken half of your HIV medications the past month and 100% means you have taken every single dose this past month. What percent of your HIV medications did you take?" Participants indicated the percentage of medications taken by clicking their mouse anywhere on the 100 point slide bar continuum. The adherence rating scale has been found reliable and valid. (23–24)

STI knowledge—We administered 14 items from a previously developed test of STI knowledge, reflecting a broad range of information about STI transmission, symptoms and disease manifestations. (25) The specific items used in this study are shown in the results. Items were responded True/False and Do Not Know, with Do Not Know responses scored incorrect. The total score was obtained by calculating the percent correct responses, Kuder Richardson-20 coefficient = .71.

Sexual risk and protective behaviors—Participants responded to items assessing their number of male and female sex partners and frequency of sexual behaviors in the previous 4-months. Specifically vaginal and anal intercourse with and without condoms were assessed within HIV seroconcordant and serodiscordant partnerships. A 4-month retrospective period was selected because previous research has shown reliable reports for numbers of sex partners and sexual events over this time period (26). Participants were instructed to think back over the past 4-months and estimate the number of sex partners and number of sexual occasions in which they practiced each behavior. The instructions included cues for recollecting behavioral events. Data were analyzed within seroconcordant and serodiscordant relationships with individual behaviors examined as well as behaviors collapsed across unprotected and protected aggregates. In addition, we calculated the percentage of intercourse occasions in which condoms were used by taking the ratio [condom protected vaginal + condom protected anal intercourse/total vaginal + total anal intercourse].

Data analyses

All of the main analyses for this study focused on participants who were currently taking ART. We first conducted descriptive analyses to determine the prevalence of STI co-infections in the sample. We report STI diagnoses and STI symptoms for the time since testing HIV positive and in the past year, separately for men, women, and transgender persons. Based on this initial analysis, we identified participants who had and had not contracted an STI since testing HIV positive. Groups were compared using bivariate logistic regressions on demographic, health, substance use, STI knowledge and sexual behaviors. Predictors found significant in bi-variable models were selected for inclusion in the

multivariable model. For all analyses, we performed logistic regressions, reporting odds ratios and 95% confidence intervals, with statistical significance defined as $p < .05$.

Results

Among the 713 persons screened for the study, 570 (79%) were currently taking ART. The final sample for analyses consisted of 415 men and 155 women, of which 26 men and 19 women identified as transgender. Table 1 shows the rates of STI since testing HIV positive and rates for having been diagnosed with an STI in the past year. Overall, 53% of participants had been diagnosed with at least one STI since testing HIV positive; 29% were diagnosed once and 24% had two or more diagnoses. Genital pain and discharge since testing HIV positive were also reported. In terms of STI diagnoses in the past year, 26% women, 19% men, and 12% transgender persons had been diagnosed with an STI. The most common new STI diagnosis was genital herpes (7%), followed by gonorrhea (6%) and the least common was Trichomoniasis (1%).

Demographic and health characteristics

Analyses showed that participant age differed between people living with HIV who were and were not diagnosed with an STI; persons diagnosed with a post-HIV STI were significantly younger. In addition, participants who had been diagnosed with an STI were significantly more likely to have a history of incarceration. STI history was not associated with gender, income, race, or employment status. In terms of health-related factors, individuals who had been diagnosed with an STI were significantly more likely to have missed their HIV medications in the previous week and were more likely to have taken less than 85% of their medications in the previous month. (see Table 2).

Substance use

Participants with a history of STI since testing HIV positive indicated significantly more alcohol and other drug use in the previous 4-months. Nearly two out of three persons with STI diagnoses, drank alcohol, half had used at least one illicit drug and 30% were poly-drug users. In addition, having had an STI was associated with using drugs before sex in the past 4-months. (see Table 2)

STI knowledge

Results showed that most participants, regardless of whether they had an STI, did not have high-levels of accurate information about STI transmission, symptoms, and treatment. (see Table 3) Less than half of participants were aware that genital herpes can be transmitted in the absence of genital ulcers and one in three believed that having gonorrhea resulted in an immunity against future infection. In addition, only 37% of participants knew that STI co-infections increase HIV infectiousness in genial fluids. Results also showed that individuals who had been diagnosed with an STI answered more STI knowledge items correctly compared to participants who had not been diagnosed with an STI.

Current sexual behaviors

The associations between having been diagnosed with an STI since testing HIV positive and recent sexual behaviors are shown in Table 4. Two hundred forty-eight (43%) participants reported HIV positive (seroconcordant) sex partners in the past 4-months and 193 (33%) had sex partners in that time period whose HIV status was negative or unknown (serodiscordant). Among the individuals with serodiscordant partners, 107 (55%) had engaged in unprotected vaginal or anal intercourse. Comparisons between groups demonstrated that individuals with a history of STI since their HIV diagnosis were significantly more likely to have HIV positive (seroconcordant) sex partners in the past 4-months. Participants with a history of STI co-infection were more likely to have engaged in unprotected anal intercourse and total unprotected intercourse, as well as significantly more occurrences of these behaviors.

Multivariable model

To identify factors independently associated with history of STI since testing HIV positive, we tested a multiple logistic regression model predicting having been diagnosed with an STI since testing HIV positive from non-redundant participant characteristics. Results showed that younger age, more accurate knowledge about STI, drug use, and having missed ART in the past week were significantly associated with having had an STI.

Discussion

The current study demonstrates a history of post-HIV diagnosis of STI is common among people receiving ART. We found that more than half of participants had been diagnosed with at least one STI since testing HIV positive. Among those who had been diagnosed with an STI, 24% had two or more STI diagnoses. More than one in four women and nearly one in five men receiving ART had been diagnosed with an STI in the previous year. STI symptoms were also common in the previous year. These rates of STI are consistent with a recent review that found a median STI point prevalence of 12% STI among people living with HIV. (18) We confirmed our study hypothesis that people living with HIV who had a history of STI were at continued high-risk for contracting new STI, increased infectiousness, and transmitting HIV. These results have implications for the use of ART to lower HIV infectiousness for prevention.

Local inflammation of the genital tract caused by STI co-infections increases HIV viral shedding and therefore HIV infectiousness. (8) Although several ART regimens effectively penetrate the genital immune compartment, activation of HIV infected CD4 cells spike HIV concentrations in genital secretions,(27–28) increasing infectiousness beyond what can be estimated from peripheral blood viral loads. We found that having contracted an STI was associated with poor ART adherence, posing an added challenge to using ART for HIV prevention. Multiple factors that can act as mediating variables may explain the association between STI co-infections and ART non-adherence including use of alcohol and other substances, health consciousness, and quality of health care. (29) Individuals who contract STI and are non-adherent to ART will likely remain highly infectious and undermine the preventive effects of using ART for HIV prevention.

We found surprisingly high levels of misinformation about STI in this sample of people living with HIV/AIDS. Similar to studies of other populations, (25) people living with HIV only knew about half of the STI knowledge items. Contrary to expectations, individuals who had been diagnosed with an STI since testing HIV positive had slightly better STI knowledge, possibly reflecting educational and counseling experiences related to their previous STI. Despite their greater STI knowledge, those who had been diagnosed engaged in substantially more risk behaviors. This finding suggests a need for STI education among people living with HIV, but education alone will not be sufficient to prevent new infections.

The findings from this study should be interpreted in light of its methodological limitations. Our methods relied on self-reported health status and sexual behaviors which may have been affected by self-report biases Tendencies to under-report sexual behaviors and substance use, (30) as well as over-report medication adherence, (31) suggest that the behaviors reported here should be considered lower-bound estimates. Our cross-sectional study design also precludes any causal or directional conclusions. Our measures may have excluded important covariates that could have helped explain the results, such as quality of health care, stigmas associated with STI, and perceptions of infectiousness. Finally, our results are based on a convenience sample that is predominantly African American people living with HIV/AIDS in one southern US city. Although our results converge with other studies, caution is warranted before generalizing these findings to other populations of people living with HIV/AIDS. Acknowledging these limitations, we believe that our findings have implications for programs that seek to test and treat people for HIV prevention.

Co-occurring STI are a significant threat to the potential for HIV treatments to reduce HIV infections. Indeed, mathematical models of infections averted by population scale-up of ART are unrealistically optimistic when they do not include estimates of sexually transmitted co-infections. (3, 32) Although viral load in the genital tract is typically lower than viral load in blood plasma, this association is inverted when there are co-occurring STI. (33) Implementing ART as a preventive strategy therefore requires aggressive STI detection and treatment. Patients taking ART should receive comprehensive information about STI as well as instruction in symptom detection, self-examination, and ability to attain sexual health services. Sexual history taking, STI screening, and risk reduction counseling should be fully integrated with the routine care for people with HIV/AIDS. Failure to allocate adequate resources to stemming STI infections and monitoring adherence in people receiving ART could render HIV treatment ineffective in preventing HIV transmission.

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References

1. Centers for Disease Control and Prevention. Advancing HIV Prevention: New Strategies for a Changing Epidemic --- United States. Morbidity and Mortality Weekly Report. 2003; 52(15):329–32. [PubMed: 12733863]
2. Dieffenbach C, Fauci A. Universal voluntary testing and treatment for prevention of HIV transmission. JAMA. 2009; 301:2380–2. [PubMed: 19509386]

3. Wilson DP, Law MG, Grulich AE, Cooper DA, Kaldor JM. Relation between HIV viral load and infectiousness: a model-based analysis. Lancet. 2008; 372(9635):314–20. [PubMed: 18657710]
4. Granich RM, Gilks CF, Dye C, De Cock KM, Williams BG. Universal voluntary HIV testing with immediate antiretroviral therapy as a strategy for elimination of HIV transmission: a mathematical model. Lancet. 2009 Jan 3; 373(9657):48–57. [PubMed: 19038438]
5. Blower SM, Gershengorn HB, Grant RM. A tale of two futures: HIV and antiretroviral therapy in San Francisco. Science. 2000; 287:650–654. [PubMed: 10649998]
6. De Cock KM, Crowley SP, Lo YR, Granich RM, Williams BG. Preventing HIV transmission with antiretrovirals. Bull World Health Organ. 2009 Jul.87(7):488-A. [PubMed: 19649357]
7. De Cock KM, Gilks CF, Lo YR, Guerma T. Can antiretroviral therapy eliminate HIV transmission? Lancet. 2009 Jan 3; 373(9657):7–9. [PubMed: 19038440]
8. Cohen MS, Gay CL. Treatment to prevent transmission of HIV-1. Clin Infect Dis. 2010 May 15; 50(Suppl 3):S85–95. [PubMed: 20397961]
9. Vernazza P, Hirschel B, Bernasconi E, Flepp M. HIV-positive individuals without additional sexually transmitted diseases (STD) and on effective anti-retroviral therapy are sexually non-infectious. Bulletin des médecins suisses. 2008; 89(5)
10. Cohen MS. HIV Treatment as Prevention and “The Swiss Statement”: in for a Dime, in for a Dollar? Clin Infect Dis. 2010 Dec 1; 51(11):1323–4. [PubMed: 21034196]
11. Hasse B, Ledergerber B, Hirschel B, Vernazza P, Glass TR, Jeannin A, et al. Frequency and Determinants of Unprotected Sex among HIV-Infected Persons: The Swiss HIV Cohort Study. Clin Infect Dis. 2010 Dec 1; 51(11):1314–22. [PubMed: 21034200]
12. Kalichman SC. Co-occurrence of treatment nonadherence and continued HIV transmission risk behaviors: implications for positive prevention interventions. Psychosom Med. 2008 Jun; 70(5): 593–7. [PubMed: 18519882]
13. Murillo W, Paz-Bailey G, Morales S, Monterroso E, Paredes M, Dobbs T, et al. Transmitted drug resistance and type of infection in newly diagnosed HIV-1 individuals in Honduras. J Clin Virol. 2010 Apr 21.
14. Hamers RL, Siwale M, Wallis CL, Labib M, van Hasselt R, Stevens WS, et al. HIV-1 drug resistance mutations are present in six percent of persons initiating antiretroviral therapy in Lusaka, Zambia. J Acquir Immune Defic Syndr. 2010 Sep 1; 55(1):95–101. [PubMed: 20585262]
15. Cohen MS, Hoffman IF, Royce RA, et al. Reduction of concentration of HIV-1 in semen after treatment of urethritis: implications for prevention of sexual transmission of HIV-1. Lancet. 1997; 349:1868–73. [PubMed: 9217758]
16. Coleman JS, Hitti J, Bukusi EA, Mwachari C, Muliro A, Nguti R, et al. Infectious correlates of HIV-1 shedding in the female upper and lower genital tracts. AIDS. 2007 Mar 30; 21(6):755–9. [PubMed: 17413697]
17. Kalichman SC, Cage M, Barnett T, Tharnish P, Rompa D, Austin J, et al. Human immunodeficiency virus in semen and plasma: investigation of sexual transmission risk behavioral correlates. AIDS Res Hum Retroviruses. 2001 Dec 10; 17(18):1695–703. [PubMed: 11788021]
18. Kalichman SC, Pellowski J, Turner C. Prevalence of sexually transmitted co-infections in people living with HIV/AIDS: systematic review with implications for using HIV treatments for prevention. Sex Transm Infect. 2011 Feb 17.
19. Mayer KH, O’Cleirigh C, Skeer M, Covahey C, Leidolf E, Vanderwarker R, et al. Which HIV-infected men who have sex with men in care are engaging in risky sex and acquiring sexually transmitted infections: findings from a Boston community health centre. Sex Transm Infect. 2010 Feb; 86(1):66–70. [PubMed: 19720603]
20. Gribble JN, Miller HG, Cooley PC, Catania JA, Pollack L, Turner CF. The impact of T-ACASI interviewing on reported drug use among men who have sex with men. Subst Use Misuse. 2000 May-Jun;35(6–8):869–90. [PubMed: 10847215]
21. Morrison-Beedy D, Carey MP, Tu X. Accuracy of audio computer-assisted self-interviewing (ACASI) and self-administered questionnaires for the assessment of sexual behavior. AIDS Behav. 2006 Sep; 10(5):541–52. [PubMed: 16721506]

22. Kalichman SC, Rompa D, Cage M. Reliability and validity of self-reported CD4 lymphocyte count and viral load test results in people living with HIV/AIDS. Int J STD AIDS. 2000 Sep; 11(9):579–85. [PubMed: 10997499]

23. Bangsberg DR, Hecht FM, Charlebois ED, Chesney M, Moss A. Comparing objective measures of adherence to HIV antiretroviral therapy: Electronic medication monitors and unannounced pill counts. AIDS Behav. 2001; 5:275–81.

24. Kalichman SC, Amaral CM, Swetzes C, Jones M, Macy R, Kalichman MO, et al. A simple single-item rating scale to measure medication adherence: further evidence for convergent validity. J Int Assoc Physicians AIDS Care (Chic Ill). 2009 Nov-Dec;8(6):367–74.

25. Jaworski BC, Carey MP. Development and psychometric evaluation of a self-administered questionnaire to measure knowledge of sexually transmitted diseases. AIDS Behav. 2007 Jul; 11(4):557–74. [PubMed: 17016760]

26. Napper L, Fisher DG, Reynolds GL, Johnson ME. HIV Risk Behavior Self-Report Reliability at Different Recall Periods. AIDS Behav. 2009

27. Cohen MS, Kashuba AD. Antiretroviral therapy for prevention of HIV infection: new clues from an animal model. PLoS Med. 2008 Feb.5(2):e30. [PubMed: 18254655]

28. Kashuba AD, Dyer JR, Kramer LM, Raasch RH, Eron JJ, Cohen MS. Antiretroviral-drug concentrations in semen: implications for sexual transmission of human immunodeficiency virus type 1. Antimicrob Agents Chemother. 1999 Aug; 43(8):1817–26. [PubMed: 10428898]

29. Kalichman SC. Co-occurrence of treatment non-adherence and continued HIV transmission risk behaviors: Implications for positive prevention interventions. Psychosom Med. 2008; 70:593–7. [PubMed: 18519882]

30. Schroder K, Carey MP, Vanable P. Methodological challenges in research on sexual risk behavior: I Item content, scaling, and data analytic options. Ann Behav Med. 2003; 26:104–23. [PubMed: 14534028]

31. Simoni J, Kurth AE, Pearson C, Pantalone DW, Merrill J, Frick P. Self-Report Measures of Antiretroviral Therapy Adherence: A Review with Recommendations for HIV Research and Clinical Management. AIDS Behav. 2006; 10:227–331. [PubMed: 16783535]

32. Cohen MS, Mastro TD, Cates W Jr. Universal voluntary HIV testing and immediate antiretroviral therapy. Lancet. 2009 Mar 28.373(9669):1077. author reply 80–1. [PubMed: 19328992]

33. Kalichman SC, DiBerto G, Eaton L. HIV Viral Load in Blood Plasma and Semen: Review and Implications of Empirical Findings. Sex Transm Dis. 2008; 35:55–60. [PubMed: 18217225]

Table 1

STI co-infections reported since HIV diagnosis and in the previous year among men, women, and transgender persons receiving ART.

	STI Since Testing HIV Positive								STI in the Past Year							
	Men		Women		Transgender		Total		Men		Women		Transgender		Total	
STI	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Gonorrhea	82	21	30	22	5	11	117	20	21	5	9	7	2	4	32	6
Chlamydia	49	12	37	27	3	6	89	16	8	2	6	4	1	2	15	2
Syphilis	105	27	19	14	11	23	135	23	22	6	4	3	2	4	28	5
Genital herpes	102	26	47	35	4	9	153	27	27	7	14	10	0		41	7
Trichomoniasis	4	1	30	24	1	2	35	7	1	1	6	5	0		7	1
STI symptoms																
Genital ulcer	65	16	44	32	4	9	113	20	8	2	3	2	0		11	2
Genital pain	103	26	36	26	11	23	150	26	18	4	5	4	2	4	25	4
Genital discharge	70	18	55	40	5	10	130	22	17	4	4	3	0		21	4
One STI since HIV+	118	30	36	26	15	32	169	29								
2+ diagnosessince HIV+	91	24	45	34	4	9	132	24								
Past year any STI									74	19	33	24	5	11	112	20

Note: N's: Men = 388, Women=136, Transgender =46, Total=570.

Table 2

Demographic, health characteristics and substance use among people with HIV who had not and who had been diagnosed with an STI since testing HIV positive.

	Not diagnosed with an STI (n=261)		Diagnosed with at least one STI (n=309)			
Characteristic	**n**	**%**	**n**	**%**	**OR**	**95%CI**
Men	179	69	209	68	Reference	
Women	55	21	81	26	1.65	0.89–3.08
Transgender	27	10	19	6	2.09	1.06–4.12
African American	242	93	279	90	0.73	0.40–1.33
Income < $10,000	170	65	203	65	0.99	0.69–1.39
Unemployed	89	34	102	33	1.05	0.74–1.49
Married/cohabitating	69	27	67	22	0.76	0.52–1.12
History of incarceration	160	61	220	71	1.56*	1.09–2.21
Incarcerated in past year	37	14	51	16	1.19	0.75–1.89
CD4 count < 200	47	22	70	25	1.19	0.78–182
Know their viral load	175	67	222	72	1.25	0.87–1.79
Viral load detectable	64	28	97	34	1.32	0.90–1.92
Missed ART in past week	74	28	130	42	1.85**	1.30–2.62
<85% adherent on VAS	55	21	94	33	1.71*	1.16–2.52
Substance use in the past 4 months						
Alcohol	140	53	196	63	1.49*	1.06–2.08
Cannabis	52	20	1116	38	2.40**	1.64–3.52
Cocaine/crack	50	19	70	22	1.24	0.82–1.85
Inhalants	11	4	40	12	3.38	1.69–6.32
Amphetamine	5	2	9	3	1.53	0.51–4.64
Non-prescription ‘Viagra’	14	5	32	10	2.03*	1.06–3.91
Injected drugs	4	2	7	2	1.49	0.43–5.14
Other drugs	9	3	25	8	2.46*	1.12–5.38
Any non-alcohol drugs	93	36	155	50	1.80**	1.27–2.54
Poly drug use	37	14	89	29	1.82**	1.30–2.55

	Not diagnosed with an STI (n=261)		Diagnosed with at least one STI (n=309)			
Characteristic	**n**	**%**	**n**	**%**	**OR**	**95%CI**
Alcohol use before last sex	70	27	93	31	1.18	0.81–1.70
Drug use before last sex	43	17	78	26	1.72**	1.13–2.60
	M	SD	M	SD	OR	95%CI
Age	47.7	8.2	45.0	7.5	0.95**	0.93–0.97
Education	12.1	1.6	12.2	1.6	1.02	0.92–1.13
CD4 cell count	464.1	392.1	420.6	265.9	1.00	0.99–1.00
HIV symptoms	3.0	3.1	3.5	3.4	1.05*	1.00–1.11

Note

* $p < .05$,

** $p < .01$,

Table 3

STI knowledge (percent correct) among people with HIV who had not and who had been diagnosed with an STI since testing HIV positive.

	Not diagnosed with an STI (n=261)		Diagnosed with at least one STI (n=309)			
STI Knowledge	**n**	**%**	**n**	**%**	**OR**	**95%CI**
Frequent urinary infections can cause Chlamydia.	56	22	93	30	1.57*	1.07–2.31
There is a cure for Gonorrhea.	146	55	214	69	1.77**	1.25–2.50
It is easier to get HIV if a person has another STD.	140	53	174	56	1.11	0.80–1.55
Soon after infection with HIV a person develops open sores on his or her genitals.	191	73	254	82	1.69**	1.13–2.52
There is a cure for Chlamydia.	115	44	200	65	2.32**	1.66–3.26
A woman can look at her body and tell if she has Gonorrhea.	131	50	210	68	2.10**	1.49–2.95
The same virus causes all STDs.	173	66	241	78	1.80**	1.24–2.61
Human Papillomavirus (HPV) can lead to cancer in women.	104	39	170	55	1.84**	1.32–2.58
STDs can lead to health problems that are usually more serious for men than women.	87	33	116	37	1.20	0.85–1.69
A woman can tell that she has Chlamydia if she has a bad smelling odor from her vagina.	103	40	126	41	1.05	0.75–1.47
A person who has Genital Herpes must have open sores to give the infection to his or her sexual partner.	76	29	136	44	1.91**	1.35–2.71
If a person had Gonorrhea in the past he or she is immune (protected) from getting it again.	150	57	233	75	2.26**	1.58–3.24
STDs like Gonorrhea and Syphilis increase HIV in sexual fluids.	99	38	115	37	0.97	0.69–1.36
A person who is undetectable for HIV in their blood is also undetectable in their sexual fluids.	158	61	193	63	1.08	0.77–1.52
Total percent correct STI knowledge (M, SD)	47.3	22.1	57.2	20.8	8.85**	3.95–19.84

Note

* $p < .05$,

** $p < .01$

Table 4

Sexual risk and protective behaviors among people with HIV who had not and who had been diagnosed with an STI since testing HIV positive.

	Not diagnosed with an STI (n=261)			Diagnosed with at least one STI (n=309)				
Sexual behavior in the past 4-months	**n**	**%**		**n**	**%**	**OR**	**95%CI**	
Number of sex partners								
0	113	43		89	29	Reference		
1	99	38		114	37	0.28	0.16–0.48	
2	26	10		41	13	0.41	0.23–0.70	
3+	23	8		65	21	0.55	0.28–1.10	
HIV positive partners	89	34		159	52	2.04**	1.45–2.87	
Non-HIV positive partners	81	31		112	36	1.26	0.89–1.79	
Engaged in sexual behaviors with non-HIV positive partners								
Unprotected anal intercourse	27	10		48	16	1.59+	096–2.63	
Unprotected vaginal intercourse	12	5		24	8	1.74	0.86–3.56	
Unprotected anal/vaginal intercourse	39	15		68	22	1.60*	1.04–2.48	
Frequencies of sexual behaviors with non-HIV positive partners								
	M	SD	Σ	M	SD	Σ	OR	95%CI
Unprotected anal intercourse	0.34	1.4	89	0.69	2.8	214	1.09+	0.98–1.22
Unprotected vaginal intercourse	0.18	1.1	46	0.32	1.4	98	1.10	0.95–1.26
Unprotected anal/ vaginal intercourse	0.51	1.7	135	1.0	3.2	312	1.10*	1.01–1.19
Percent condom use	70.4	37.1		61.1	39.0		0.55	0.25–1.17

Note

** p < .01,

* p < .05,

+ p < .08

Table 5

Multivariable logistic regression model predicting history of post-HIV infection STI.

Variable	Adjusted OR	95%CI
Gender	1.36	0.90–2.05
Age	0.96**	0.94–0.98
History of incarceration	1.13	0.69–1.87
STI knowledge score	1.16**	1.09–1.23
Alcohol use	1.01	0.68–1.52
Drug use	1.56*	1.05–2.34
Missed medications in past week	1.60**	1.09–2.34
Unprotected serodiscordant intercourse	1.03	0.94–1.12

Note

** $p < .01$,

* $p < .05$