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Order of Orifices: Sequence of Condom Use and Ejaculation by Orifice during Anal Intercourse among Women, Implications for HIV Transmission

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Abstract

Background—For women the order of penile insertion, condom use, and ejaculation by orifice during sexual events affects the probability of HIV transmission and design of HIV prevention methods.

Methods—From October 2006-June 2009, 431 women in Los Angeles and Baltimore in a rectal health study reported the sequence of penile insertion, condom use, and ejaculation by orifice location by computer assisted self-interview. Multinomial logistic regression identified predictors of condom use by orifice among women who reported vaginal intercourse (VI) during their last anal intercourse (AI) event.

Results—Of the 192 reporting on a last AI event, 96.3% (180/187) reported VI. Of these, 83.1% had VI *before* AI; 66.1% reported ejaculation during VI and 45.2% during AI. Only one third used a condom for both VI and AI, less than 10% for VI only or AI only; and half used no condoms. After adjusting for race, partner type, and substance use, compared to women who used condoms

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Conflicts of Interestg

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for both VI and AI at last AI, being older (units=5 years) (adjusted odds ratio [AOR]=0.76, 95% confidence interval [CI]: 0.60, 0.96), with serodiscordant partners (AOR=0.22, 95% CI: 0.08, 0.61) and HIV-positive with seroconcordant partners (AOR = 0.15; 95% CI: 0.04, 0.54) were inversely associated with non-condom use.

Conclusions—For most of the women in our study VI accompanied AI, with AI usually occurring after VI. This evidence for use of multiple orifices during the same sexual encounter and low use of condoms across orifices supports the need for a multi-compartment HIV prevention strategy.

Introduction

Reports from across the globe demonstrate that many women practice anal intercourse (AI) at some point in their lifetime. In a nationally representative survey of adults in the United States lifetime AI was reported by about 40%, and AI in the past year by 20% of women aged 20-49 years.¹ Even higher prevalence has been recorded within sub-groups at “high risk” for HIV acquisition in the US: from 16% of substance-using women² and 19- 22% of women attending public STD clinics reporting AI within the past 3 months^{3,4} and as high as 5 to 8% among female substance users in the past 30 days⁵. In South Africa, the prevalence of lifetime AI has been reported to be in excess of 40% among female sex workers⁶ compared to only 5% among young women in the general population,⁷ 10% of women in the past 3 months in community settings⁸, and in the past month by 11% of women surveyed in alcohol serving establishments⁹ – again with higher prevalence for “high risk groups”. Yet, despite the well-established greater efficiency of HIV transmission via AI over vaginal intercourse (VI),¹⁰⁻¹² women are less likely to use condoms during AI than VI and more practice unprotected AI than men who have sex with men (MSM).^{13,14} This has led to the supposition that much transmission of HIV within heterosexual partnerships may be the result of AI. Therefore, the practice of AI as a behavioral risk factor for HIV acquisition among women needs to be better understood.

The development of new prevention technologies for women, such as microbicides, has largely focused on preventing HIV acquisition during VI. However, after the failure of several large vaginal microbicide trials to demonstrate efficacy (i.e., the Carraguard trial¹⁵, HPTN 035¹⁶, and VOICE¹⁷), the concern was raised that rectally acquired HIV may contribute significantly to HIV incidence among women and that method failure in these trials may have partially been due to the focus on a single orifice, the vagina, for prevention. Because women have multiple orifices available for sexual activity, including the mouth, vagina, or rectum, and recent reports have noted higher practice of AI with more confidential modes of reporting,¹⁸ prevention methods for women will need to be safe and acceptable for use in multiple orifices¹⁹.

The factors that affect the choices women and their partners face during each sexual encounter, such as which orifices to utilize, in what order, and where to ejaculate, have been understudied. There is clear evidence of the influence of behaviors, such as substance use²⁰ and having new partners or violence on AI²¹. There is evidence women practice more condom use during AI in the context of perceived risk (i.e., sex with non-main partners) as

condom use has been reported highest among singles (46%); followed by singles in relationships (24%); and lowest among married individuals (11%)²² in the US general population. The role of ejaculate -by location and occurrence to heterosexual HIV transmission is also relevant. Condom use during AI may reduce exposure to ejaculate or the partners may ejaculate outside of the anal orifice, yet there is a dearth of such detail for women.

To contribute to the understanding of HIV acquisition risk from AI among women, we examined the frequency and context of AI and condom use among women who reported practice of AI in two US cities. We then specifically considered the potential for exposure to HIV among women who also engaged in VI at their last AI event by investigating the sequence of sexual acts (insertion order), condom use, and ejaculation by orifice (vagina and rectum).

Methods

Study Design

From October 2006 to June 2009, the University of California Los Angeles (UCLA) Microbicide Development Program (UCLA IPCP U19) conducted a cross-sectional rectal health and behaviors study to examine the effects of AI and other rectal behaviors on rectal health among both men and women in Baltimore at the Johns Hopkins University (JHU) and in two community sites in Los Angeles: the AIDS Research Alliance (ARA) and UCLA Clinical AIDS Research and Education (CARE) Center. Recruitment was from research registries (from ARA and UCLA) and newspaper, internet (Craig's List), and clinic posted advertisements. Eligibility criteria included: at least 18 years of age; willing to be tested for sexually transmitted infections (STIs) including HIV; willing to undergo an anal exam; and mentally competent to understand study procedures and give informed consent. By design, 50% of the parent study population were male, and 50% were HIV-positive. Eligibility criteria by AI status was defined as no AI in the past year for the non-AI men and women. For the practicing AI group it was reported AI in the past 30 days for men and reported AI in the past 12 months for women. HIV-1 status was verified in clinic by rapid tests and confirmed via Western Blot.

Study Procedures

Following written informed consent, participants completed computer-assisted self-interviews (CASIs) about rectal hygiene behavior, anorectal symptoms, substance use, and sexual behavior, including lifetime AI practice, the number of male partners in the past month, the practice of AI in the past month, and frequency of AI with most recent partners in the past month. Participants were tested for STIs and underwent perianal and anorectal examinations using high resolution anoscopy (HRA) to detect anal and distal rectal clinical signs. Study procedures were reviewed and approved by the Division of AIDS at the National Institutes of Health, and institutional review boards at UCLA, ARA, and JHU.

Measures: last AI event

Participants reporting recent AI were asked detailed information on their last AI event including substances use (alcohol, marijuana, methamphetamine, ecstasy, amyl nitrate, ketamine, gamma-hydroxybutyric acid, cocaine, heroin, marijuana, acid, mushrooms, oxycontin, valium, and vicodin), partner type (main or other), partner serostatus, and any other sexual acts practiced during that AI event as well as whether condoms were used, and if ejaculation occurred during those acts. Next they were shown their reported complete list of acts and were asked to order each act during that sexual event in sequence. This involved selecting the act they engaged in first, then select the next act, and so on until all acts had been selected. Participants were able to select the same act multiple times in the appropriate order. These data determined the order of orifice insertion among those who reported multiple sexual acts at their last AI event. Data on condom use and ejaculation during reported sexual acts at the last AI event were collected separately from data collected on the sequence of events. Thus, 34% (62/180) of women were missing data on the sequence of sexual acts at their last AI event because CASI questionnaires did not include consistency checks to ensure that participants selected all reported sexual acts when ordering the sequence of sexual acts at their last AI event. Finally, our analysis excludes women who did not report having VI at their last AI event (4%), and thus those who may have been at high risk of HIV infection.

Statistical Analyses

Basic frequencies were calculated for the practice of AI within the full sample of women. Because the purpose of the present study was to examine women's behavior during sexual encounters in which they practiced both VI and AI, we restricted the remainder of our analysis to women who reported recent AI and VI at their last AI event. To characterize our women who reported VI at their last AI event (N=180), we calculated descriptive statistics by HIV status. Next, we examined the order of orifice insertion, condom use by orifice, and the location of ejaculation at the last AI event reported by study participants. Finally, we used multinomial logistic regression to examine the relationship between condom use by orifice (neither VI nor AI, VI only, AI only, or both VI and AI) and the following predictors: study site, age (units = 5 years), race (Black or non-Black), any substance use (excluding alcohol and marijuana) at last AI event, partner type (main or non-main), and partnership serostatus (HIV-negative concordant, HIV-positive concordant, of HIV serodiscordant). Partnerships with partners of the same HIV status as women were considered seroconcordant. Partnerships with HIV-positive or HIV status unknown partners reported by HIV-negative women were considered serodiscordant, while HIV-negative or HIV status unknown partners reported by HIV-positive women were considered serodiscordant. Because race and study site were highly correlated (78% of Baltimore participants were Black and 64% of LA participants were non-Black), we excluded study site from our final model. All analyses were performed in Stata version 11.0 (StataCorp, College Station, TX).

Results

In the full sample of women (N=431), 25% (105/427) had AI in their lifetime, but not in the past year. Among these 105 women, most frequent reasons for no longer practicing AI were

that it hurt or was uncomfortable (38%) and that other kinds of sex were preferred (26%). Other reasons for not having had AI in the past year were reported by less than 10%¹. Within those 431 enrolled women, 200 reported recent AI and 96% (192/200) of those women reported detailed information on their last AI event during which 96% (180/187) also reported having VI. Of women who reported AI in the past year and having VI at their last AI event (N=180), more than half were African American (58%), a quarter were under 30 years of age (mean age=37.4 years, SD=10.2), and by design approximately half were HIV-positive (42%) (Table 1). In the past month, 87% of women reported having sexual intercourse (VI or AI) with a mean of 1.6 (SD=1.8) male partners. Most (83%) (119/143) reported a last AI event in the past month and having AI a mean of 4.9 (SD=8.6) times. The majority of partners at last AI were HIV seroconcordant: 91% (73/80) of HIV-negative women and 43% (22/51) of HIV-positive women had a seroconcordant partner. Among HIV negative women 8.8% (7/80) had a serodiscordant partner; 5 HIV-positive and 2 HIV status unknown), while 56.9% (29/51; 28 HIV-negative and 1 HIV status unknown) of HIV-positive women had a serodiscordant partner. Approximately 73% of women reported that their last AI event was with a main partner.

Among women reporting the order of orifice insertion at their last AI event, 83% (98/118) reported that all vaginal insertion occurred prior to rectal, 12% (14/118) that all rectal insertion occurred prior to vaginal, and only 5% (6/118) reported alternating between vaginal and rectal insertion (Table 2). Almost all women provided reports on condom use by orifice of insertion (98% =176/180); of those, 52% (91/176) reported not using condoms at all, 31% (54/176) reported using condoms for both VI and AI; few reported using condoms for VI only (9%;15/176) or AI only (9%; 16/176). Among the 93% of women reporting on ejaculation by site, 36% (61/168) reported their partner ejaculating in both orifices, 30% (50/168) reported ejaculation in the vagina alone, 9% (15/168) reported ejaculation exclusively in the rectum, and 25% (42/168) reported there was no ejaculation in either orifice. Because ejaculation in a condom may have been interpreted as no ejaculation, reports by condom use were analyzed. Equal proportions reported ejaculation in both orifices by condom use (37% (29/78) of those who reported condom use for VI or AI and 36% (32/90) of those reporting NO condom use). Among those not using condoms, fewer reported ejaculation during AI than VI (46% (49/106) versus 71% (77/108) respectively, $p=0.0002$). Finally, among those reporting there was no ejaculation, more were condom users for AI and VI than no condom users (36% (28/78) versus 16% (14/91), respectively chi-square p -value=0.01) indicating if condoms are used there is less ejaculation in either orifice.

Condom use by orifice of insertion at the last AI event varied by the participant's and their partner's HIV status (chi-square p -value=0.003) (Figure 1). Among HIV-positive women, more women reported using condoms for both VI and AI than for neither AI nor VI and there was no difference by partner sero-status. However, partner sero-status changed condom use patterns for HIV negative women; condoms for both VI and AI were reported

¹Reasons for not having AI in the past year reported by <10%: 'my partner does not want to have AI again', 'my current partner does not want to have AI', 'I do not want to have AI with my current partner', 'I have a physical problem or pain in my butt, I was forced to have AI and do not choose to have AI again, and I am worried about getting infected with HIV'.

more with serodiscordant than seroconcordant partners (29% (2/7) vs. 19% (13/70) respectively). No condom use was reported by more HIV negative women with seroconcordant than serodiscordant partners (67% (47/70) vs. 43% (3/7), respectively). Condom use by orifice of insertion also varied by partner type; women who last had AI with a non-main partner were more likely to have used a condom for both VI and AI (45%), while more than half the women (57%) who last had AI with a main partner reported no condom use (Fisher's exact p-value = 0.03).

In the multinomial logistic regression model for condom use by orifice of insertion at last AI (with condom use for both AI and VI as reference) the odds of no condom use were lower among older women (units=5 years) (adjusted odds ratio [AOR]=0.76, 95% confidence interval [CI]: 0.60, 0.96), women with serodiscordant partners (AOR=0.22, 95% CI: 0.08, 0.61), and HIV-positive women with seroconcordant partners (AOR = 0.15; 95% CI: 0.04, 0.54) (Table 3). There were no significant predictors of using condoms for VI only or AI only compared to using a condom for both VI and AI. Models were all adjusted for age, race, substance use at last AI, partner type at last AI, and partnership sero-concordance status at last AI.

Discussion

To our knowledge this is the first study to examine the order of orifice insertion, condom use, and ejaculation location among women who report VI and AI within the same sexual encounter. In these urban US settings, when having AI most women also engage in VI, with AI usually occurring after VI. This has implications for the potential acquisition of bacterial and viral infections in multiple orifices during a single sexual encounter as well as the transmission of bacteria and viruses inhabiting the vagina to the anus via a penis, which may be facilitated by vaginal and penile fluids as well as commercial lubricants. We reported previously that among women reporting recent AI, 44% with rectal *Neisseria gonorrhoea* (GC) or rectal *Chlamydia trachomatis* (CT) also had a urogenital GC/CT infection compared to only 6.7% of men with a rectal GC/CT infection who also had a urethral infection²³ demonstrating infection with multiple STIs in multiple orifices are much more common among women than men. In another study of women reporting recent AI in 12 Los Angeles STD clinics, we also found extremely high rates of both vaginal and rectal infection with CT and/or GC than infection in any single site.²⁴ Owing to the sensitivity of nucleic acid amplification testing, it is possible that positive rectal specimen in these studies were not true rectal infections but rather were caused by cross contamination with urogenital CT or GC. However, our findings from the present study suggest that actual infection in both orifices may be more likely due to way heterosexual AI is practiced because women who report AI also report VI with the same partner during the same sexual encounter. These findings highlight the importance of studying the role of multiple orifice exposure in prevention and control of HIV as well as other STIs.

Although more women reported ejaculation in the vagina (66%) than in the rectum (45%), the condom use pattern was different perhaps because ejaculating into condoms meant less ejaculation in the orifice. Our finding in Table 2 that approximately equal numbers of women reported condom use during VI or AI is inconsistent with reports from previous

studies suggesting that condom use is higher during VI than AI within heterosexual partnerships;^{13,14} however, those studies did not consider the practice of VI and AI during the same sexual encounter. Further, there was little evidence within our sample of women using condoms in one orifice and not the other as most women used condoms for both VI and AI or neither and few other studies ask about condom use for VI and AI in the same sexual encounter. We must recognize condom use is motivated by more than the prevention of HIV; women may be concerned with the prevention of pregnancy, or the presence of fecal matter on the condom or penis following AI perhaps resulting in different patterns of condom use. Our findings of extremely high frequency of multiple orifice exposure among women at their last AI event and the fact that most women either used condoms for both orifices or not at all, support multi-compartment thinking for anti-HIV microbicides for the many women who practice AI.

Although not presented above, women who reported more sexual encounters in the past month were more likely to report condom use for AI only than for both VI and AI. These findings suggest that higher risk or more sexually experienced women may be aware of the greater risk of HIV infection during AI, and thus choose to use condoms during this higher risk sexual act only. These may also be “higher risk women” who have higher risk partners, even commercial partners, who use condoms in sexual events with greater likelihood of exposure. Because only a small proportion of women reported condom use during AI only, additional research is needed to evaluate this association. Because of challenges by potential issues in temporality we could not model the effect of sexual frequency on condom use because the number of sexual encounters were reported for the past month but participants’ last AI event could have occurred at any time within the past year.

HIV-negative women with seroconcordant partners reported lower condom use than those of any woman with a serodiscordant partner or HIV-positive women with seroconcordant partners. We suggest these HIV positive women may be using condoms for pregnancy prevention and more concerned about this than HIV negative women. It also suggests that once HIV is involved condom use is more likely than for those who only confront the potential of exposure to HIV or to STIs.

This study should be viewed in light of several limitations. First, participants were not randomly selected from all women who practice AI in Los Angeles and Baltimore, and thus our findings may not be generalizable to all AI practicing women even though it captured a highly diverse sample in terms of age and race/ethnicity. Moreover, the frequency of AI reported is specific to women who have had relatively “recent” (in past year) AI and intentionally included half HIV positive and half HIV negative women. Second, participants may have under-reported sexual risk behaviors due to the sensitive nature of this information or misunderstood the questions due to their complexity. However, this misreporting may have been minimal because CASIs were utilized for data collection and have been shown to improve the accuracy and completeness of reporting on sensitive information compared to face-to-face interviews.^{25,26} Third and finally, we cannot be certain of the accuracy of AI partners’ reported HIV status as partners were not HIV tested as part of this study and there was missing data (about one quarter of HIV negative women did not provide partner HIV status). Even with these limitations this study collected uniquely detailed epidemiologic data

regarding the practice of AI among US women in two cities that can be used to advance interpretation and research in the field of HIV prevention and can serve as a model to offer suggestions for data to be collected in other populations and regions.

Although there is growing recognition of the importance of developing multi-compartment products (MCPs) for HIV prevention among women, the process of their development will not be simple. Different formulations for each orifice may be required; participants in a recent Phase I clinical trial (RMP-02/MTN-006) reported increased adverse events and decreased acceptability of a rectally applied vaginal microbicide (1% tenofovir gel) compared to HEC placebo²⁷. Yet there is solid progress in the direction of developing MCPs as the safety of different formulations of vaginal microbicides in the rectum are now being evaluated²⁸. Given the availability of multiple orifices for sexual intercourse among women and the prevalence of penetration in both the vagina and rectum at the last AI event within our sample, effective microbicides formulated for use during both VI and AI may dramatically reduce HIV infection rates among heterosexual women who practice AI. Therefore, our findings coupled with previous epidemiologic data on the frequency of STI in multiple orifices among women having AI provide compelling evidence of a need for multi-compartment prevention methods, which could also benefit women who only engage in AI within a single sexual encounter.

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Figure 1.

Condom use by orifice of insertion and partnership serostatus at the last AI event.

Table 1

Characteristics of female study participants and their last anal intercourse event by HIV status.

Characteristic	HIV-negative (N=105)		HIV-positive (N=75)		Total (N=180)		p-value ~
	n	%	n	%	n	%	
Study Site							0.05
Los Angeles	46	43.8	44	58.7	90	50.0	
Baltimore	59	56.2	31	41.3	90	50.0	
Mean age (years)	36.2	SD=10.7	40.0	SD=8.9	37.8	SD=10.1	0.01
Age (years)							0.02
<30	34	32.4	11	14.7	45	25.0	
30-39	33	31.4	22	29.3	55	30.6	
40-49	28	26.7	32	42.7	60	33.3	
50	10	9.5	10	13.3	20	11.1	
Race/Ethnicity							0.55
Hispanic	13	12.9	15	20.3	28	16.0	
African American	60	59.4	42	56.8	102	58.3	
White	19	18.8	13	17.6	32	18.3	
Other	9	8.9	4	5.4	13	7.4	
Marital Status							0.03
Single	45	43.3	25	33.3	70	39.1	
Married/living together	40	38.5	22	29.3	62	34.6	
Separated/divorced	17	16.4	23	30.7	40	22.4	
Other	2	1.9	5	6.7	7	3.9	
Education							< 0.0001
< High School	18	17.5	28	38.4	46	26.1	
High School	30	29.1	26	35.6	56	31.8	
> High School	55	53.4	19	26.0	74	42.1	
Sexual intercourse (VI or AI) (past month)	86	85.1	64	88.9	150	86.7	0.48
Mean # male sex partners (past month)	1.3	SD=1.1	1.9	SD=2.4	1.6	SD=1.8	0.06
Mean # sex episodes (past month)	12.4	SD=41.5	8.4	SD=11.4	10.8	SD=32.7	0.45
AI with last AI partner (past month)	64	80.0	55	87.3	119	83.2	0.25
Mean # AI acts with last partner (past month)	4.2	SD=7.6	5.7	SD=9.7	4.9	SD=8.6	0.36
Last AI event							
Main partner	77	74.8	52	70.3	129	72.9	0.51
Partner serostatus							< 0.0001
HIV-negative	73	91.3	28	54.9	101	77.1	
HIV-positive	5	6.3	22	43.1	27	20.6	
HIV status unknown	2	2.5	1	2.0	3	2.3	
Any substance use**	16	15.5	14	18.9	30	17.0	0.55
Alcohol	34	34.7	33	47.8	67	40.1	0.09
Marijuana	17	16.5	11	14.9	28	15.8	0.84
Methamphetamine	5	4.9	3	4.0	8	4.5	1.00

Characteristic	HIV-negative (N=105)		HIV-positive (N=75)		Total (N=180)		p-value [~]
	n	%	n	%	n	%	
Ecstasy	2	1.9	0	0.0	2	1.1	0.51
Amyl nitrates (poppers)	1	1.0	1	1.3	2	1.1	1.00
Cocaine	9	8.7	9	12.0	18	10.1	0.62
Heroin	4	3.9	5	6.7	9	5.1	0.50
Vicodin	2	2.0	1	11.3	3	1.7	1.00
Valium	1	1.0	1	1.3	2	1.1	1.00
Mean time penis in rectum (minutes)	7.6	SD=7.0	10.4	SD=15.8	8.8	SD=11.5	0.13

AI = anal intercourse; VI = vaginal intercourse; SD = standard deviation.

Numbers may not sum to column totals due to missing data; percents may not sum to 100 due to rounding.

[†]Excluding alcohol and marijuana.

^{*}< 1% reported Acid, Mushrooms, Oxycontin, Gamma-hydroxybutyric acid (GHB), or Katamine.

[~]p-value from t-test, chi-square, or Fisher's exact test.

Table 2

Order of insertion, condom use, and ejaculation location among female participants who reported VI at their last AI event.

	N	%
Order of insertion (N=118)		
Vaginal prior to rectal	98	83.1
Vaginal or rectal ejaculation	67	75.3
Vaginal only	22	32.8
Any rectal ejaculation *	45	67.2
Rectal prior to vaginal	14	11.9
Vaginal or rectal ejaculation	11	78.6
Vaginal ejaculation only	8	72.7
Any rectal ejaculation *	3	27.3
Alternating AI and VI	6	5.1
Condom use (N=176)		
Neither VI nor AI	91	51.7
VI only	15	8.5
AI only	16	9.1
Both VI and AI	54	30.7
Ejaculation Location (N=168)		
Neither vagina nor rectum	42	25.0
Vagina only	50	29.8
Rectum only	15	8.9
Both vagina and rectum	61	36.3

AI = anal intercourse; VI = vaginal intercourse.

* Includes those who ejaculated during AI only and those who ejaculated during both VI and AI.

Table 3

Predictors of condom use by orifice of insertion identified using multinomial logistic regression among female participants who reported VI at their last AI event (N=124).

Condom Use	AOR	95% CI
<u>Neither VI nor AI</u>		
Age (units=5 years)	0.76	0.60, 0.96
African American	1.47	0.56, 3.87
Substance use at last AI [^]	1.76	0.45, 6.82
Main partner at last AI	2.01	0.67, 5.98
Partnership serostatus at last AI		
HIV-negative concordant	Ref	-
HIV-positive concordant	0.15	0.04, 0.54
Serodiscordant	0.22	0.08, 0.61
<u>VI only</u>		
Age (units=5 years)	0.83	0.58, 1.19
African American	2.35	0.48, 11.43
Substance use at last AI [^]	2.69	0.47, 15.27
Main partner at last AI	3.77	0.42, 34.28
Partnership serostatus at last AI		
HIV-negative concordant	Ref	-
HIV-positive concordant	0.54	0.09, 3.10
HIV serodiscordant	0.60	0.12, 3.01
<u>AI only</u>		
Age (units=5 years)	0.88	0.62, 1.24
African American	0.61	0.14, 2.66
Substance use at last AI [^]	0.91	0.09, 9.62
Main partner at last AI	0.73	0.16, 3.28
Partnership serostatus at last AI		
HIV-negative concordant	Ref	-
HIV-positive concordant	0.97	0.17, 5.64
Serodiscordant	0.51	0.10, 2.70

Reference group = women who used condoms for both VI & AI.

Abbreviations: A = anal intercourse; VI = vaginal intercourse; AOR = adjusted odds ratio; CI = confidence interval.

[^] Includes methamphetamine, ecstasy, amyl nitrates, ketamine, gamma-hydroxybutyric acid, cocaine, heroin, acid, mushrooms, oxycontin, vicodin, and valium.