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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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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 to 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. Including the 36% who ejaculated in both the rectum and vagina, 66% report any ejaculation in the vagina and 45% in the rectum. One-third used a condom for both VI and AI, <10% for VI only or AI only, and half used no condoms. After adjusting for race, partner type, and substance use, compared with women who used condoms 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 to 0.96], with serodiscordant partners (AOR = 0.22; 95% CI: 0.08 to 0.61), and HIV-positive with seroconcordant partners (AOR = 0.15; 95% CI: 0.04 to 0.54) were associated with not using condoms.

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 multicompartment HIV prevention strategy.

Key Words: anal intercourse, HIV transmission, sexual behavior

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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 subgroups at "high risk" for HIV acquisition in the US: from 16% of substance-using women[2] and 19%–22% of women attending public sexually transmitted disease clinics reporting AI within the past 3 months[3,4] and as high as 5%–8% among female substance users in the past 30 days.[5] In South Africa, the prevalence of lifetime AI has been reported to be in excess of 40% among female sex workers[6] compared with only 5% among young women in the general population,[7] 10% of women in the past 3 months in community settings,[8] and in the past month by 11% of women surveyed in alcohol serving establishments[9]—again with higher prevalence for "high-risk groups." However, despite the well-established greater efficiency of HIV transmission through 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.[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 (ie, the Carraguard trial,[15] HPTN 035,[16] and VOICE[17]), the concern was raised that rectally acquired HIV may contribute significantly to HIV incidence among women and that method

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failure in these trials may have partially been because of 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 orifices.[19]

The factors that affect the choices women and their partners face during each sexual encounter, such as which orifices to use, in what order, and where to ejaculate, have been understudied. There is a clear evidence of the influence of behaviors, such as substance use[20] and having new partners or violence on AI.[21] There is evidence for women practicing more condom use during AI in the context of perceived risk (ie, sex with nonmain 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 for heterosexual HIV transmission, is also relevant. Condom use during AI may reduce exposure to ejaculate or the partners may ejaculate outside the anal orifice; however, 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 2 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 and in 2 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 (Craigslist), 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 examination; 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 were 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 through Western blot.

Study Procedures

Following written informed consent, participants completed computer-assisted self-interviews 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 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 Johns Hopkins University.

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, γ-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 whether 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 this 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 nonmain partner), 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, whereas 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% included: "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". 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 younger than 30 years (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. Most 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) and 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 before rectal, 12% (14/118) reported that all rectal insertion occurred before 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, and few reported

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**
Study site, n (%)				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, yr, mean (SD)	36.2 (10.7)	40.0 (8.9)	37.8 (10.1)	0.01
Age, yr, n (%)				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, n (%)				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, n (%)				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, n (%)				< 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 number of male sex partners (past month), mean (SD)	1.3 (1.1)	1.9 (2.4)	1.6 (1.8)	0.06
Mean number of sex episodes (past month), mean (SD)	12.4 (41.5)	8.4 (11.4)	10.8 (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), mean (SD)	4.2 (7.6)	5.7 (9.7)	4.9 (8.6)	0.36
Last AI event, n (%)				
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, n (%)†‡	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
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 (min), mean (SD)	7.6 (7.0)	10.4 (15.8)	8.8 (11.5)	0.13

Numbers may not sum to column totals because of missing data and percents may not sum to 100 because of rounding.

*P value from t test, χ^2, or Fisher exact test.

†<1% reported acid, mushrooms, oxycontin, γ-hydroxybutyric acid, or katamine.

‡Excluding alcohol and marijuana.

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 before rectal	98 (83.1)
Vaginal or rectal ejaculation	67 (75.3)
Vaginal only	22 (32.8)
Any rectal ejaculation*	45 (67.2)
Rectal before 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)

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

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). Fewer reported ejaculation during AI than VI [46% (49/106) versus 71% (77/108) respectively, $P = 0.0002$] among those reporting no condom use during AI and VI, respectively. Finally, more women reported no ejaculation in either orifice among those who used condoms during either AI or VI than those who did not use condoms at all [36% (28/78) versus 16% (14/90), respectively, χ^2 $P = 0.01$]; indicating that 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 (χ^2 test $P = 0.003$) (Fig. 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 serostatus. However, partner serostatus changed condom use patterns for HIV-negative women; condoms for both VI and AI were reported 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 nonmain partner were more likely to have used a condom for both VI and AI (45%), whereas more than half the women (57%) who last had AI with a main partner reported no condom use (Fisher exact $P = 0.03$).

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 to 0.96], women with serodiscordant partners (AOR = 0.22; 95% CI: 0.08 to 0.61), and HIV-positive women with seroconcordant partners (AOR = 0.15; 95% CI: 0.04 to 0.54) (Table 3). There were no significant predictors of using condoms for VI only or AI only compared with 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 seroconcordance status at last AI.

DISCUSSION

To the best of 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 and the

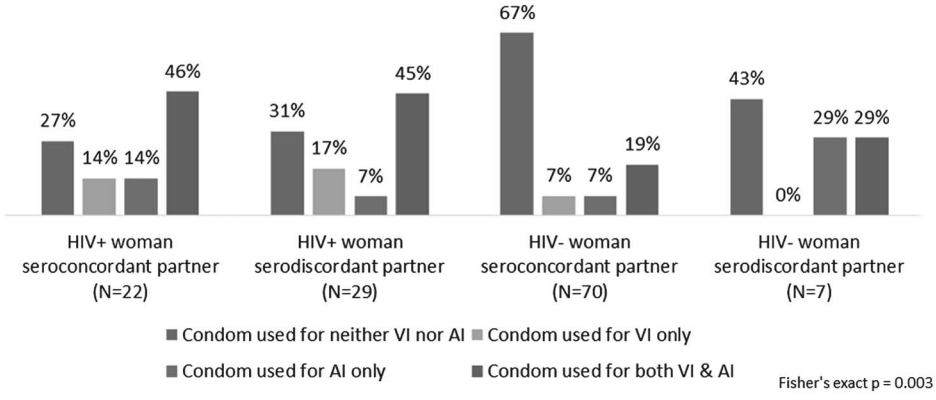

FIGURE 1. Condom use by orifice of insertion and partnership serostatus at the last AI event.

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

Reference group = women who used condoms for both VI and AI.
*Includes methamphetamine, ecstasy, amyl nitrates, ketamine, gamma-hydroxybutyric acid, cocaine, heroin, acid, mushrooms, oxycontin, vicodin, and valium.

transmission of bacteria and viruses inhabiting the vagina to the anus through 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 with only 6.7% of men with a rectal GC/CT infection who also had a urethral infection[23] demonstrating that infection with multiple STIs in multiple orifices is much more common among women than men. In another study of women reporting recent AI in 12 Los Angeles sexually transmitted disease clinics, we also found extremely higher 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 was not true rectal infections but rather was caused by cross contamination with urogenital CT or GC. However, our findings from this study suggest that actual infection in both orifices may be more likely because of the 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 and 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 number 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. Furthermore, there was little evidence within our sample of women using condoms in 1 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 that 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 after 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 multicompartment 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 was 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 that these HIV-positive women may be using condoms for pregnancy prevention and are 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 although 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 underreported sexual risk behaviors because of the sensitive nature of this information or misunderstood the questions because of their complexity. However, this misreporting may have been minimal because completed computer-assisted self-interviews were used for data collection and have been shown to improve the accuracy and completeness of reporting on sensitive information compared with 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 1 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 2 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 multicompartment products 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 with HEC placebo.[27] However, there is solid progress in the direction of developing multicompartment products as the safety of different formulations of vaginal microbicides in the rectum is now being evaluated.[28] 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 multicompartment prevention methods, which could also benefit women who only engage in AI within a single sexual encounter.

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