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HIV Transmission Risk Behavior in a Cohort of HIV-Infected Treatment-Naïve Men and Women in the United States

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Abstract

Antiretroviral therapy (ART) can minimize HIV transmission. Prevention benefits may be compromised by barriers to virologic suppression, and by increased condomless sex among those initiating ART. We evaluated condomless sex in a cohort of HIV-infected US individuals poised to initiate ART in a clinical trial. We assessed partner and sex act type, condom use, and perception of infectiousness. Six percent of participants reported as not infectious; men who have sex with men were more likely to perceive high infectivity. Prevalence of condomless sex was 44 %; 74 % of those also reported homosexual acquisition of HIV. Predictors of increased risk of condomless sex included greater numbers of lifetime partners, recent stimulant drug use and an HIV-positive or unknown serostatus partner. In the context of serodifferent partners, lower perception of infectiousness was also associated with a higher risk of condomless sex. Results highlight opportunities for prevention education for HIV infected individuals at ART initiation.

Keywords

Condom use; HIV transmission; ART-naïve; Behavior

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Introduction

The HIV epidemic in the United States is characterized by 1.1 million individuals living with HIV [1], including 47,500 new HIV infections in 2010 [2]. Approximately 90 % of HIV infections in the US are transmitted via sexual activity [3].

Antiretroviral therapy (ART)-treated individuals with HIV demonstrate reduced infectiousness to sexual partners compared to those not on ART [4, 5]. Mathematical models have suggested that if HIV diagnosis, care linkage, ART treatment, and virologic suppression were maximized, the global HIV epidemic could be extinguished [6]. Numerous psychosocial, socioeconomic, and structural barriers prevent realization of each step of this care and treatment cascade [7, 8].

Transmission-risk behavior (TRB), overwhelmingly condomless sex, may compromise the protective effect of ART via “risk compensation”—whereby the use of a strategy perceived to confer protection against HIV transmission (or acquisition) leads to an increase in risky behavior. Whether or not biomedical HIV prevention strategies lead to increased TRB is a frequently mentioned concern when scale-up of such interventions is discussed.

In order to optimally understand changes in TRB after initiation of ART, it is critical to rigorously describe TRB at the inception of ART. TRB has been assessed by others using a variety of measures, including counts of sexual partners and proportion of sex acts that are non-condom protected. Conflicting results from clinical trials of biomedical prevention strategies characterize the available literature. With regard to the effect of these interventions on TRB, the majority of studies on pre-exposure prophylaxis, post-exposure prophylaxis, and vaccines show no evidence of risk compensation; some evidence from the male circumcision, vaccine, and ART literature suggests the possibility of increased TRB accompanying such interventions [9–16]. A US-based cohort of HIV-infected women suggested fewer sexual partners after initiation of first-time ART, but also less condom use [17]. In international settings, findings have been more consistent, with the vast majority of cohorts demonstrating absence of increased TRB after ART initiation; [18–25] a single study demonstrating increased risk behavior post-ART initiation may be confounded by the improved general health status associated with ART treatment [26].

TRB, specifically condomless sex, was examined as part of a randomized, open-label trial of three ART regimens for treatment-naïve individuals [AIDS Clinical Trials Group (ACTG) A5257]. The objectives of this cross sectional baseline analysis of the A5257 study data are to describe the prevalence of self-reported condomless sex in this contemporary, ART-naïve, HIV-infected US-based population immediately prior to ART initiation. We also investigated risk factors associated with condomless sex with a specific focus on whether there was evidence of serosorting and self-reported perception of infectiousness with the goal of identifying education opportunities for HIV prevention at the point of first ART initiation.

Methods

ACTG A5257 was a phase III, prospective, randomized, open-label trial conducted at 57 ACTG and the International Maternal Pediatric Adolescent AIDS Clinical Trials Group

(IMPAACT) clinical research sites in the U.S. and Puerto Rico. Enrollment occurred between May, 2009 and June, 2011. Eligible participants were ART-naïve men and women >18 years with documented HIV-1 RNA level >1000 copies/ml who had no evidence of any major nucleoside reverse transcriptase inhibitor (NRTI) or protease inhibitor (PI)-resistance associated mutations. Participants were randomized 1:1:1 to receive one of three ART regimens of tenofovir/emtricitabine (TDF/FTC) plus raltegravir (RAL), atazanavir/ritonavir (ATV/R), or darunavir/ritonavir (DRV/R). The primary study methods and results have been previously presented [27].

Sexual behaviors over the prior month were captured at study entry and annually during study follow-up by self-report through a paper-based questionnaire. The behavioral questionnaire was adapted from sexual behavior questionnaires used in previous ACTG and other National Institutes of Health Division of AIDS (NIH DAIDS) clinical trials network studies with input from site investigators (Supplementary material). Completed questionnaires were mailed to the data center for keying in a sealed envelope without oversight or review. In the event of literacy issues, or by participant request, assistance with completion of the questionnaire by site staff was permitted. The current analysis reflects questionnaires from the study entry visit only.

The questionnaire was divided into sections for primary and non-primary sexual partners. Participants were asked about the HIV serostatus of partners in the past month and the number and type of protected and unprotected sex acts with these partners. Questions regarding sex acts did not include oral sex. Additional questions included number of lifetime partners, sexual partner preference, and perception of infectiousness (the perceived likelihood of infecting a partner if practicing condomless sex). Questions requiring a specific number were left open-ended for participants to complete; questions relating to partner serostatus or perception of infectiousness included designated choices or a visual analog scale, respectively.

Statistical Analysis

The primary outcome of condomless sex was defined as at least one reported unprotected vaginal or anal receptive or insertive sex act in the past month. A secondary serosorted outcome was further stratified according to reported partner serostatus. Only expected responses based on the skip logic of the questionnaire were used in the endpoint definition. In the event of missing responses regarding type of sex act following a positive response indicating a given type of partner, data were imputed as follows: (a) in the event of no type of activity reported, all outcomes were assumed missing; (b) in the event of at least one type of activity reported, any missing response for the remaining types of sex acts were imputed as zero; (c) responses regarding insertive anal activity were set to missing for all females. Participants not completing the questionnaire were excluded from all analyses given no evaluable data.

The prevalence of condomless sex during the month prior to ART initiation was estimated among participants reporting any evaluable sexual activity (including those reporting no sex) as well as restricted only to those reporting sexual activity; 95 % confidence intervals (CIs) were obtained via the Wald interval from the binomial distribution.

Risk factors associated with condomless sex were evaluated only among participants reporting sexual activity in the past month. To provide a relative risk interpretation, analyses used log binomial regression—a simple log linear model with Poisson error distribution for our binary outcome. Parameter estimation used generalized estimating equations (GEE) with an independent working correlation matrix to account for misspecification of the binomial error distribution [28] as well as dependency between multiple observations within individuals (serosorting analysis only). Risk factors for condomless sex of interest were identified a priori as defined in Table 1. Risk factors with moderate evidence of an association ($p \leq 0.20$) in univariate analyses were included in multivariable modeling with some exclusions for collinearity. Interpretations of the estimated relative risk (RR) ratios (95 % CIs) from the final adjusted models were guided by the consistency, trend and magnitude of the observed effects sizes in conjunction with the level of statistical evidence. Effect modification (interaction) by race/ethnicity, sex and partner serostatus was also assessed sequentially for all selected covariates. All analyses used SAS software v9.4 (SAS Institute Inc., Cary, NC).

Results

The ACTG A5257 population included 1810 HIV-infected treatment naïve enrolled participants. Overall, 34 % of the participants were non-Hispanic white, 42 % were non-Hispanic black, and 22 % were Hispanic. Women comprised 24 % of the population. Median (Q1–Q3) plasma viral load was 4.62 (4.14–5.12) log₁₀ copies/mL. Approximately 31 % of the population had a baseline HIV-1 RNA level $\leq 100,000$ copies/mL. Approximately half (49 %) of participants were diagnosed within the past year with most (90 %) reporting sexual contact as the most likely mode of transmission; the majority of participants (97 %) were aware of their HIV diagnosis for the full 1 month time horizon encompassed by our baseline behavioral questionnaire. Proportions of participants reporting alcohol and substance use in the past month are noted in Table 2. For the purposes of this analysis, we considered MSM to be men reporting any male partners; men who had sex exclusively with women were considered separately. Participants not reporting a sexual partner preference at study entry were excluded.

Reported Sexual Partners and Perception of Infectiousness

The baseline sexual behavior questionnaire was completed (at least partially) by 1707 (94 %) participants; numbers of respondents by question are provided in Table 2. Among those responding, 19 % reported 5 or fewer lifetime partners, 37 % reported 6–20, 22 % reported 21–50, and 23 % reported more than 50. Among responders, 33 % reported no partners in the past month, 47 % reported one partner and 20 % reported more than one partner; 42 % reported a primary partner only, 15 % reported non-primary partners only, and 10 % reported both primary and non-primary partners. There were notable differences in these distributions by sex and reported partner preference (Table 2).

On a linear analog scale, the median perception of infectiousness was 78 (Q1–Q3 50–100). Based on our predefined categorization, 59 % considered themselves highly infectious, 26 % moderately infectious, and 9 % minimally infectious (highest, middle, and lowest thirds of

the scale); 6 % considered themselves not infectious (providing a rating of 0 on a 0–100 scale) (Table 2). Of note, women were more likely to consider themselves as not infectious compared to men (11 vs 4 %); non-Hispanic blacks had the greatest proportions reporting as minimally or not infectious (58 and 50 %, respectively, among responders in these categories). Further evaluation of the perception of infectiousness by race/ethnicity and baseline HIV-1 RNA level revealed marked differences by race/ethnicity particularly among women (Fig. 1). While 65 and 75 % of non-Hispanic black and Hispanic MSM with higher baseline viral loads (>100,000 copies/ml) perceived themselves as highly infectious, only 47 and 43 % of their female counterparts reported the same perception of infectiousness. Similar differences were also apparent between Hispanic MSM versus Hispanic women with lower baseline viral loads (<100,000 copies/ml) reporting a high perception; 61 vs. 44 %, respectively.

Interestingly, participants reporting at least a college education or the highest income category (>\$50,000) were more likely to report higher levels of perception of infectiousness. Perception of high infectiousness was also more commonly reported among those whose likely mode of HIV acquisition was homosexual intercourse compared to heterosexual intercourse (61 vs. 30 %, $p = 0.003$).

Population Reporting Condomless Sex

Among the 1438 with an evaluable outcome, the prevalence of condomless sex was 19 % (17, 21 %) (Fig. 2). Among those reporting sexual activity in the past month ($n = 637$), the prevalence of condomless sex was 44 % (40, 47 %).

Participants reporting condomless sex were more likely to be MSM ($p < 0.001$), to have a non-primary partner ($p = 0.04$), a greater number of lifetime partners ($p < 0.001$) and a greater number of partners in the past month ($p < 0.001$, Table 2). When accounting for partner serostatus, 63 % of sex acts with HIV-positive partners were non-condom protected, compared to 25 and 41 % of acts reported with HIV-negative or unknown serostatus partners, respectively (Table 2).

Interestingly, among 105 participants reporting multiple partners of differing serostatuses, 66 (63 %) of these indicated at least one unprotected sex act.

Predictors of Condomless Sex

Risk factors in the univariate analyses demonstrating moderate evidence of association with condomless sex included younger age, race/ethnicity, mode of HIV transmission, perception of infectiousness, stimulant drug use, type and number of partners in the past month, total number of lifetime partners and sexual partner preference. Evidence of collinearity was apparent between sexual partner preference, mode of transmission, and number of partners in the past month hence only sexual partner preference was retained in further models.

In adjusted analysis of risk factors associated with condomless sex (regardless of partner serostatus), a higher risk of condomless sex was associated with greater number of reported lifetime partners ($p = 0.018$) and recent stimulant drug use relative to participants reporting no drug use ($p = 0.031$). There was also evidence of a higher risk of condomless sex among

those participants reporting low or medium perception of infectiousness relative to those with a high perception ($p = 0.07$, Fig. 3).

The risk of condomless sex was lower for MSW compared to MSM (RR = 0.42, 95 % CI (0.22, 0.79); $p = 0.007$) and among those identifying as Hispanic race compared to those identifying as non-Hispanic white (RR = 0.67, 95 % CI (0.48, 0.92); $p = 0.014$). Relative to the lowest age group, no consistent trend was evident with increasing age and risk of condomless sex ($p = 0.12$), and there was no difference in the risk of condomless sex for women compared to MSM (RR = 1.07, 95 % CI (0.80, 1.42); $p = 0.67$).

When adjusting for the effect of partner serostatus, the associations previously highlighted with the risk of condomless sex remained consistent but were attenuated (Fig. 4). Evidence of interaction between partner serostatus with self-reported perception of infectiousness was apparent ($p = 0.05$). Specifically, while the perception of infectiousness appeared to drive the risk of condomless sex in the setting of an HIV negative partner, this was not apparent in the setting of HIV-positive partners and partners of unknown serostatus.

This finding is illustrated via predicted absolute risk (95 % CI) of condomless sex for a subset of hypothetical individuals (Fig. 5). While the estimated risk of condomless sex with HIV-positive partners and with those of unknown serostatus is relatively consistent across all levels of perception of infectiousness, the estimated absolute risk of condomless sex with HIV-negative partners is markedly higher among participants perceiving themselves as low/non-infectious (range 0.39–0.69) compared to those participants perceiving themselves as medium or high perception of infectiousness (range 0.19–0.35, Fig. 5).

Sexual positioning with regards to partner serostatus was further examined among MSM participants reporting sexual activity in the past month (Table 3). Although small sample sizes precluded formal modeling of these data, observationally, differences in seropositioning behavior are apparent. Among MSM reporting sex acts with HIV negative or unknown serostatus partners, a greater proportion reported unprotected receptive acts compared to insertive acts (56 vs. 38 % and 50 vs. 41 %, respectively). In contrast, with HIV-positive partners, unprotected receptive and insertive experiences were reported in similar proportions (50 vs. 46 %).

Discussion

To adequately “set the stage” for evaluating whether risk compensation occurs in a domestic population of HIV infected participants following initiation of ART, we aimed to rigorously characterize the TRB of the population immediately prior to ART initiation. Associations with TRB pre-ART provide important insights into those most at risk for risk compensation upon ART initiation. To date, evaluation of risk compensation accompanying initiation of ART in HIV-infected individuals has been largely limited to stable heterosexual serodiscordant couples as part of HIV prevention studies [4, 29]. However, increasing rates of STIs, particularly syphilis among HIV-infected MSM suggest that sexual behaviors capable of transmitting HIV are prevalent among some populations of HIV-infected MSM.

In A5257, we examined an HIV-infected population on the cusp of ART initiation as part of a randomized initial treatment trial. At this time point immediately prior to ART initiation, of those reporting at least one sex act in the past month, 44 % reported some condomless sex; nearly three quarters of those whose HIV was likely acquired through MSM contact reported some condomless sex. Increased risks for condomless sex included higher numbers of total lifetime partners, recent stimulant drug use, lower perception of infectiousness and an HIV-positive or unknown serostatus partner. This is consistent with attributable risk data and national epidemiology showing that the largest burden of new HIV infections are among MSM, and a large portion of MSM risk behavior is associated with methamphetamine use [30, 31].

Condomless sex was less prevalent among men who reported sex only with women, and also among participants reporting Hispanic ethnicity, compared to non-Hispanic white participants. Future fertility goals did not appear to be associated with rates of condomless sex, for men or women—suggesting that procreation was not the (sole) motivator for condomless intercourse among heterosexual individuals—at least at the moment immediately prior to ART initiation.

Evidence of serosorting was also apparent in this HIV-infected population. We observed that while perception of infectiousness drove the risk of condomless sex in the setting of HIV-negative serostatus partner, a relatively high risk of condomless sex was evident with HIV-positive partners regardless of the perception of infectiousness; the risk of condomless sex in the setting of partners of unknown serostatus was intermediate. We also found that women were more likely to report a perception of low or non-infectiousness compared to men, despite similar baseline viral loads between men and women. This finding may reflect an accurate perception by women of receptive vaginal intercourse as lower risk for HIV-transmission from an HIV-infected woman to an HIV-uninfected man compared to transmission from an infected man to an uninfected woman. Adjusting for perception of infectiousness and partner serostatus left only a lower risk for MSM and a higher risk for recent stimulant users. Unpacking the finding of increased condomless sex with a reduced perception of infectiousness, we found that low/no perception of infectiousness tended to be disproportionately likely among participants reporting lower socioeconomic status and black race. These results suggest a potential opportunity for additional HIV transmission risk prevention education and interventions to remind populations that pre-ART initiation remains a high-risk scenario for transmission. Interestingly, our descriptive assessment of seropositioning suggested a lower prevalence of condomless insertive sexual activity compared to receptive activity with HIV-negative and unknown serostatus partners. Unfortunately small sample sizes precluded a more robust examination of this issue.

Estimations of predicted absolute risk of condomless sex across categories of number of lifetime sexual partners, race/ethnicity groups and perceptions of infectiousness for MSM are illustrative in defining groups most at-risk for reporting condomless sex at high levels (as high as almost 90 %). We used the models generated from analyses of A5257 data to describe a hypothetical cohort that informs the predicted absolute risks of condomless sex in a theoretical cohort of HIV-infected individuals. For example, for an HIV-positive 21 year old white MSM reporting a moderate number of lifetime sexual partners, who considers

himself of moderate infectiousness and has a history of stimulant drug use in the past month, the estimated absolute risk of reporting condomless sex in the past month was 90 %; in contrast, a similar individual without a history of stimulant drug use had an estimated risk of 71 % (Fig. 5). It is reassuring to note lower absolute risks of condomless sex with HIV-uninfected partners for this population as perception of infectiousness increased, with no assurance that their self-perception of infectiousness is, in fact, correct—this finding at the very least suggests appropriate concern for horizontal transmission of HIV to sexual partners.

We recognize the limitations inherent with self-reported data, including social desirability bias and misreported information, and particularly with the topics of sexual behavior and recreational drug use. The paper-based questionnaire (compared to a computer-aided questionnaire) also resulted in missing data from skip patterns and limited questionnaire responses. We addressed these issues through a pre-defined set of imputations and based interpretations and inferences on the consistency, trend and magnitude of the observed effects sizes in conjunction with the level of statistical evidence. The restriction of this analysis to participants reporting recent sexual activity prior to ART initiation also restricted our study population and question of interest and is not necessarily generalizable to those individuals who reported no recent sexual activity, or to behavior after ART has been initiated. There is evidence to suggest differences between these two groups with respect to baseline and sexual behavior characteristics; however, it is not possible to discern from this analysis—or from the data captured as part of the study—whether participants not reporting sexual activity are mindfully avoiding sexual activity, do not have an active partner during the period targeted on the questionnaire, prefer not to answer such questions, or a combination of these reasons or for another reason entirely. Additionally, this baseline cross-sectional analysis does not allow us to address the most pressing clinical and public health question: Is ART-initiation associated with changes in TRB over time? This longitudinal analysis is ongoing.

These results, however, indicate an opportunity for HIV-prevention at a moment in time when individuals are embarking on ART. Once such individuals become virologically suppressed on ART, their risk of ongoing secondary transmission is minimized. However, during the period prior to and around the time of ART initiation, behavior, and condomless sex in particular, will be the ultimate governor of HIV transmission. Understanding perception of risk and recreational stimulant use among pre- and early ART using individuals, particularly among MSM, creates an educational and interventional opportunity with the potential to reduce new HIV infections.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1. Perception of infectiousness by baseline viral load, sex and sexual partner preference and race/ethnicity among A5257 Study Participants at Study Entry

Fig. 2.
Prevalence of reported condomless sex at baseline among A5257 Study Participants

Fig. 3.

Adjusted relative risk ratios (95 % CI) for reported condomless sex at baseline (not accounting for partner serostatus)

Fig. 4. Adjusted relative risk ratios (95 % CI) for reported condomless sex at baseline (accounting for partner serostatus)

Fig. 5.

Estimates of predicted absolute risk of condomless sex with perception of infectiousness and partner serostatus among MSM 18–29 years of age and self-report of 21–50 sexual partners stratified by race and stimulant drug use. **a** No history of self-reported stimulant drug use. **b** Self-reported stimulant drug use in the past month. *Note* Error bars give 95 % confidence intervals. Due to small numbers, the “Asian/Other/More than one race” race/ethnicity group was excluded. Perception of infectiousness is defined as ‘Low or not infectious (NI)’, ‘medium’ or ‘high’ infectiousness perception; partner serostatus is defined as ‘HIV+’, ‘HIV–’, or ‘Unsure’ of partner serostatus

Table 1

Definition of model covariates

Characteristic	Covariate definition ^a
HIV disease status	
HIV-1 RNA	Categorized as <10,000; 10,000–99,999; 100,000–500,000; >500,000 copies/mL
Mode of transmission	Participant self-report for acquiring HIV infection. Categorized as homosexual contact; heterosexual contact; and non-sexual contact (transfusion; injectable drug use; occupational exposure; does not want to report; unknown; or other)
Risk behaviors	
Type of alcoholic drinker	Participant self-report of alcohol use over the past month. Categorized as abstainer (0 drinks); moderate drinker (average of 1 drink/day for women and two drinks/day for men); heavy drinker (average of >3 drinks/day for women and >4 drinks/day for men); binge drinker (any report of >4 drinks in 2 h for women OR >5 drinks in 2 h for men)
Stimulant drug use	Participant self-report of ever using amphetamines or cocaine. Categorized as never; within last month; and more than 1 month ago or longer
Fertility desires/desire to have children	Participant self-report of desire to have more children. Categorized as yes; no; and unsure
Perception of infectiousness	Participant self-report using a continuous visual analog scale from 0 (not at all infectious) to 100 (highly infectious) of how likely the participant would be to infect someone else with HIV had the participant had condomless sex with another individual. Categorized as not infectious (0); low infectiousness (1–33); medium infectiousness (34–66); and highly infectious (67–100)
Sexual partner characteristics	
Sexual partner preference	Participant self-report of type of sexual partner. Categorized as men who have sex with only men, mostly men, both men and women, and mostly women (MSM, any); men who have sex with women only (MSW); and women who have sex with men and/or women (WSM/W)
Type of sexual partner in the past month	Participant self-report of primary and non-primary partners. Categorized as primary partner only; non-primary partner only; primary and non-primary partners; and no partners
Total number of sexual partners in lifetime?	Participant self-report of number of individuals a participant had vaginal or anal sex with over lifetime. Categorized as <5 partners; 6–20 partners; 21–50 partners; and >50 partners
Number of partners in the past month?	Participant self-report of number of individuals a participant had vaginal or anal sex with in the past month. Categorized as no partners; one partner; and >one partner
Partner serostatus	Participant self-report of HIV status of sexual partner. Categorized as HIV-positive partner; HIV-negative partner; or unsure of partner HIV status

^a All characteristics were selected and defined a priori. Due to small sample size and modeling purposes, some categories were combined post hoc for analysis

Table 2

Population characteristics

	A5257 Population (N = 1810) ^{b,c}	Sex/reported sexual partner preference				Reported condomless sex in past month			
		Total (N = 1667) ^c	MSM (N = 1043)	MSW (N = 223)	WSM/W (N = 401)	Total (N = 637)	Yes (N = 278)	No (N = 359)	p ^d
Sex									
Male	1375 (76)	1,043 (100)	223 (100)	0 (0)	517 (81)	232 (83)	285 (79)	0.19*	
Female	435 (24)	0 (0)	0 (0)	401 (100)	120 (19)	46 (17)	74 (21)		
Age at study entry									
18–29	528 (29)	380 (36)	35 (16)	80 (20)	219 (34)	89 (32)	130 (36)	0.87**	
30–39	507 (28)	302 (29)	55 (25)	102 (25)	192 (30)	94 (34)	98 (27)		
40–49	510 (28)	265 (25)	67 (30)	137 (34)	170 (27)	80 (29)	90 (25)		
50 and above	265 (15)	96 (9)	66 (30)	82 (20)	56 (9)	15 (5)	41 (11)		
Race/ethnicity (self-reported)									
Non-Hispanic white	616 (34)	480 (46)	28 (13)	62 (15)	266 (42)	143 (51)	123 (34)	<0.001*	
Non-Hispanic black	757 (42)	335 (32)	125 (56)	242 (60)	232 (37)	91 (33)	141 (39)		
Hispanic	390 (22)	193 (19)	65 (29)	92 (23)	119 (19)	35 (13)	84 (24)		
Asian/more than one race	43 (2)	32 (3)	4 (2)	5 (1)	18 (3)	9 (3)	9 (3)		
Baseline HIV-1 RNA (copies/mL)									
<10,000	367 (20)	195 (19)	31 (14)	114 (28)	140 (22)	59 (21)	81 (23)	0.47**	
10,000–99,999	888 (49)	519 (50)	112 (50)	191 (48)	315 (49)	134 (48)	181 (50)		
100,000–500,000	426 (24)	388 (23)	63 (28)	71 (18)	149 (23)	73 (26)	76 (21)		
>500,000	129 (7)	117 (7)	17 (8)	25 (6)	33 (5)	12 (4)	21 (6)		
Homosexual contact	978 (57)	894 (90)	12 (6)	2 (1)	388 (65)	194 (74)	194 (58)	<0.001*	
Heterosexual contact	575 (33)	523 (33)	155 (72)	333 (89)	169 (28)	55 (21)	114 (34)		
Non-sexual contact/unknown	170 (10)	155 (10)	49 (23)	41 (11)	40 (7)	13 (5)	27 (8)		
Years since HIV-1 diagnosis									
<1	831 (49)	472 (48)	126 (59)	163 (44)	260 (44)	109 (42)	151 (45)	0.31*	
1–3	442 (26)	261 (26)	47 (22)	97 (26)	172 (29)	76 (29)	96 (29)		
3–5	182 (11)	113 (11)	14 (7)	44 (12)	74 (13)	29 (11)	45 (14)		
>5	255 (15)	143 (14)	28 (13)	68 (18)	86 (15)	45 (17)	41 (12)		
Perception of infectiousness									

	AS257 Population (N = 1810) ^{b,c}	Sex/reported sexual partner preference				Reported condomless sex in past month			p ^a
		Total (N = 1667) ^c	MSM (N = 1043)	MSW (N = 223)	WSM/W (N = 401)	Total (N = 637)	Yes (N = 278)	No (N = 359)	
Not infectious	91 (6)	32 (3)	16 (8)	39 (11)	19 (3)	6 (2)	13 (4)	0.07**	
Low	153 (10)	95 (10)	15 (8)	37 (10)	65 (11)	35 (13)	30 (9)		
Medium	420 (26)	259 (26)	52 (27)	103 (28)	193 (31)	93 (34)	100 (29)		
High	933 (58)	614 (61)	110 (57)	192 (52)	338 (55)	137 (51)	201 (58)		
Type of alcoholic drinker									
Abstainer	537 (33)	235 (24)	78 (38)	194 (51)	143 (24)	52 (20)	91 (27)	0.13*	
Moderate/heavy drinker	681 (41)	462 (47)	76 (37)	119 (31)	274 (46)	124 (48)	150 (45)		
Binge drinker	426 (26)	289 (29)	49 (24)	70 (18)	179 (30)	84 (32)	95 (28)		
Stimulant drug use									
Never used	1,072 (64)	605 (61)	148 (72)	270 (69)	377 (63)	144 (55)	233 (68)	<0.001*	
> 1 month ago	488 (29)	326 (33)	41 (20)	101 (26)	178 (30)	85 (33)	93 (27)		
Within last month	103 (6)	60 (6)	17 (8)	20 (5)	47 (8)	31 (12)	16 (5)		
Desire to have more children									
Yes/unsure	644 (39)	424 (43)	76 (36)	118 (30)	259 (43)	115 (44)	144 (42)	0.62*	
No desire	1005 (61)	553 (57)	134 (64)	269 (70)	342 (57)	145 (56)	197 (58)		
Sexual partner preference									
MSM (any)	1043 (63)	—	—	—	444 (71)	220 (80)	224 (63)	<0.001*	
MSW (only)	223 (13)	—	—	—	66 (10)	10 (4)	56 (16)		
WSM/W	401 (24)	—	—	—	119 (19)	46 (17)	73 (21)		
Total sex partners in lifetime									
5	248 (19)	69 (8)	40 (24)	130 (43)	72 (14)	23 (10)	49 (17)	<0.001**	
6–20	481 (37)	288 (35)	68 (40)	120 (40)	156 (29)	51 (21)	105 (36)		
21–50	282 (22)	212 (26)	31 (18)	36 (12)	140 (26)	65 (27)	75 (26)		
>50	299 (23)	250 (31)	29 (17)	17 (6)	163 (31)	100 (42)	63 (22)		
Number of partners in the last month									
No partners	482 (33)	281 (31)	65 (36)	125 (39)					
1	678 (47)	387 (43)	97 (53)	176 (54)	415 (65)	161 (58)	254 (71)	<0.001*	
> 1	286 (20)	239 (26)	20 (11)	23 (7)	222 (35)	117 (42)	105 (29)		
Type of sexual partner in the past month									

	A5257 Population (N = 1810) ^{b,c}	Sex/reported sexual partner preference			Reported condomless sex in past month			<i>p</i> ^a
		Total (N = 1667) ^c	MSM (N = 1043)	MSW (N = 223)	WSM/W (N = 401)	Total (N = 637)	Yes (N = 278)	No (N = 359)
Primary only	611 (42)	333 (37)	93 (51)	170 (52)	372 (58)	147 (53)	225 (63)	0.043*
Non-primary only	215 (15)	185 (20)	13 (7)	11 (3)	148 (23)	72 (26)	76 (21)	
Primary and non-primary	141 (10)	109 (12)	12 (7)	19 (6)	117 (18)	59 (21)	58 (16)	
Sex acts^d								
		(N = 767)			(N = 338)			(N = 429)
Partner serostatus ^d								
HIV +	-	-	-	-	327	205 (63)		122 (37)
HIV -	-	-	-	-	292	72 (25)		220 (75)
Unsure/don't know	-	-	-	-	148	61 (41)		87 (59)

Data are number (%) of patients; MSM, men who have sex with men; MSW, men who have sex with women only; WSM/W, women who have sex with men or women

^aOverall p value used *Chi square and **Wilcoxon rank sum tests

^bOf the 1810 participants, 4 did not report race/ethnicity, 87 did not report mode of transmission, 100 did not report years since HIV-1 diagnosis, 213 did not report perception of infectiousness, 166 did not report alcohol use, 146 did not report illicit drug use, 147 did not report stimulant use, 161 did not report desire for more kids, 500 did not report number of sex partners in lifetime, 364 did not report type of sexual partner, and 364 did not report number of partners in last month

^cOf the 1810 participants, 143 participants did not report sexual partner preference

^dParticipants were able to contribute more than one response (total N = 637); total N reflects number of sex acts by partner serostatus

Table 3

Reported condomless sexual activity in the last month according to partner serostatus and positioning among MSM

Positioning	HIV-positive		HIV-negative		Unsure of status		
	0	1	Total	0	1	0	Total
Number of condomless sex acts by partner serostatus (percent)							
Vaginal	10 (8 %)	11 (4 %)	21 (6 %)	20 (10 %)	5 (6 %)	4 (4 %)	25 (9 %)
Receptive anal	51 (43 %)	123 (50 %)	174 (48 %)	113 (54 %)	45 (56 %)	48 (52 %)	158 (54 %)
Insertive anal	57 (48 %)	113 (46 %)	170 (47 %)	77 (37 %)	31 (38 %)	40 (43 %)	108 (37 %)

Outcomes were restricted to MSM who reported sexual activity in the last month

Total column reflects number of MSM reporting sexual acts for the given positioning and partner serostatus combination; participants were able to contribute up to nine possible positioning and partner serostatus combinations

MSM, men who have sex with men