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Sexual risk behaviors among HIV-infected South Indian couples in the HAART era: implications for reproductive health and HIV care delivery

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Abstract

The current study examines sexual behaviors among HIV-infected Indians in primary care, where access to highly active antiretroviral therapy (HAART) has recently increased. Between January to April 2008, we assessed the sexual behaviors of 247 HIV-infected South Indians in care. Multivariable logistic regression models were used to determine predictors of being in a HIV-seroconcordant primary relationship, being sexually active, and reporting unprotected sex. Over three-fourths (80%) of participants were HAART-experienced. Among the 58% of participants who were currently in a seroconcordant relationship, one-third were serodiscordant when first tested for HIV. **Approximately two-thirds** (63.2%) of participants were sexually active; 9.0% reported unprotected sex. In the multivariable analyses, participants who were in a seroconcordant primary relationship were more likely to have children, use alcohol, report unprotected sex, and have been enrolled in care for >12 months. **Sexually active participants** were more likely to be on HAART, have a prior tuberculosis diagnosis, test *Herpes simplex* type 2 antibody seropositive, and have low general health perceptions. Participants who reported unprotected sex were more likely to be in a seroconcordant relationship, be childless, want to have a child, and use alcohol. We did not document an association between HAART and unprotected sex. Among HIV-infected Indians in primary care, predictors of unprotected sex included alcohol use and desire for children. Prevention interventions for Indian couples should integrate reproductive health and alcohol use counseling at entry into care.

Keywords

HIV; AIDS; sexual behavior; HAART; India

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INTRODUCTION

In both the developed and developing world, increased access to highly active antiretroviral therapy (HAART) has extended life and reduced morbidity and mortality (Kumarasamy 2005; Palella 1998), and has enabled HIV-infected individuals to resume behaviors, including sexual activity (Crepaz 2004; 2006). As HAART significantly reduces plasma HIV RNA levels and improves physical health, HIV-infected individuals may engage in unsafe sex (Dukers 2001; Kelly 1998; Ostrow 2002; Stolte 2004). However, increased access to care via HIV prevention counseling and receiving HAART could also encourage decreases in sexual risk behaviors. Data from the developed world has suggested that HAART initiation is not necessarily associated with increased sexual risk taking behaviors (Crepaz 2004).

The effect of HAART on sexual behavior may differ in resource-constrained settings due to difficulties accessing clinical care, differences in cultural and gender norms, and less familiarity with treatment benefits (Fisher 2009). In India, condom use remains relatively low and serostatus disclosure is uncommon (Solomon 2004). In traditional societies such as India in which the overwhelming majority of the adult population is married and the social pressure for married couples to procreate is great, unprotected sex within marriage may be linked to broader fertility concerns (Bhattacharya 2004; Visaria 1999). Despite the increasing availability of generic HAART in India through the government National AIDS Control Program (NACO 2006), the impact of treatment on preventing secondary transmission remains to be fully elucidated. An increase in unprotected sex following the introduction of HAART could have unintentional consequences on the future spread of the HIV/AIDS epidemic if not appropriately addressed via prevention interventions for HIV-infected individuals (Solomon 2005). Limited data from Sub-Saharan Africa has suggested that HAART is not associated with an increase in sexual risk taking behavior, (Bateganya 2005; Bunnell 2006; Kennedy 2007; Moatti 2003; Sarna 2008) but has not been fully explored in India, the home of the largest population of people living with HIV outside of Africa (United Nations 2008).

The current study examines socio-demographic, behavioral, and clinical factors associated with being sexually active and engaging in unprotected sex among HIV-infected South Indians in clinical care. We also examine differences between HIV-concordant relative to serodiscordant primary relationships.

METHODS

Setting and study population

Between January and April 2008, 247 HIV-infected patients receiving outpatient HIV clinical and preventive care at YRG Center for AIDS Research and Education (YRGCARE), a large community-based HIV care facility in Chennai, India were enrolled in this study. All participants were HIV-infected, ≥ 18 years of age, and had been enrolled in care there for ≥ 6 months. Participants who had initiated HAART had to have been on therapy for ≥ 3 months. The study sample was selected to match the larger population of patients receiving HIV clinical care at YRGCARE based on gender, age, enrollment CD4 cell count, and HAART status.

Services at YRG CARE include integrated medical services for the treatment of HIV and related illnesses, prevention programs, and nutrition counseling. YRGCARE has clinical protocols for HIV treatment, which are consistent with World Health Organization (WHO) treatment guidelines (World Health Organization 2006). Patients are seen every 3–6 months or as clinically indicated, and undergo laboratory monitoring every 3–6 months. Standard of

care at YRGCARE also includes voluntary counseling and testing (VCT) program of partners of HIV-infected individuals receiving care (Solomon 2006), in which patients testing for HIV undergo pre- and post-test counseling. As part of this VCT program, couples are counseled together about sexually transmitted infections (STI) and risk reduction strategies. Patients and their partners are provided with free condoms at each clinic visit. Patients are strongly encouraged to disclose their HIV status to their sex partners at enrollment to care and to attend clinic visits with their primary partner. Uninfected primary partners are assessed for their HIV status at follow-up visits, which occurs every 3–6 months.

Data was collected under the approval of the Institutional Review Boards (IRBs) at YRGCARE, Brown University, and the Miriam Hospital.

Survey assessment of socio-demographic and behavioral data

After identification and consent, participants completed a structured interviewer-administered survey. The survey was delivered in either Tamil or English; the Tamil survey was translated from the original English version and then back-translated into English to ensure consistency between the two versions. The survey was originally piloted among twenty participants (data not included), after which the survey was revised to ensure relevance for the local cultural context through feedback from pilot participants and study staff. Multiple variables that assessed the same parameters of sexual risk behaviors were asked throughout the survey to determine the accuracy of self-reported data. Study staff underwent training sessions that involved rehearsing the survey questions, training in non-judgmental survey delivery, and instruction in prevention counseling..

Participant demographics included age, sex, residential status (urban vs rural), education, employment, marital status, cohabitation status, number of children, and migrant worker (defined as whether one travels regularly for employment or is a truck driver). Fertility intent was defined as whether the participant was interested in having a child. Alcohol use, as drinking frequency over the past month, was measured with a frequency scale (Babor 2001). General health perceptions were measured by asking participants “How do you feel about your current health?” to indicate their overall health using a percentage scale from 0 (worst) to 100 (best)(AIDS Clinical Trials Group (ACTG) 2004). An overall general health perceptions score, ranging from 0 to 100, was divided into low and high categories based on the distribution of individual scores.

In terms of partner HIV infection status, an HIV-concordant relationship was defined as both the participant and his/her primary partner had tested positive for HIV infection, and a discordant relationship was defined as the primary partner of the participant had tested or had been reported to be HIV-negative up to the study date. Sexual behavior over the past 3 months was assessed by inquiring about frequency of sex (regardless of the number of partners) and frequency of condom use for each sex act. Among sexually active participants who did not use condoms, we asked further questions about type of sex acts for which condoms were not used with primary and non-primary sex partners. “Sexually active” was defined as having engaged in anal or vaginal sex either with a primary or non-primary partner in the past 3 months. Among those participants who were sexually active, “unprotected sex” was defined as having engaged in at least one act of sex without a condom with a primary or non-primary partner in the past 3 months, which is in accordance with indicators used in other studies (Bunnell 2006; Moatti 2003).

Clinical and laboratory assessments via medical record review

Medical record reviews were also conducted to confirm HAART history and to obtain relevant clinical data, including CD4 cell count at time of enrollment to care and at the time of the survey (measurement within 6 months of survey date) and STI and opportunistic infections diagnoses, which was a part of the YRG CARE Chennai HIV Natural History Study Observational Database (Cecelia 2006). This database collects information on demographics, including probable route of HIV infection and date of HIV diagnosis; clinical status, including data related to opportunistic infections, current treatment regimens, and adverse events; and laboratory data. The medical record was considered the referent measure for inconsistencies between participant self-report and medical record data documented by a clinic physician.

For all participants and for their primary partners as part of standard clinical care, blood specimens were tested for HIV by an enzyme-linked immunosorbent assay rapid HIV antibody test (ABBOTT Determine HIV-1/2, ABBOTT Laboratories, IL, USA; HIV TRI-DOT, BIOMED Industries, India), and reactive sera were confirmed by Western blot analysis (Bio-Rad Laboratories, Hercules, CA) or by 2 different HIV antibody tests. *Herpes simplex* type 2 was diagnosed as any clinically identifiable genital outbreak of vesicular or mucosal inflammation and/or Herpes Select 2 ELISA IgG (Focus Diagnostics, Cypress, CA). Tuberculosis (TB) diagnosis was based on consistent history and physical exam and culture yielding *Mycobacterium tuberculosis* or positive sputum or aspirate tests for acid-fast bacilli, radiological features suggestive of TB, or clinical and radiological improvement in response to anti-tuberculosis treatment.

Statistical analysis

Descriptive statistics were calculated with mean and standard deviation for variables that were normally distributed; and the median and interquartile range (IQR) were calculated for variables influenced by extreme values. We first calculated demographic, behavioral, and clinical predictors of being in a HIV concordant primary relationship. We then examined variables associated with being sexually active, and then among participants who were sexually active, we examined variables associated with reported unprotected sex. Multivariable logistic regression models were used to assess selected socio-demographic, behavioral, and clinical factors associated with being in a HIV concordant primary relationship, being sexually active, and reported unprotected sex. Independent risk factors were assessed using a stepwise regression model (cutoff p-value of 0.20). After introducing independent risk factors into the models, each covariate was then introduced to assess confounding, which was determined based on a change of at least 0.10 or 10% of the non-log transformed beta coefficient of independent risk factors. The following variables were included in the adjusted model of predictors of being in a HIV concordant primary relationship: sex, residential status, has children, alcohol use, reported unprotected sex, and time in clinical care. The following variables were included in the adjusted model of predictors of being sexually active: sex, age, residential status, HAART status, CD4 cell count at the time of the study, HSV-2 antibody positive, prior tuberculosis diagnosis, general health perceptions, and time in clinical care. The following variables were included in the adjusted model of predictors of reported unprotected sex: residential status, HAART status, primary partner HIV status, number of children, desire to have children, general health perceptions, and alcohol use. All data analyses were conducted using STATA (STACORP, version 10.0, College Station, TX) software.

RESULTS

Among the 247 study participants (>95% heterosexual HIV transmission), a third were women, 64% were urban residents, and 84% were > 30 years old. Almost three-fourths of participants (70%) had been enrolled in the HIV care program for >24 months. Most participants (80%) were HAART-experienced. The median CD4 cell count at the time of the study was 402 cells/ul (IQR: 263–568). Most participants (>90%) were married/currently living with their primary partner and 81% already had a child.

The majority (58%) were in a HIV concordant primary relationship. Among those currently in a HIV concordant primary relationship, a third (32.6%) seroconverted following their partners' enrollment in care, and the median time to HIV seroconversion was 119 days. Approximately two-thirds (63.2%) of participants reported being sexually active in the past 3 months, and 9.0% of them reported unprotected sex during that time.

Demographic, behavioral, and clinical predictors of being in a HIV concordant primary relationship

Table 1 presents univariate and multivariable analyses of predictors of being in a HIV concordant primary relationship. In the univariate analysis, participants who were female, not employed, urban residents, had a child, wanted to have a child, used alcohol, reported unprotected sex, and had been in clinical care for >12 months were significantly more likely to be in a HIV concordant primary relationship ($p<0.05$). Participants who were migrant workers were significantly less likely to be in a HIV concordant relationship ($p<0.05$). Participants in discordant and concordant relationships did not vary by age, education, cohabitation status, general health perceptions, being sexually active, HAART status, HSV-2 antibody positivity, prior tuberculosis diagnosis, and current CD4 cell count.

In multivariable analysis, participants in concordant relationships were more likely to be women (AOR: 3.82; 95% CI: 1.94–7.50; $p<0.0001$), to be urban residents (AOR: 2.12; 95% CI: 1.16–3.87; $p=0.014$), and to have children (OR: 2.28; 95% CI: 1.07–4.86; $p=0.031$) compared to discordant participants. Concordant participants were more likely to report alcohol use (AOR: 3.05; 95% CI: 1.36–6.81; $p=0.006$) and be in clinical care for a longer period of time (AOR for 12–24 months: 7.75; 95% CI: 2.53–23.75; $p<0.0001$ and AOR for >24 months: 5.08; 95% CI: 2.20–11.68; $p<0.0001$) compared to discordant participants.

Patterns of sex across concordant and discordant couples

Table 2 summarizes the frequency of reported sex, and the proportion of sex acts that were protected by condoms. Similar proportions of participants in concordant (65.3%) and discordant (60.2%) relationships reported to be currently sexually active. The median number of sex acts with primary partners in the last three months was slightly lower among concordant participants (median: 6; IQR: 3–10) than discordant participants (median: 9; IQR: 4–12). However, the proportion of sex acts that were protected by condoms was lower among concordant participants (88%) compared to discordant participants (99.2%). Two participants, one who was concordant and the other discordant, reported having had sex with a non-primary partner in the last three months. Out of a total of 65 reported sex acts with a non-primary partner, all were reported to be protected by condoms.

Multivariable analysis of predictors of being sexually active

Table 3 presents univariate and multivariable analyses of predictors of being sexually active. Participants who were sexually active were less likely to be HAART-experienced (AOR: 0.31; 95% CI: 0.13–0.74; $p=0.009$), to have lower general health perceptions (AOR: 0.41 (0.23–0.75); $p=0.004$), and to have a prior diagnosis of tuberculosis (AOR: 0.40; 95% CI:

0.20–0.80); $p=0.009$), and were more likely to be *Herpes simplex* type 2 antibody positive (AOR: 2.16; 95% CI: 1.01–4.59); $p=0.045$) compared to participants who were currently not sexually active. Though not statistically significant, participants who were sexually active were more likely to be urban residents (AOR: 1.80; 95% CI: 0.99–3.28); $p=0.054$). Participant gender, age, current CD4 cell count, and time enrolled in clinical care were not associated with being sexually active.

Multivariable analysis of predictors of reported unprotected sex

Table 4 presents univariate and multivariable analyses of predictors of reported unprotected sex among participants who were sexually active. Participants who reported unprotected sex were more likely to be in a HIV concordant primary relationship (AOR: 17.37; 95% CI: 1.66–180.82); $p=0.017$), to not have any children (AOR: 13.10; 95% CI: 2.20–77.81; $p=0.005$), to want to have children (AOR: 11.75; 95% CI: 1.25–110.07); $p=0.031$), and to use alcohol (AOR: 5.77; 95% CI: 1.13–29.52); $p=0.035$). The current study did not document a significant association between HAART status and unprotected sex.

DISCUSSION

Among South Indian HIV-infected patients enrolled in clinical care, unprotected sex was being driven by fertility concerns. Further efforts will be needed to integrate reproductive health programs into HIV clinical and preventive care in pronatal societies, such as India, where the societal and familial obligation is to get married and to have children is strong (Visaria 1999). Participants who used alcohol were also more likely to report unprotected sex, as has been seen in other settings (Fisher 2007; Madhivanan 2005), suggesting the need to develop targeted interventions focused on substance use for patient sub-populations. We did not document an association between HAART and unprotected sex.

We found that among concordant participants, a third had been in a discordant relationship at the time of entry into care and then consequently transmitted HIV to their primary partner (Kumarasamy 2009). Concordant participants were more likely to report unprotected sex, to have children, and to be enrolled in care longer than their discordant counterparts. Due to the cross-sectional design of the current study, we are unable to ascertain correlates of unprotected sex at the time of seroconversion. Our findings do suggest that timely prevention counseling that integrates reproductive health delivered soon after enrollment into care could be an effective means of secondary prevention, and could decrease HIV transmission within couples.

In the current study, the desire to have children was an important predictor of reporting unprotected sex, and the fewer number of children participants had, the more likely they were to report unprotected sex. HIV-infected individuals may perceive a greater impetus to have children more quickly compared to uninfected individuals because of a limited lifespan imposed by HIV infection. Participants who already had one or more children were not more likely to engage in unprotected sex, suggesting that the overall number of children desired may be no greater than their HIV-uninfected counterparts. Though HAART decreases the risk of sexual transmission of HIV through decreasing viral levels in blood and plasma (Cuvin et al 2000; Vernazza 2000), HAART-experienced individuals could still be at risk of transmitting HIV, especially in resource-limited settings without adequate viral load monitoring. Data from Uganda has suggested that HAART-experienced women are more likely to report wanting children or wanting more children (Maier 2008). However, another study from Uganda found that HAART-experienced women were more likely to use contraceptives compared to HAART-naïve women (Andia 2009). In a clinic-based study among Spanish heterosexual discordant couples, sexual risk behavior was strongly associated with recent pregnancy (Hernando 2009). In India, condoms have traditionally

been considered as a part of family planning rather than as means of preventing HIV/STI transmission (Roth 2001; Solomon 2004). Unprotected sex to procreate remains an important limitation of condom-based HIV prevention interventions for couples trying to fulfill their reproductive goals.

The data in the current study underscore the need for further research regarding the cost-effectiveness and cultural acceptability of biomedical interventions that could address the needs of Indian couples seeking to procreate, including viral suppression of the HIV-infected partner via prompt initiation of HAART (Barreiro 2006), assisted reproduction after sperm washing (Bujan 2007; Savasi 2008), and antiretroviral chemoprophylaxis, including pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) (Cohen 2007; Liu 2006) (Mayer 2010). Given the close link between heterosexual HIV transmission and the incidence of pregnancy, future studies will be needed to examine the impact of HAART on fertility in resource-limited settings so that couples can be sexually active, achieve their reproductive goals, and minimize the risk of HIV transmission.

The current study is broadly consistent with earlier data emerging from sub-Saharan Africa that HAART is not associated with an increase in sexual risk taking behaviors (Bateganya 2005; Bechange 2008; Bunnell 2006; Kaida 2008; Moatti 2003). Recent studies from ART treatment programs in Kenya and South Africa have documented a decrease in unprotected sex following ART initiation (Eisele 2008b; a; Luchters 2008). Though early studies from the developed world had found an increase in sexual risk taking behavior following the introduction of HAART (Dukers 2001; Kelly 1998; Ostrow 2002), a later meta-analysis did not find that HAART was associated with behavioral disinhibition (Crepaz 2004). Since participants in the current study received regular prevention counseling about initiating HAART if they wanted to engage in unprotected sex for the purpose of having a child, it is possible that the slight **non-significant** elevation we documented in HAART use among those reporting unprotected sex may be connected to wanting to have a child. Participants in the current study generally reported to only be sexually active with their primary partner. A recent population level analysis from Rwanda and Zambia found that most heterosexual HIV transmission occurs within the context of marriage or cohabitation (Dunkle 2008), which is concordant with earlier data showing unprotected sex mainly in the context of primary partnerships (Moatti 2003; Sarna 2008). These data from differing social milieus do suggest the possible difficulty of negotiating safe sex with primary partners. Further studies are needed to examine barriers to condom use among couples.

There are study limitations to note. In the current setting with low levels of reported sexual risk behavior, a larger sample size with greater power to detect an association between HAART and sexual risk behavior may be needed. A concern with utilizing self-reported sexual risk behaviors is recall and social desirability bias (Buvé 2001; Schroder 2003). It is possible that the low levels of reported sexual risk behaviors (ie unprotected sex, multiple sex partners) in this study sample may be associated with misreporting of sexual risk behaviors. Since the current study took place within the context of an HIV care program with regular prevention counseling, participants may have had a greater incentive to misreport sexual risk behaviors compared to a general population sample. This study utilized non-clinic research staff to conduct data collection who were not involved in care delivery and utilized a variety of different measures to assess sexual risk behaviors. Also, study staff received training to elicit sexual risk behaviors in a culturally sensitive manner. While the validity of self-reported sexual risk taking behaviors must always be questioned, prior studies measuring sexual risk behaviors among HIV-infected individuals have generally relied on self-report (Kennedy 2007), and an earlier study from this clinical setting utilized self-reported sexual risk behaviors and found an association with HIV infection (Kumarasamy 2009). Further research in this setting evaluating new data collection

techniques, such as ACASI that are less susceptible to social desirability bias, will need to be investigated.

As part of standard of care, participants received risk reduction counseling and free condoms at each clinic visit and it is not possible to disentangle the contribution of various prevention activities (ie counseling, condom provision, VCT) on risk behavior. Participants in the study may be a self-selected sample and may not be representative of the HIV-infected population in need of treatment, but we attempted to ensure that the study sample matched the wider clinic patient population during the study period on important clinical and demographic variables. A strength of the current study is data was available on the HIV status of the primary partner, which has not been available in many studies assessing the impact of HAART on sexual behavior in resource-limited settings. Although earlier studies have examined sexual behavior in the context of HIV transmission and acquisition in India (Mehendale 2006), to date this is the first study (**to our knowledge**) examining the association between treatment and sexual behaviors among HIV-infected Indians receiving clinical care.

Increasing calls have been made to rapidly expand the provision of HAART in resource-limited settings, and it has been suggested that treating all HIV-infected patients could have a major impact on HIV transmission (Granich 2009). Proactive risk reduction strategies targeted towards discordant couples, including prompt treatment initiation of the HIV-infected partner and empirically developed culturally-relevant couples prevention interventions, delivered promptly after enrolling into clinical care could be particularly efficacious (Allen 2003; Bunnell 2005; Rogers 2005). These findings suggest the need for continued prevention counseling that integrates reproductive health within the context of primary marital relationships as part of the roll-out of HAART programs in India.

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Table 1

Demographic, behavioral and clinical predictors of being in a HIV concordant primary relationship among HIV-infected participants in clinical care in South India (N=247)

Characteristic	Proportion, % by partner HIV status			Univariate odds ratios, OR (95% CI); p-value	Multivariable odds ratio, OR (95% CI); p-value*
Demographic characteristics	Concordant couple (N=144)	Discordant couple (N=103)			
Sex *					
Male	59.0	79.6		1.00	1.00
Female	40.1	20.4		2.71 (1.51–4.85); 0.001	3.82 (1.94–7.50); <0.0001
Age, years					
<30	17.4	14.6		1.00	
>30	82.6	85.4		0.81 (0.40–1.62); 0.557	
Education					
Secondary or below	86.8	80.6		1.00	
University or greater	13.2	19.4		0.79 (0.56–1.11); 0.188	
Current employment					
Employed	72.9	85.4		1.00	
Not employed	27.1	14.6		1.29 (1.04–1.61); 0.021	
Residential status *					
Rural	29.2	44.7		1.00	1.00
Urban	70.8	55.3		1.96 (1.12–3.44); 0.013	2.12 (1.16–3.87); 0.014
Migrant worker					
No	92.4	84.5		1.00	
Yes	7.6	15.5		0.45 (0.18–1.09); 0.0499	
Lives with spouse					
No	13.9	22.3		1.00	
Yes	86.1	77.7		1.78 (0.87–3.65); 0.0845	
Has children *					
No	14.6	25.2		1.00	1.00
Yes	85.4	74.8		1.97 (1.04–3.75); 0.037	2.28 (1.07–4.86); 0.031
Behavioral characteristics					
Wants to have a child					
No	35.6	37.9	1.00		
Yes	74.3	62.1	1.76 (1.00–3.04); 0.042		
Alcohol use *					
No	77.8	87.4	1.00	1.00	

Behavioral characteristics					
Yes	22.2	12.6	1.98 (0.98–3.99); 0.057	3.05 (1.36–6.81); 0.006	
General health perceptions					
High	44.4	36.9	1.00		
Low	55.6	63.1	0.73 (0.43–1.22); 0.235		
Sexually active					
No	34.3	39.8	1.00		
Yes	65.7	60.2	1.26 (0.75–2.14); 0.374		
Reported unprotected sex *					
No	91.0	99.0	1.00	1.00	
Yes	9.0	1.0	10.12 (1.30–78.64); 0.027	17.95 (1.64–196.31); 0.018	

Clinical characteristics					
HAART-experienced					
No	19.4	19.4	1.00		
Yes	80.1	80.6	1.00 (0.50–1.98); 0.996		
CD4 cell count (cells/ul)					
≤350	12.7	11.8	1.00		
350–500	29.6	28.4	0.96 (0.40–2.30); 0.937		
>500	57.7	59.8	0.89 (0.40–1.99); 0.789		
Prevalent HSV-2 positive					
No	75.7	84.5	1.00		
Yes	24.3	15.5	1.75 (0.87–3.61); 0.095		
Prior tuberculosis diagnosis					
No	31.9	42.7	1.00		
Yes	68.1	57.3	1.59 (0.91–2.78); 0.084		
Time in clinical care *					
<12 months	7.6	61.2	1.00	1.00	
12–24 months	16.0	12.6	4.34 (1.48–12.98); 0.003	7.75 (2.53–23.75); <0.0001	
>24 months	76.4	26.2	4.29 (1.89–10.19); <0.0001	5.08 (2.20–11.68); <0.0001	

**Bolted results reflect statistically significant associations (p<0.05).

* Variables included in multivariable model: sex, residential status, has children, alcohol use, reported unprotected sex, and time in clinical care.

Table 2

Patterns of reported sexual intercourse by primary partner HIV status (N=247)

	Total, % (N=247)	Concordant, % (N=144)	Discordant, % (N=103)
Sexually active (%)	156 (63.2%)	94 (65.3%)	62 (60.2%)
Median number of sex acts with primary partner (IQR)	7 (3–10)	6 (3–10)	9 (4–12)
Proportion of sex acts protected with primary partner (%) *	1291/1392 (92.7%)	704/800 (88%)	587/592 (99.2%)

* Two participants reported having had sex with a non-primary partner, one who was concordant and the other discordant. Out of a total of 65 reported sex acts with a non-primary partner, all were protected.

Table 3

Selected predictors of being sexually active among HIV-infected participants in clinical care in South India (N=247)

	Proportion who were sexually active		Univariate odds ratios, OR (95% CI); p-value	Multivariable odds ratios, AOR (95% CI); p-value
	Yes (%) N=156	No (%) N=91		
Sex				
Male	68.6	65.9	1.00	1.00
Female	31.4	34.1	0.88 (0.51–1.53); 0.667	0.57 (0.28–1.13); 0.111
Age, years				
<30	16.7	15.4	1.00	1.00
>30	83.3	84.6	0.91 (0.44–1.84); 0.792	0.74 (0.31–1.75); 0.500
Residential status				
Rural	67.3	40.7	1.00	1.00
Urban	32.7	59.3	1.41 (0.82–2.41); 0.208	1.80 (0.99–3.28); 0.054
HAART experienced				
No	25.0	9.9	1.00	1.00
Yes	75.0	90.1	0.32 (0.15–0.71); 0.005	0.31 (0.13–0.74); 0.009
CD4 cell count, cells/ul				
≤350	9.0	17.6	1.00	1.00
350–500	30.1	26.4	2.23 (0.93–5.34); 0.069	1.63 (0.65–4.10); 0.295
>500	59.6	54.9	2.12 (0.95–4.70); 0.063	1.39 (0.658–3.32); 0.455
Prevalent HSV-2 positive				
No	23.1	83.5	1.00	1.00
Yes	76.9	16.5	1.52 (0.77–2.96); 0.219	2.16 (1.01–4.59); 0.045
Prevalent tuberculosis				
No	41.7	24.5	1.00	1.00
Yes	58.3	72.5	0.53 (0.30–0.93); 0.026	0.40 (0.20–0.80); 0.009
General health perceptions				
High	48.7	28.6	1.00	1.00
Low	51.3	71.4	0.42 (0.24–0.73); 0.002	0.41 (0.23–0.75); 0.004
Time in clinical care				
<12 months	16.0	14.3	1.00	1.00
12–24 months	16.0	12.1	1.18 (0.44–3.13); 0.737	1.93 (0.65–5.71); 0.232
>24 months	67.9	73.6	0.82 (0.39–1.71); 0.604	1.05 (0.46–2.41); 0.894

**Bolted results reflect statistically significant associations (p<0.05).

Table 4

Selected predictors of reported unprotected sex among sexually-active HIV-infected participants in clinical care in South India (N=156)

	Proportion reporting unprotected sex		Univariate odds ratios, OR (95% CI); p-value	Multivariable odds ratios, AOR (95% CI); p-value
	Yes (%) N=14	No (%) N=142		
Residential status				
Rural	57.1	31.7	1.00	1.00
Urban	42.9	68.3	0.61 (0.20–1.88); 0.399	0.41 (0.11–1.57); 0.198
HAART experienced				
No	14.3	26.1	1.00	1.00
Yes	85.7	73.9	2.11 (0.45–9.89); 0.342	2.70 (0.48–15.15); 0.258
Partner HIV status				
Discordant	7.1	43.0	1.00	1.00
Concordant	92.9	57.0	9.79 (1.24–76.88); 0.030	17.37 (1.66–180.82); 0.017
# of children				
2 or more	35.7	54.9	1.00	1.00
1	28.6	33.8	1.30 (0.33–5.08); 0.706	1.69 (0.37–7.64); 0.492
0	35.7	11.3	4.87 (1.26–18.82); 0.022	13.10 (2.20–77.81); 0.005
Wants to have a child				
No	14.3	31.0	1.00	1.00
Yes	85.7	69.0	2.69 (0.57–12.54); 0.207	11.75 (1.25–110.07); 0.031
General health perceptions				
High	35.7	50.0	1.00	1.00
Low	64.3	50.0	1.80 (0.57–5.63); 0.313	3.08 (0.78–12.10); 0.106
Alcohol use				
No	64.3	81.7	1.00	1.00
Yes	35.7	18.3	2.47 (0.76–8.01); 0.129	5.77 (1.13–29.52); 0.035

**Bolted results reflect statistically significant associations (p<0.05).