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Factors associated with HIV infection among Indian women

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Summary

There is still a paucity of research on the sociodemographic and other underlying factors associated with HIV transmission among women in India. This study was designed to investigate such factors in sexually experienced Indian women. We used data from the National Family Health Survey 3 (NFHS-3), which tested 52,853 women for HIV, including 27,556 husband and wife pairs. Significant risk factors for all women and married women only were: aged 26–35 years (adjusted odds ratios [AORs] = 3.65 and 2.53, respectively), being poor (AORs = 1.57 and 1.79), having had a genital sore in the last 12 months (AORs = 3.16 and 3.01) and having more than one sexual partner (AORs = 5.95 and 5.15). For husband and wife pairs, suffering sexual violence (AOR = 2.63), husband having other wife/wives (AOR = 3.40) and husband's education being secondary level or higher (AOR = 0.43) were significant. Intervention strategies in India should target young married (aged 25–35 years) and formerly married urban women who are poor, as well as those who have suffered sexual violence from their husbands, and/or are (or whose husbands are) multi-partnered. Empowerment of women is fundamental to HIV/AIDS prevention in India.

Keywords

India; HIV; women; marriage; sexually transmitted infections; National Family Health Survey 3; sexual violence

INTRODUCTION

The Indian National AIDS Control Organization (NACO) and international organizations such UNAIDS estimated the number of HIV infections in India in 2007. The new estimate was based on the National Family Health Survey 2005–2006 (NFHS-3),^{1,2} a household-based survey of HIV in women aged 15–49 years and men aged 15–54 years. NFHS-1 (ever married women) was conducted in 1992–1993 and NFHS-2 (women and children) was conducted in 1998–1999. In addition to HIV prevalence estimates, NFHS-3 provided information on men and unmarried women for the first time. NACO published the revised estimate of 2.47 million HIV infections (0.28% of the total adult population) in 2007, based on the NFHS-3 survey. This revised national estimate reflects the availability of better data, and resulted in a substantially lower estimate of HIV prevalence in India.

In India, where cultural constraints and social taboos impose great secrecy regarding sexuality, marital status is very closely related to HIV transmission in women. Newmann and Sarin³ have shown that having sex exclusively with one's husband was the only HIV risk factor for the majority of women.

The presence of other sexually transmitted infections (STIs) and inflammation of the genital mucosa increase vulnerability to HIV infection in women through heterosexual vaginal intercourse.^{4,5} Herpes simplex virus 2 (HSV-2), a common infection, is a co-factor that makes the female genital tract more susceptible to HIV infection.⁶ Women are frequently forced to tolerate abuse, violence and infidelity from their husbands.⁷ When they engage in sex, their lack of knowledge about their own sexual health, ignorance about their regular partners' and the continued culture of silence make them unable to negotiate safer sex practices. The specific aim of this study was to determine the level of risk of HIV infection in India, both among all women and among married women currently living with their husbands.

METHODS

We analysed the data from the NFHS-3 2005–2006. In each state, the rural sample was selected in two stages, whereas a three-stage procedure was followed in urban areas because of the larger populations in the wards. Sample weighting was used to maximize the representativeness of the sample. The survey collected demographic, socioeconomic and behavioural data through an interviewer-administered questionnaire, as well as 100,000 blood samples for HIV testing from a nationally representative sample of 250,000 adult women and men in all the states of India except Nagaland.² Blood collection for HIV testing was not conducted in Nagaland due to local opposition; thus, that state was not included in this study. Given that the older surveillance estimates were not based on a representative sample of adults in India, it was decided that general population estimates of HIV in India could be greatly improved if HIV testing was included in the NFHS-3.⁸ NFHS-3 also included women aged 15–49 years who had never married, as well as both ever married and never married men aged 15–54 years. Therefore, all women aged 15–49 years and men aged 15–54 years in households selected for the NFHS-3 HIV sample were eligible for HIV testing. In this study, we considered both 'all women' and 'only married women' who could be linked to their husbands. The latter group provided additional information about couple relationships. Nationwide, a total of 102,946 participants were tested for HIV, of whom 52,853 were women. However, the analytical sample consisted of 37,781 women after excluding the subjects with missing values and restricting the sample to those women who were sexually experienced or exposed and provided data on their marital status. Since sexual debut in Indian women occurs mostly within marriage, only 86 out of 12,656 never-married women who were included in the final analysis reported having ever had sexual exposure. The NFHS-3 thus provides a nationally representative estimate of HIV prevalence among sexually experienced Indian women. Among all the participants, there were 27,556 married couples who were currently living together and agreed to be tested for HIV (hereafter referred to as 'couple-linked'). The final analysis was based on 22,684 couples, since subjects with missing values were excluded from the analytical sample. We did, however, analyse characteristics of those with missing variables.

The International Institute of Population Sciences (IIPS), Mumbai, India and Macro International, Calverton, MD, USA provided technical assistance for NFHS-3. NFHS-3 data processing involved editing, data entry using CSPro software, verification of data entry and secondary editing by the research organizations. Final data cleaning and recoding into a standard structure and naming of variables was done at IIPS.²

Ethical issues

NFHS-3 obtained informed consent from the individual respondents for the interview, as well as for blood sampling. The data collection procedures were approved by the ORC Macro Institutional Review Board. The University of California, Los Angeles (UCLA) Institutional Review Board concluded that analyses in this study were exempted from IRB review (UCLA IRB# G09-08-035-01) since the data were publicly available and contained no identifiers.

Statistical analysis

We implemented two different models: (1) all sexually experienced women participating in NFHS-3 and (2) all married women currently living with their husbands for whom data were available (couple-linked). Subsequently, we refer to these two models as model 1 and model 2, respectively. We first examined the frequency distribution of all the independent variables to describe the basic characteristics of all women, ever married women, currently married women, couples in which both were HIV-infected (concordant couples), and couples in which only the wife was infected (wives-only infected discordant couple).

The dependent variable of interest in models 1 and 2 was the HIV test results of women (positive or negative). Initially, we computed the crude-odds ratios (CORs) and 95% confidence intervals (CI), using univariate methods to measure the association between the dependent and the independent variables. We used multiple logistic regression models to adjust for factors associated with HIV status. Variables entered in the full model were either significant ($P < 0.05$) in univariate analysis or were selected on the basis of prior knowledge (see Appendix 1). We first used a scoring method with the best subset selection having the highest score test value for the final reduced model.^{9,10} We further applied a stepwise procedure at a cut-off P value of 0.15 for entry and 0.30 for exit from the full model^{11,12} to select variables for the reduced models. The variables included in the two models are listed in Appendix 2. In determining which of the two models (full or reduced) was final, the model that had the lower value for Akaike's information criterion (AIC) and P values over 0.05 in the Lemeshow and Hosmer¹³ goodness of fit test was selected. We also looked for the presence of multicollinearity, using a variance influence factor (VIF). As recommended by Cody and Smith¹⁴, VIF values exceeding 10 were investigated carefully. The 'employed or not' variable from our final model was removed because it exhibited multicollinearity with the 'education' variable. After removing the 'employed or not' variable, the model fit better. All analyses were conducted using SAS for Windows, version 9.1 (SAS Inc, Cary, NC, USA).

RESULTS

NFHS-3 estimates HIV prevalence of 0.22% in women and 0.36% in men.² Factors that predicted HIV status are presented for both models, model 1 for all women ($n = 37,781$) and model 2 for only couple-linked women ($n = 22,684$). Table 1 presents the percent distribution of all participants and adjusted odds ratios (AORs) only for significant variables and those variables expected to be significant.

Both models

About 25% of all women and 28% of women living with their current partner had never heard of AIDS. Only 6% of all women who ever had intercourse and 7% of currently married women reported using a male or female condom as a contraceptive.

The risk of contracting HIV was significantly higher for women aged 26–35 years than for those aged 36–49 years (model 1, AOR = 3.65, 95% CI 2.45–5.44; model 2, AOR = 2.53,

95% CI 1.14–5.65). Women with a history of a genital sore(s) in the 12 months preceding data collection had a significantly higher risk of HIV infection (model 1, AOR = 3.16, 95% CI 1.32–7.56; model 2, AOR = 3.01, 95% CI 1.03–8.77). We found poverty to be significantly associated with HIV infection. Women from below the poverty line (BPL) households had a higher level of infection (model 1, AOR = 1.57, 95% CI 1.10–2.43; model 2, AOR = 1.79, 95% CI 1.11–2.89). BPL is a composite of criteria of poverty incorporating 13 different parameters. About one-third (33%) of all infected women held a BPL card. A strong positive association of HIV infection was observed in women having more than one sexual partner during their lifetime (model 1, AOR = 5.95, 95% CI 2.83–12.52; model 2, AOR = 5.15, 95% CI 1.09–24.46).

Although more than 50% of ever married women were married before they were 18 years old, we did not find any significant elevation of risk for HIV from early adolescent marriage (model 1, AOR = 0.64, 95% CI 0.17–2.37; model 2, AOR = 0.78, 95% CI 0.17–3.54). Moreover, 50% of all women initiated sexual activity before aged 18 years, but it was not related to HIV risk in women (model 1, AOR = 1.61, 95% CI 0.44–5.89; model 2, AOR = 1.19, 95% CI 0.27–5.33).

Model 1: all women—Among 52,853 women tested for HIV, 12,656 (24%) had never married and 40,197 (76%) had ever married (see Figure 1). However, in the analytical sample of sexually experienced women, only 77 (0.20%) were never married and 37,704 (99.80%) were ever married. Of those ever married, 35,190 (93%) were currently married/living together, 1692 (5%) were widowed and 822 (2%) were divorced, separated or not living with a spouse. Only 11 (6%) of all HIV-infected women were found to be never-married women, an overall prevalence of 0.09% that closely matches the NFHS-3 estimate of 0.03%,² whereas prevalence among ever married women was 0.45%. The prevalence was highest among widowed women (2.94%), followed by divorced/separated women (1.57%). In model 1, both partners were HIV-positive (32%; 57/180) for all HIV-infected ever married women. AORs were significant for women who were currently married (2.47, 95% CI 1.69–5.57), widowed (22.70, 95% CI 11.14–50.91) and divorced or separated (9.46, 95% CI 8.20–56.21), compared with the never married group.

Muslim religion was inversely associated with HIV infection (AOR = 0.29, 95% CI 0.09–0.94). However, only 4% of the total infected women were Muslim. Although only 10% of the women in the sample were Christian or Sikh, they comprised 36% of the unmarried women population who had had premarital sex. Urban women had a higher risk of contracting HIV (AOR = 1.61, 95% CI 1.16–2.24).

Although we did not find any significant association between HIV infection and blood transfusion (AOR = 0.90, 95% CI 0.36–2.21) in model 1, 5% of all infected women reported a history of blood transfusion, and 20% of wives-only infected discordant couples reported a history of blood transfusion.

Although 13% of all ever married HIV-infected women had experienced sexual violence, it was not significantly associated with HIV infection (AOR = 1.52, 95% CI 0.75–3.07).

Only 86 women reported having premarital sex, of whom 77 were included in the analysis. None of these 77 were infected with HIV. About 5% of them had a history of a genital sore in the last 12 months, compared with 0.03% of all never married women. Almost all (92%) of them had more than one lifetime partner, and 92% of them were not using any form of contraception. None of the 11 HIV-infected never-married women reported having sexual exposure or a history of blood transfusion.

Model 2: only married women currently living with their husbands ('couple-linked')—Unlike model 1, Muslim religion did not show a protective effect against HIV infection (AOR = 0.32, 95% CI 0.08–1.26), but only 4% were Muslim.

Education level of women did not show a significant relation with their HIV status, whereas husbands' education levels being secondary school or higher was associated with decreased risk of HIV infection (AOR = 0.43, 95% CI 0.21–0.85).

Wives were more at risk of acquiring HIV infection if their husband had ever been tested for HIV (AOR = 2.77, 95% CI 1.43–5.34). About 23% of all husbands in model 2 thought that contraception was the woman's responsibility. This attitude was significantly associated with higher HIV risk for their wives (AOR = 1.87, 95% CI 1.21–5.76). If the husband had other wives/partners, the wife had a higher risk of HIV infection (AOR = 3.40, 95% CI 1.09–10.63), although only 2% of husbands reported other wives/partners. Only 34% of husbands had used a condom the last time they had sex with partners other than their wives.

HIV infection was positively associated with sexual violence (AOR = 2.63, 95% CI 1.53–4.01) (see Appendix 3 for criteria regarding sexual violence); 9% of all HIV-infected women reported sexual violence. Approximately 9% of infected women who were currently living with their husbands reported a history of blood transfusion, but no association with HIV infection was observed (AOR = 0.76, 95% CI 0.24–2.44).

Among currently married women with incomplete data, the majority (72%) experienced their first intercourse when younger than 18 years old, 78% reported having no education, 61% had husbands who had no education, 42% of their households had a BPL card and 84% were rural residents. Although condom/female condom use was very low overall (8%) in the analytical sample, it was even lower (2%) among women with incomplete data. Responses regarding a history of a genital sore in the last 12 months, a husband with other wives/partners, and total number of sexual partners did not differ between responding and non-responding women.

DISCUSSION

In both models, being aged 26–35 years, impoverished, having a genital sore in the last 12 months and/or having more than one sexual partner during one's lifetime were significantly associated with HIV infection. Women's education level was not found to be associated with contracting HIV, whereas having a husband with secondary school or higher education was protective.

Our study underscores that husband-related risk factors increase the vulnerability of Indian women for HIV infection. The prevalence of HIV among ever married women is higher than the national average.¹⁵ Since most HIV transmission in women takes place within marriage,¹⁶ ever married women (including widowed and divorced) should be a major focus of intervention efforts. Our study confirmed the low percentage of condom use by married men with their wives and other sexual partners. The high risk for HIV among widowed women may be due to their husbands having been HIV infected. Widowed women may also have had other sexual partners after their husbands' death.¹⁷

Unlike sex workers and patients attending STI clinics, married couples are not usually targeted for HIV risk reduction programs in India. Since sexual contact with their husbands is the only risk factor for most married women, it is likely that these women were infected by their husbands.¹⁸ Panda and Chatterjee¹⁹ showed in one study in Manipur that male injecting drug users (IDUs) were transmitting HIV to their uninfected wives. Kumar and Virk²⁰ indicate that there is an urgent need to reach out to women married to IDUs. One

study in Mumbai showed that a significant proportion of men who attend STI clinics in Mumbai were bisexual (having sex with both women and men) and engaged in high-risk sexual practices.²¹ NACO has reported that IDUs and men who have sex with men have emerged as important transmitters of HIV in India.¹⁵

The majority of women who were victims of violence after the age of 14 had experienced it from their current husband.² Violence and threats of violence are associated with increased risk for sexual transmission of HIV. Women who experienced abuse were significantly less likely to have used condoms with their intimate partners,²² had been victims of unprotected anal sex and were more likely to be HIV-infected.²³ Our study confirms the increased risk for HIV infection among women experiencing sexual violence from their husbands (model 2). Thus, there is a need to design interventions that empower women to protect themselves from sexual violence, especially from their intimate partners.^{24,25}

Reported genital sores were highly correlated with HIV infection in women in our study. STI and HIV treatment and prevention programmes in India should provide education about risk factors for HIV transmission and prevention strategies.

An important goal in India is to reduce HIV transmission through blood transfusion from 4% (the recent surveillance estimate) to 0.5% or less.²⁶ Our study suggests that one-fifth of the total HIV infections in HIV-discordant couples in which only the wife was infected may have occurred through contaminated blood transfusions. However, eliciting accurate responses to very sensitive personal questions is a challenge in large-scale surveys with face-to-face interviews. Nonetheless, the Indian government should continue efforts to assure blood safety measures, including stringent donor screening nationwide.

Many studies have reported that early marriage increases the risk of HIV infection, due to the immaturity of the genital tract mucosa.^{27,28} Although more than three-fifths of the women in our sample were married before they were 18 years old, we did not find a correlation with HIV infection. Auvert and Carel²⁹ reported that in urban sub-Saharan Africa, the association of HIV status with younger age at sexual debut was high, and was mainly due to an increased number of lifetime partners and longer exposure to sexual activity. This may also be due to the larger area of cervical ectopy when young.³⁰ In our study, we did not find this factor to be significant, but the majority of women who were married in adolescence in our study reported only one sexual partner.

Having multiple partners is highly correlated with HIV infection,³¹ and our findings corroborate this observation. Both models showed significant associations with women having more than one sexual partner. Husbands having other wives/partners were also found to be strongly associated with HIV infection among currently married women. HIV programs should continue to emphasize that monogamy is a major strategy for combating HIV.^{32,33}

Husbands with secondary school or higher levels of education were less likely to infect their wives with HIV. This may be because they have better knowledge of how to prevent HIV acquisition and transmission.³⁴

Strengths of the study

The NFHS-3 data-set is very large, and was designed to be representative of all Indian women. Due to the very large sample size of the data, bias caused by sparse data and using opportunistic sampling was reduced.

Limitations of the study

The data were based on a cross-sectional survey, and so we cannot make any inferences about the actual causation of HIV infection. Since the behavioural data were collected through interviewer-administered questionnaire, the sensitivity of questions on sexual behaviour and sexual violence may have suffered from reporting bias.

Despite the large sample size, some subgroups had few subjects; for example, never married respondents who were sexually experienced. It is likely that some of the infected never married women were reluctant to disclose their sexual activity. Despite very low prevalence in never married women, some risk indicators (e.g. genital sores, premarital sex, total number of sexual partners) might have been under-reported because of fear of stigmatization. There were missing values for sexual violence. Moreover, complete deletion of the subjects with missing values reduced the eligible analytical sample size, particularly in model 1. The results of the non-responding sample of currently married women (model 2) indicate that their age distribution, religion, husbands having other wives/partners and total number of sexual partners were similar to the analytical sample. However, the proportion having a sexual debut younger than 18 years old, and those with no education and whose husbands also had no education were significantly higher among the non-respondents. Moreover, prevalence of condom use was very low among them. These data suggest that the women with missing data were at higher risk for acquiring HIV than the analytical sample.

Finally, Nagaland could not be included in our study. Since the state of Nagaland has one of the six highest rates of HIV prevalence in India, the findings of this study might not be generalizable to all Indian women.

RECOMMENDATIONS

Despite limitations, our study supports the need for empowerment of women to negotiate safer sex. Impoverished married women whose husbands have other partners should be targeted for special interventions, although they may be difficult to identify. Married men's level of education is important regarding preventing HIV transmission. More widespread education of both men and women in India, however, could be an effective tool to reduce the HIV burden among married women. Intervention strategies need to emphasize respect for women and wives; the unacceptability of sexual violence and that both men and women with multiple partners are at risk, as well as women with genital ulcers. Women need to be aware that their own fidelity may not protect them from infection with HIV and other STIs by their husbands. Thus, condom use both within and outside marriage needs to be emphasized more effectively.

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APPENDIX 1: VARIABLES IN THE FULL MODEL

Age, age at sexual debut, age at first marriage, age difference within the couple, marital status, education, partner’s education, wealth index (quintiles), whether the household has a government-issued below the poverty line (BPL) card, residence, religion, whether employed, occupation, partner’s occupation, whether the respondent drinks alcohol, whether the respondent had a STI in the last 12 months, whether the respondent had a genital sore in the last 12 months, whether the respondent had ever heard of AIDS, ever tested for HIV, husband ever been tested for HIV, current method of contraception, having received a blood transfusion, total number of sexual partners of self and husband, married more than once, husband having other wives/partners, husband having ever paid for sex and whether husband thinks contraception is the woman’s responsibility.

APPENDIX 2: VARIABLES IN THE REDUCED MODELS

Model 1: Age, marital status, education, whether the household holds government-issued BPL card, religion, whether the respondent has ever heard of AIDS, whether the respondent had a genital sore in the last 12 months and total number of sexual partners.

Model 2: Age, husband having other wives/partners, husband’s education level, ever experienced sexual violence, whether husband thinks contraception is the woman’s responsibility, whether husband ever tested for HIV, whether the household holds BPL card and having a genital sore in the last 12 months.

APPENDIX 3: DEFINITION OF SEXUAL VIOLENCE

Sexual violence was based on the following items in the questionnaire:

Does/did your husband ever do any of the following things to you:

- Physically force you to have sexual intercourse with him even when you did not want to?
- Force you to perform any sexual acts you did not want to do?

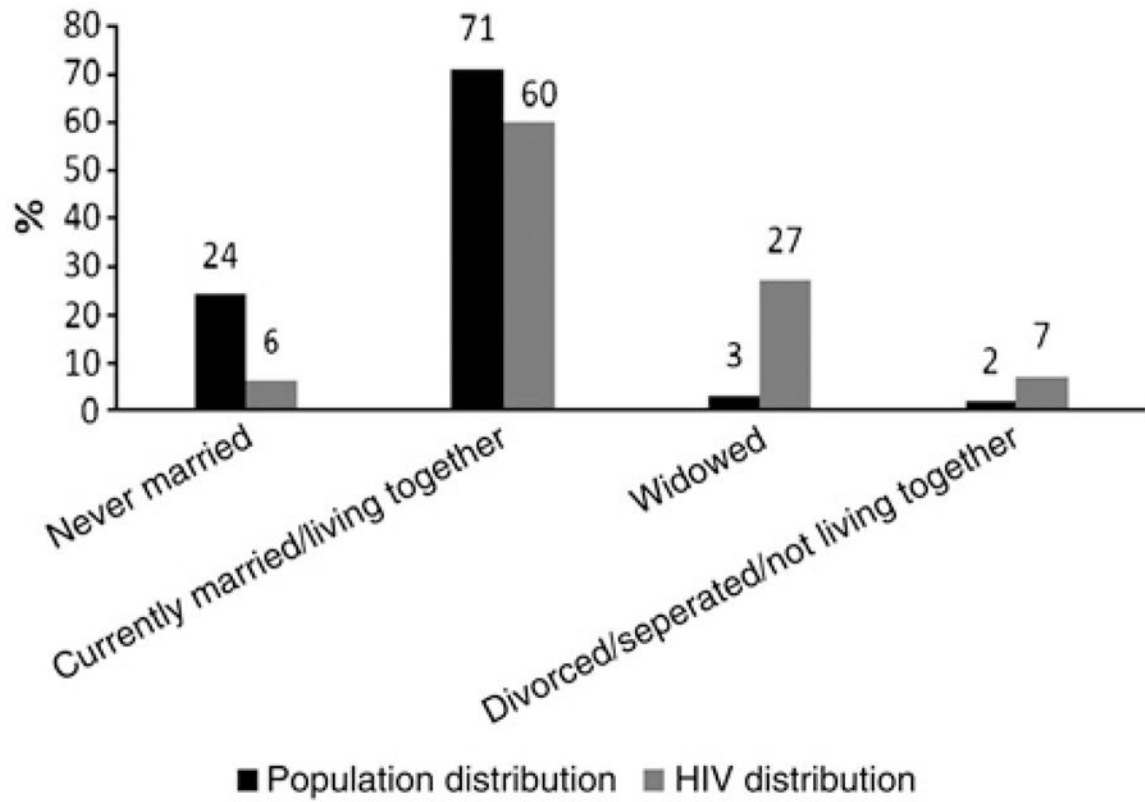


Figure 1.
Percentage distribution of women in the entire NFHS-3 by marital status and percentage distribution of HIV-infected women by marital status

Table 1

Predictors of HIV infection in women in India

Characteristics	All women (model 1)			Within current couples (model 2)				
	Total* n*	%	AOR	95% CI	Total* n*	%	AOR	95% CI
Total	37,781	100	-	-	22,684	100	-	-
Age (years)								
15-25	9069	24	3.07	1.83, 5.15	6032	27	1.87	0.68, 5.1
26-35	14,673	39	3.65	2.45, 5.44	9509	42	2.53	1.14, 5.1
36-49	14,045	37	1.00	-	7143	31	1.00	-
Age at sexual debut (years)								
10-17	19,030	50	1.61	0.44, 5.89	10,350	46	1.19	0.27, 5.1
18	18,751	50	1.00	-	12,334	54	1.00	-
Marital status								
Never married	77	0.2	1.00	-	N/A	N/A	N/A	N/A
Currently married	35,190	93	2.47	1.69, 5.57	22,684	100	N/A	N/A
Widowed	1692	5	22.70	11.14, 50.91	N/A	N/A	N/A	N/A
Divorced/separated	889	2	9.46	8.20, 56.21	N/A	N/A	N/A	N/A
Education								
No education	14,838	39	1.00	-	7066	31	1.00	-
Primary	5929	16	0.92	0.50, 1.66	3585	16	0.87	0.38, 1.1
Secondary/higher	17,014	45	0.81	0.46, 1.43	12,033	53	0.78	0.36, 1.1
Husband's education								
No education	N/A	N/A	N/A	N/A	3364	15	1.00	-
Primary	N/A	N/A	N/A	N/A	3283	14	0.49	0.21, 1.1
Secondary/higher	N/A	N/A	N/A	N/A	16,037	71	0.43	0.21, 0.1
Household has below poverty line card								
Yes	9186	24	1.57	1.10, 2.43	5002	22	1.79	1.11, 2.1
No	28,595	76	1.00	-	17,682	78	1.00	-
Religion								
Hindu	29,309	78	1.2	0.61, 2.36	17,781	78	1.02	0.47, 2.1

Characteristics	All women (model 1)		Within current couples (model 2)					
	Total*	AOR	Total*	AOR				
Muslim	4894	1.3	0.29	0.09, 0.94	2648	12	0.32	0.08, 1.1
Christian/Sikh/other	3578	9	1.00	-	2255	10	1.00	-
Residence								
Urban	17,790	47	1.61	1.16, 2.24	11,967	53	1.30	0.81, 2.1
Rural	19,991	53	1.00	-	10,717	47	1.00	-
Husband ever tested for HIV								
Yes	N/A	N/A	N/A	N/A	1692	7	2.77	1.43, 5.1
No	N/A	N/A	N/A	N/A	20,992	93	1.00	-
Reported a genital sore in the last 12 months								
Yes	699	2	3.16	1.32, 7.56	404	2	3.01	1.03, 8.1
No	37,082	98	1.00	-	22,280	98	1.00	-
Current contraceptive method								
No method	15,378	41	1.00	-	8155	36	1.00	-
Condom/female condom	2198	6	0.73	0.25, 2.10	1755	8	0.77	0.22, 2.1
Other	20,205	53	1.25	0.80, 1.96	12,774	56	1.39	0.78, 2.1
Husband thinks contraception is the woman's responsibility								
Yes	N/A	N/A	N/A	N/A	5128	23	1.87	1.21, 5.1
No	N/A	N/A	N/A	N/A	17,556	77	1.00	-
Husband has other wives/partners								
Yes	N/A	N/A	N/A	N/A	369	2	3.40	1.09, 10.1
No	N/A	N/A	N/A	N/A	22,315	98	1.00	-
Total number of sexual partners in a lifetime								
More than one	608	2	5.95	2.83, 12.52	275	1	5.15	1.09, 24.1
One	37,173	98	1.00	-	22,409	99	1.00	-

AOR = adjusted odds ratio; CI = confidence interval; N/A = not applicable

* Values may not total 100%, due to rounding