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Cervical cancer awareness and presence of abnormal cytology among HIV-infected women on ART in Rural Andhra Pradesh, India

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Abstract

Cervical cancer is a leading cause of death among women in low and middle-income countries, and women living with HIV are at high risk for cervical cancer. The objective of this study was to estimate the prevalence and correlates of cervical cancer and pre-cancer lesions and to examine cervical cancer knowledge among women living with HIV receiving antiretroviral therapy in rural Andhra Pradesh, India. We conducted cytology-based screening and administered a standardized questionnaire among 598 HIV-infected women. We found 5 (0.8%), 39 (6.5%), 29 (4.9%), and 4 (0.7%) had atypical squamous cells of undetermined significance (ASCUS), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), and squamous cervical carcinoma (SCC), respectively. In multivariable logistic regression analysis, ASCUS/LSIL was independently associated with >16 years old at first sexual encounter and smokeless tobacco use. We found no factors associated with HSIL/SCC. In total, 101 women (16.9%) had heard of cervical cancer and 28 (27.7%) of them correctly identified HIV infections as a risk factor. In light of the high prevalence of pre-cancer lesions and low level of cervical cancer knowledge in our study population, focused interventions are needed to improve cervical cancer literacy and prevention among rural women living with HIV.

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Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

Keywords

female; prevalence; cytology; lesion; prevention

Introduction

Cervical cancer is one of the most common gynecological malignancies worldwide.[1] Women in low- and middle-income countries (LMIC) carry a disproportionally high burden – largely due to lack of skilled health professionals for effective screening, financial limitations, and inadequate facilities in LMIC. [2, 3] The risk of developing cervical cancer is significantly higher among women living with HIV.[4] HIV-related immune suppression reduces the likelihood of hosts' cell-mediated immunity to clear human papillomavirus (HPV) infections that may lead to invasive cervical cancer. [5, 6] Cervical cancer incidence rate among women living with HIV is nearly six times the rate among women in the general population. [7] The increased uptake of antiretroviral therapy (ART) has drastically reduced the presentation of some AIDS-defining cancer, such as Kaposi's sarcoma and non-Hodgkin's lymphoma. [8] However, ART treatment has not led to population-level decline in cervical cancer. [5, 9] Early identification and treatment of premalignant cervical lesions remain the most critical intervention to decrease morbidity and mortality related to cervical carcinoma.

The dual burden of cervical cancer and HIV poses a tremendous public health challenge in India. [1] Currently, no standard guideline or nationwide program exists for cervical cancer screening in India. [10] Health literacy about cervical cancer is critical to utilization of screening and prevention measures in the community. Studies among women living in India have observed low levels of cervical cancer knowledge, including prevention and screening. [11–14] Furthermore, screening and early treatment services are less accessible in rural regions, which may explain the higher cervical cancer incidence compared to urban regions. [14, 15] Understanding cervical cancer risk factors and awareness among women living with HIV in rural settings is an important first step to identify strategies to curtail the burden and optimize prevention guidelines.

We conducted a cervical cancer sub-study embedded within a parent intervention trial conducted in rural Andhra Pradesh, India. Andhra Pradesh has one of the highest HIV prevalence in India at 0.66% − approximately 2.5 times the national HIV prevalence. [16] There is no province-wide screening program for early cervical cancer detection, and cervical cancer screening is not a standard practice for women starting ART in the region. The aim of our study was to determine the prevalence and correlates of cervical carcinoma and abnormal lesions, and to examine knowledge and attitudes regarding cervical cancer among HIV-infected rural women participating in an ART adherence trial in Andhra Pradesh.

Methods

Parent study design, sample, and setting

The parent prospective cluster RCT recruited 600 women in Nellore, a rural district of Andhra Pradesh in southern India. Detailed procedures of the parent RCT are described elsewhere. [17] Briefly, between April 2014 and November 2016, women who met the following criteria were recruited from primary health clinics: i) 18–50 years of age with a verified HIV diagnosis; ii) received ART for at least three months; iii) living with a child aged 3–8 years; iv) have a CD4 T cell count greater than 100 cells/mm^3; and v) have not participated in our previous Asha studies. Parent study intervention assigned trained village Asha or community health workers (CHW) who reinforced general education provided to the participants in face-to face group sessions wherein health professionals educated on disease progression, treatment, the importance of ART adherence, and maintaining healthy life style.

Procedures for cervical cancer sub-study

We extracted demographic information and CD4+ T cell count data from the parent study database. Papanicolaou (Pap) smears and cervical cancer survey were administered between February and March of 2018. All participants had completed 6 months of the parent study intervention at the time of the survey. A local gynecologist collected cervical scrape smears using endocervical brushes and the samples were transported to the local pathology laboratory. Conventional Pap smears were done using hematoxylin and eosin stains of smears fixed in absolute alcohol. Cervical smear results were reported following the Bethesda System 2001. [18] Pap smear results included no lesion; atypical squamous cells of undetermined significance (ASCUS); low-grade squamous intraepithelial lesions (LSIL); high-grade intraepithelial lesions (HSIL); or squamous cell carcinoma (SCC).

Measures

The main outcomes of interest were: i) prevalence and correlates of abnormal cytology; and ii) knowledge of cervical cancer among study participants. Abnormal outcomes were further categorized as: 1) ASCUS or LSIL, relatively low level of abnormalities that frequently regress spontaneously without treatment; [19] and 2) HSIL, moderate to severe lesions that are more likely to be associated with the progression to cervical carcinoma, or SCC. [19] We also examined any abnormal cytology as an outcome of interest, which combined ASCUS, LSIL, HSIL, and SCC.

We administered a 21-item questionnaire that explored cervical cancer- and HPV-related knowledge, and attitudes towards cervical cancer in general. Participants were first asked: ‘Have you ever heard of cervical cancer?’ Those responding ‘Yes’ were then asked three additional questions about their general awareness of and attitudes towards cervical cancer. Next, the questionnaire covered knowledge of cervical cancer symptoms (five items); risk factors (four items); and treatment, diagnosis, and prevention of cervical cancer (four items). Responses to the questions were ‘yes’, ‘no’, or ‘I do not know’. Each item was analyzed separately.

Sociodemographic and clinical data collected included age, marital status, education, monthly income, age at first sexual encounter, number of sexual partners to date, smoking history, use of smokeless tobacco, date of parent study intervention assignment, and date of HIV diagnosis. We analyzed CD4 T cell counts at the time closest to the cervical cancer screening. Education levels were categorized into the following categories: no education, < 5 years, 5–9 years, and ≥ 10 years. Monthly household income and age at first sexual encounter were dichotomized at the median. Age was categorized as ≤ 30 years, 31–40 years, and ≥ 41 years. Use of smokeless tobacco was categorized as 'Yes' if participants reported current use of any form of smokeless tobacco at any level of frequency. Years since HIV diagnosis was analyzed as a continuous variable.

Statistical analysis

Prevalence estimates of abnormal cytology were calculated as the number of observed abnormal smears divided by the total number of women screened, and the 95% confidence limits to each prevalence estimate were obtained by the Wilson score method. Bivariate associations between selected covariates and abnormal cytology were assessed with logistic regression modeling. Subsequently, multivariable logistic regression was constructed to model abnormal smears as the dependent outcome with age, education (dichotomized as having any level of education vs. no formal education), income, age at first sexual encounter, current use of smokeless tobacco, years since HIV diagnosis, and knowledge about cervical cancer (based on the question 'Have you ever heard of cervical cancer?') as the independent variables. These variables were selected based on *a priori* knowledge and included in the model regardless of their observed statistical association with the outcome. Odds ratios were estimated for each independent variable with adjustment for all other variables in the model. Alternatively, log-binomial models that estimate prevalence ratios were considered, however, given the aim was to assess associations with a cross-sectional approach and the outcome of interest was rare, both measures were adequate and we favored logistic modeling. [20]

Data cleaning and statistical analysis were performed using SAS version 9.4 (SAS Institute, Cary, North Carolina, U.S.). In accordance with recent guidelines provided by the American Statistical Association, no alpha cutoff was specified for statistical significance. [21, 22]

Ethical considerations

The parent study and the cervical cancer sub-study were approved by the Human Subjects Protection Committee at University of California Los Angeles, University of California Irvine, and the Ministry of Health in India. All participants provided written consent prior to enrollment in both studies.

Results

Characteristics of participants

A total of 598 out of 600 eligible participants accepted the cervical cancer screening and were included in the analyses. The median age of participants was 37 years old (Table 1). Approximately half of the participants were divorced or widowed (51.8%) and 48.7% had no formal education. Median household income was 2000 rupees (approximately $30 U.S.

dollars) per month. Over half of the participants reported first sexual encounter at age 16 years or younger, and most of the participants reported having one (22.7%) or two (51.8%) sexual partners in their lifetime. Most of the participants (98.2%) had no smoking history. About one in three participants reported ever having used smokeless tobacco and 28.1% of them reported currently using smokeless tobacco. The median number of years since HIV diagnosis was 6 years, and the median CD4+ T cell count at the time closest to the cervical cancer screening was 1058 cells/mm^3 (Table 1).

Cytology outcomes

Figure 1 shows the prevalence of abnormal cytology results. Overall, 77 (12.9%) study participants were found with abnormal cytology results. The prevalence of ASCUS, LSIL, and HSIL were 0.8%, 6.5% and 4.9%, respectively. Four (0.7%) participants had results indicative of SCC.

Table 2 shows the bivariate and multivariable logistic regression analysis of factors associated with ASCUS and LSIL (n = 44) compared to negative cytology (n = 554). In the unadjusted model, older age (31 – 40 years) was associated with increased odds of ASCUS and LSIL compared to younger age (≤ 30 years old) (crude odds ratio [cOR] = 3.44; 95% CI = 1.19, 9.96). Furthermore, older age at first sexual encounter (cOR = 3.10; 95% CI = 1.56, 6.15), current use of any form of smokeless tobacco (cOR = 3.90; 95% CI = 1.84, 8.29), and longer years of living with a positive HIV diagnosis (cOR = 1.14; 95% CI = 1.05, 1.24) were associated with increased odds of ASCUS and LSIL. In the fully adjusted model, older age at first sexual encounter (adjusted odds ratio [aOR] = 2.82; 95% CI = 1.38, 5.75) and current use of smokeless tobacco (aOR = 3.01; 95% CI = 1.25, 7.27) remained significantly associated with increased odds of ASCUS and LSIL.

We also examined the association between the same set of covariates and HSIL/SCC (n = 33) but did not find evidence of associations (Table 3). Likewise, we explored the associations using any abnormal cytology (combining ASCUS, LSIL, HSIL, and SCC; n=77; Supplemental Table) as the dependent outcome. While the direction of effects remained similar to the ASCUS/LSIL model, the adjusted effects of age at first sexual encounter (aOR = 1.80; 95% CI = 1.09, 2.99) and use of smokeless tobacco (aOR = 1.86; 95% CI = 0.88, 3.94) were reduced. Additionally, the duration of HIV infection (time since HIV diagnosis) was positively associated with an increased odds of any abnormal cytology in the adjusted model (aOR = 1.09; 95% CI = 1.01, 1.17; supplement table).

Cervical cancer knowledge and awareness

We found low levels of cervical cancer knowledge and awareness among study participants. Over 80% (n=491) of participants had never heard of cervical cancer (Table 4). Among the 101 women who knew about cervical cancer, most reported that they heard about the condition from friends, community health workers, or neighbors. Only one participant reported learning about cervical cancer through a health care professional. Among those who heard about cervical cancer, 22% reported being concerned about developing cervical cancer and 43% knew that irregular menstrual bleeding could be a symptom. Similarly, the majority of the women (99%) had poor knowledge regarding traditional risk factors of

cervical cancer, such as early onset of sexual activity, multiple sexual partners, and HIV infection (Table 4). Very few knew that cervical cancer can be treated (n = 7 [8.9%]) or that cervical cancer is easier to prevent if lesions are found early (n = 10 [9.9%]). Furthermore, no one knew of HPV or that HPV can be transmitted sexually. Only one participant had heard of Pap smear before, and she received the procedure over a year ago (Table 4).

Discussion

We present results from a large cervical cancer screening study among an underserved population of rural women living with HIV in Andhra Pradesh, India. Over 5% of our participants had cytology results indicative of cervical carcinoma or high-grade lesions. Furthermore, we found very low level of knowledge about cervical cancer and no prior history of screening among study participants. Given the high risk of cervical cancer among women living with HIV, our findings underscore an urgent need to implement routine cervical cancer screening and education programs in this population.

Our prevalence estimates for HSIL and SCC were similar to two previous studies of women living with HIV in Uttar Pradesh and Maharashtra, India,[23, 24] but lower than a study of HIV-infected women in Maharashtra.[25] Women in the Maharashtra study may have been at particularly low risk for HPV infection, as 94% of the participants reported having only one sexual partner in their lifetime, which is much higher than the 23% in our study population. Our findings, confirm the higher risk of cervical carcinoma among women living with HIV in India compared to HIV-uninfected women (<1% for HSIL)[26, 27] and support systematic cervical cancer screening among women living with HIV.

We found similar prevalence estimates for ASCUS and LSIL as another study among HIV-infected women with presumably lower sexual risk of HPV,[25] but lower prevalence of ASCUS and LSIL compared to studies in Eastern India and Maharashtra.[23, 24] The lower prevalence of ASCUS and LSIL observed in our population may be because our participants had completed 6 months of ART adherence and nutritional intervention at the time of cytology screening, resulting in significant improvement in CD4+ T cell counts. [17, 28] Previous studies have shown a strong association between CD4+ T cell recovery and regression of ASCUS and LSIL. [29, 30] While studies have shown that ART is also associated with reduced HSIL and SCC, [31, 32] these outcomes develop over a longer period of time and thus longer follow-up of patients may be needed to observe reduction in HSIL and SCC.

In our population of rural women, older age (> 16 years old) at first sexual debut was independently associated with increased odds of LSIL and ASCUS. This finding is inconsistent with previous literature, which found that younger age at first sexual intercourse is positively associated with HPV infection, abnormal cytology, and invasive cervical cancer. [33–35] Notably, participants who reported first sexual encounter at > 16 years were also more likely to report having two or more sexual partners in her lifetime (data not shown).

These findings highlight the importance of local epidemiological context when considering risk factors of cervical cancer. For example, in the context of rural India, younger age at first sexual encounter may be indicative of child marriages that are highly prevalent in such

settings and not necessarily linked to increased number of sex partners and higher risk of sexually transmitted diseases as found in Western settings. [36] In addition, our finding that lifetime number of sexual partners was not associated with abnormal cytology suggests that cervical cancer risk in this population of women may be driven by sexual risk behaviors among male partners, independent of their own sexual history. [37] In India and other developing nations, there is a significant amount of evidence for the association between men who migrate for employment and increased sexual risk behaviors [38–41] and HIV risks for female partners. [41, 42] Mobile migrant workers, such as truck drivers, may act as the potential bridge population and transmit infection from high-risk groups to their partners residing home who would have been at low risk for infection. [40, 43]

Additionally, we found that current use of smokeless tobacco is positively associated with the risk of LSIL and ASCUS. Smokeless tobacco is the most prevalent form of tobacco use among rural Indian women. [44] While cigarette smoking is a well-established risk factor for cervical cancer, we are aware of only one study that examined the association between smokeless tobacco use and cervical cancer in India. [45] The study found greater daily use of smokeless tobacco was associated with increased risk of invasive cervical cancer (OR = 4.0).

We were unable to confirm traditional risk factors for HSIL/SCC in our population, such as older age and multiple sexual partners. [46, 47] This may be due to unmeasured confounders that we did not capture in our data such as HPV infection status and time on ART, or due to our relatively small sample who developed HSIL or SCC (n = 33).

The low level of cervical cancer awareness found in our study was similar to previous studies of HIV-uninfected women in India. [11–14, 48] Importantly, despite all participants in our study receiving regular HIV care at the time of the survey, only one participant reported learning about cervical cancer from a health facility. This suggests that there were numerous missed opportunities to provide education regarding cervical cancer or screen high-risk women at clinic visits for HIV care. Integration of cervical cancer prevention services within HIV care has been shown to be feasible in many settings. [49] Our findings suggest that such integrated care is urgently needed in India.

Our research had some limitations. First, statistical associations between exposures and outcomes may not represent causal relationships due to study design. Second, HPV data were not collected, which is an important marker for the development of abnormal lesions preceding cervical cancer. Future studies should assess HPV prevalence among this population in addition to other important factors, such as time on ART and HIV viral load. Third, our study population had high CD4 counts at the time of cervical cancer screening, due to the 6 months of ART adherence intervention that was given as part of the parent study. Therefore, our findings are likely to be generalizable to women living with HIV who are stable on ART in Andhra Pradesh, but may not be generalizable to those with poorly controlled HIV disease. Moreover, behavioral data from male partners were not collected. Future studies should include behavioral and sexual history information of male partners and consider computer-assisted self-interviewing in settings like India, which has been shown to improve the accuracy of sensitive data. [50]

Our findings underline the urgent need for integrated cervical cancer intervention involving education, screening, and treatment among women living with HIV in rural Andhra Pradesh. Interventions should leverage the existing HIV care infrastructure, which already maintains regular contact with patients, to include cervical cancer screening and prevention education. Additional research is needed to determine the optimal schedule and method for cervical cancer screening in this population, including use of genotyping tests to identify high-risk human papillomavirus infection.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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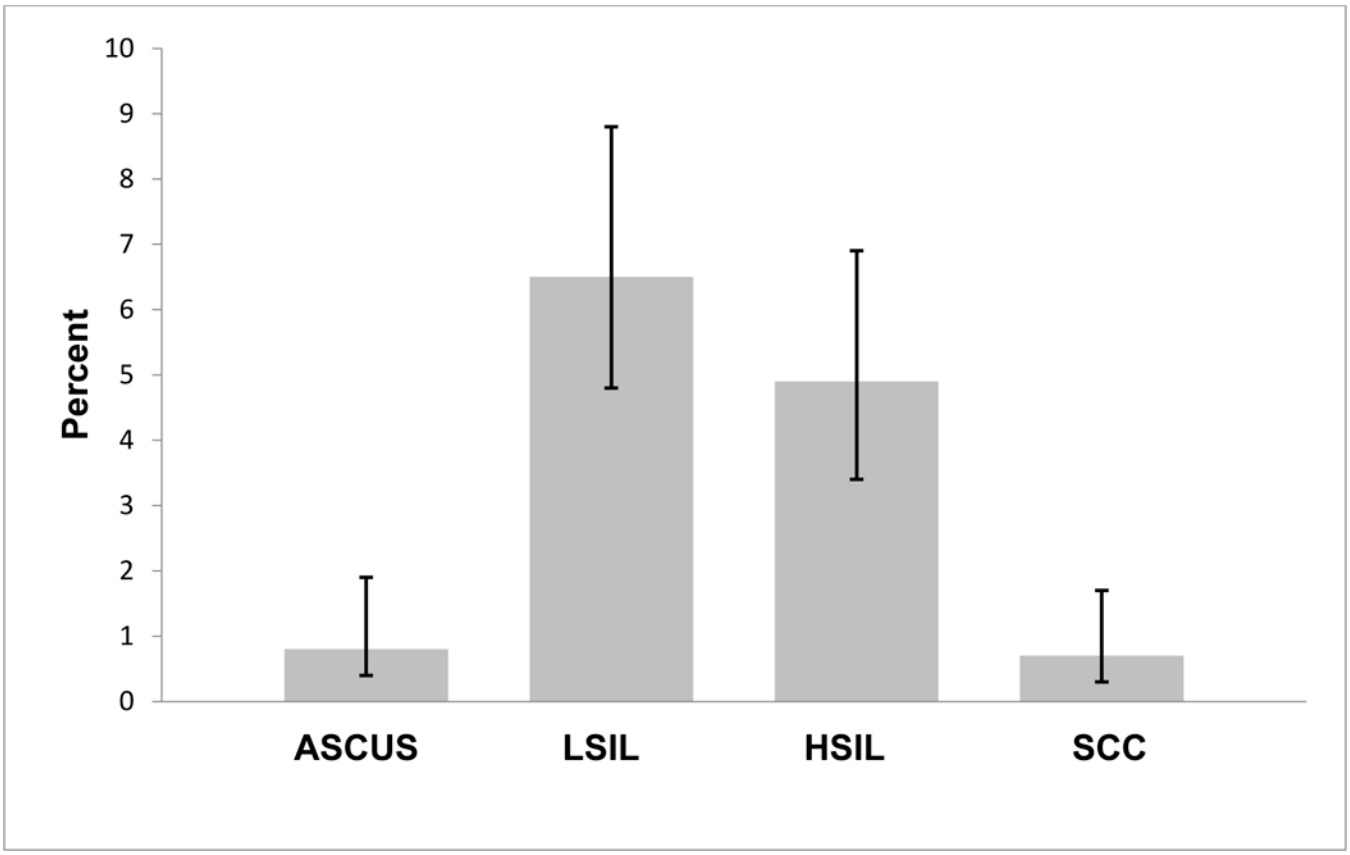

Figure 1. Prevalence of cervical abnormalities among study participants (n=598)

Abbreviations: LSIL=Low-grade squamous intraepithelial lesion; HSIL=High-grade squamous intraepithelial lesion; ASCUS=Atypical squamous cells of undetermined significance; SCC=Squamous cell carcinoma. Note: Error bars are representative of 95% confidence limits calculated by the Wilson score method.

Table 1.

Characteristics of the study participants (N=598)

Characteristic		n (%)	Median (IQR)
Age in years			37 (32 – 42)
Education	No education	291 (48.7%)	
	< 5 years	98 (16.4%)	
	5–9 years	122 (20.4%)	
	≥ 10 years	87 (14.5%)	
Marital status	Married	288 (48.2%)	
	Divorced/widowed	310 (51.8%)	
Household monthly income in Rupee			2000 (1500 – 2700)
Age at first sexual encounter	≤ 16 years	309 (51.7%)	
	> 16 years	289 (48.3%)	
Number of sexual partners to date	1	136 (22.7%)	
	2	310 (51.8%)	
	3 – 5	152 (25.4%)	
Ever smoked any form of tobacco	Yes	11 (1.8%)	
	No	587 (98.2%)	
How often do you smoke tobacco currently	Not at all	11 (100.0%)	
Ever used any form of smokeless tobacco	Yes	192 (32.1%)	
	No	405 (67.7%)	
	Don’t know	1 (0.2%)	
Currently use smokeless tobacco	Yes	54 (28.1%)	
	No	137 (71.4%)	
	Don’t know	1 (0.5%)	
CD4 (cells/mm^3) at the time of screening			1058 (869 – 1278)
Years since HIV diagnosis			6 (4 – 8)
Months since parent intervention assignment			31 (23–40)
ART regimen	Lamivudine + Tenofovir Disoproxil Fumarate + Efavirenz	342 (57.2%)	
	Zidovudine + Lamivudine + Nevirapine	167 (27.9%)	
	Other	89 (14.9%)	

Abbreviations: IQR = interquartile range; ART = antiretroviral therapy.

Table 2.

Correlates of LSIL or ASCUS (n=565[a])

Variables		Prevalence n/N (%)	Crude OR (95% CI)	Adjusted OR[b] (95% CI)
Age	≤ 30 years	4/107 (3.7)	1.00	1.00
	31–40 years	33/280 (11.8)	3.44 (1.19–9.96)	2.37 (0.79–7.11)
	≥ 41 years	7/178 (3.9)	1.05 (0.30–3.69)	0.83 (0.23–3.00)
Education	No education	17/275 (6.2)	1.00	1.00
	Some education	27/290 (9.3)	1.56 (0.83–2.93)	1.39 (0.71–2.73)
Marital status	Married	23/274 (8.4)	1.00	Not included in model
	Divorced/widowed	21/291 (7.2)	0.85 (0.46–1.57)	
Number of sexual partners to date	1	11/130 (8.5)	1.00	Not included in model
	More than 1	33/435 (7.6)	0.89 (0.44–1.81)	
Age at first sexual encounter	≤ 16 years	12/292 (4.1)	1.00	1.00
	> 16 years	32/273 (11.7)	3.10 (1.56–6.15)	2.82 (1.38–5.75)
Monthly household income (rupees)	< 2000	18/198 (9.1)	1.00	1.00
	≥ 2000	26/367 (7.1)	0.76 (0.41–1.43)	1.09 (0.52–2.25)
Smokeless tobacco use	No	33/513 (6.4)	1.00	1.00
	Yes	11/52 (21.2)	3.90 (1.84–8.29)	3.01 (1.25–7.27)
Years since HIV diagnosis (+1 year)			1.14 (1.05–1.25)	1.01 (0.998–1.22)
Ever heard of cervical cancer	No	39/472 (8.3)	1.00	1.00
	Yes	5/93 (5.4)	0.63 (0.24–1.65)	0.50 (0.18–1.39)
CD4+ T cell count (cells/mm3)	< 1000	21/251 (8.4)	1.00	Not included in model
	≥ 1000	23/314 (7.3)	0.87 (0.47–1.60)	Not included in model

Abbreviations: OR=Odds ratio; CI=Confidence interval; LSIL=Low-grade squamous intraepithelial lesion; ASCUS=Atypical squamous cells of undetermined significance; HSIL=High-grade squamous intraepithelial lesion; SCC=Squamous cell carcinoma.

[a]Patients with SCC or HSIL were excluded from this analysis.

[b]Adjusted odds ratios for each independent variable were adjusted for all other variables included in the model.

Table 3.

Correlates of HSIL or SCC (n=554[a])

Variables		Prevalence n/N (%)	Crude OR (95% CI)	Adjusted OR[b] (95% CI)
Age	≤ 30 years	7/110 (6.4)	1.00	1.00
	31–40 years	13/260 (5.0)	0.78 (0.30–2.00)	0.68 (0.25–1.81)
	≥ 41 years	13/184 (7.1)	1.12 (0.43–2.90)	0.99 (0.37–2.66)
Education	No education	16/274 (5.8)	1.00	1.00
	Some education	17/280 (6.1)	1.04 (0.52–2.11)	0.97 (0.46–2.05)
Marital status	Married	14/265 (5.3)	1.00	Not included in model
	Divorced/widowed	19/289 (6.6)	1.26 (0.62–2.57)	
Number of sexual partners to date	1	6/125 (4.8)	1.00	Not included in model
	More than 1	27/429 (6.3)	1.33 (0.54–3.30)	
Age at first sexual encounter	≤ 16 years	17/297 (5.7)	1.00	1.00
	> 16 years	16/257 (6.2)	1.09 (0.54–2.21)	1.10 (0.54–2.25)
Monthly household income (rupees)	< 2000	12/192 (6.3)	1.00	1.00
	≥ 2000	21/362 (5.8)	0.92 (0.44–1.92)	0.94 (0.44–2.01)
Smokeless tobacco use	No	31/511 (6.1)	1.00	1.00
	Yes	2/43 (4.7)	0.76 (0.18–3.27)	0.68 (0.15–3.13)
Years since HIV diagnosis (+1 year)			1.06 (0.95–1.17)	1.07 (0.96–1.19)
Ever heard of cervical cancer	No	25/458 (5.5)	1.00	1.00
	Yes	8/96 (8.3)	1.58 (0.69–3.61)	1.56 (0.66–3.68)
CD4+ T cell count (cells/mm3)	< 1000	15/245 (6.1)	1.00	Not included in model
	≥ 1000	18/309 (5.8)	0.95 (0.47–1.92)	Not included in model

Abbreviations: OR=Odds ratio; CI=Confidence interval; LSIL=Low-grade squamous intraepithelial lesion; ASCUS=Atypical squamous cells of undetermined significance; HSIL=High-grade squamous intraepithelial lesion; SCC=Squamous cell carcinoma.

[a]Patients with LSIL or ASCUS were excluded from this analysis.

[b]Adjusted odds ratios for each independent variable were adjusted for all other variables included in the model.

Table 4.

Cervical cancer knowledge and awareness among study participants (n=598)

Questions		n (%)
Have you heard about cervical cancer?	Yes	101 (16.9%)
	No	491 (82.1%)
	Do not know	6 (1.0%)
Has anyone in your family ever been told they had cervical cancer? *	Yes	4 (4.0%)
	No	97 (96.0%)
Where did you first hear about cervical cancer? *	District hospital	1 (1.0%)
	Friends	32 (31.7%)
	Family	4 (4.0%)
	Asha or neighbors	57 (56.4%)
	Do not know	7 (6.9%)
Are you concerned about having or developing cervical cancer? *	No	12 (11.9%)
	A little	21 (20.8%)
	Moderately	1 (1.0%)
	Do not know	67 (66.3%)
Cervical cancer symptoms		
Irregular menstrual bleeding *	Yes	44 (43.6%)
Bleeding after sexual activity *	Yes	1 (1.0%)
Weight loss *	Yes	6 (5.9%)
Difficulty in passing urine *	Yes	3 (3.0%)
Blood stained discharge from vagina *	Yes	8 (7.9%)
Cervical cancer risk factors		
Early start of sexual activity *	Yes	1 (1.0%)
Multiple sexual partners *	Yes	1 (1.0%)
Two or more babies born in the same birth *	Yes	1 (1.0%)
HIV *	Yes	28 (27.7%)
General knowledge		
Can cervical cancer be treated? *	Yes	8 (7.9%)
Is there a test that can let you know if you are at risk for cervical cancer? *	Yes	26 (25.7%)
Cervical cancer is easier to prevent if cancer cells are found early *	Yes	10 (9.9%)
Are women with HIV more likely to get cervical cancer? *	Yes	32 (31.7%)
Have you ever heard about a Pap test?	Yes	1 (0.2%)
Have you ever had a Pap smear test?	Yes	1 (0.2%)
When did you have your most recent Pap test?	≥ 1 year ago	1
Have you ever heard about Human Papillomavirus (HPV)?	No	597 (99.8%)
	Do not know	1 (0.2%)
Can HPV be passed while having sex?	No	6 (1.0%)

Questions		n (%)
	Do not know	592 (99.0%)
Can using condoms during sexual intercourse protect you from getting infected with HPV?	Yes	2 (0.3%)
	Do not know	596 (99.7%)

*Among participants who have heard of cervical cancer.