

Brief Report

Spread of HIV Infection in Married Monogamous Women in India

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Context.—A high prevalence of human immunodeficiency virus (HIV) infection in female sex workers (FSWs) and men who attend sexually transmitted disease (STD) clinics poses a risk for spread of infection to other populations.

Objective.—To examine spread of HIV to a low-risk population by comparing prevalence of, and risk factors for, HIV and STDs in FSWs and non-FSWs.

Methods.—Women attending STD clinics in Pune, India, were assessed for STDs and HIV from May 13, 1993, to July 11, 1996. Demographic and behavioral information was collected, and clinical and laboratory assessment was performed.

Main Outcome Measure.—Prevalence and risk determinants of HIV infection.

Results.—Of 916 women enrolled, 525 were FSWs and 391 were non-FSWs. Prevalence of HIV in FSWs and non-FSWs was 49.9% and 13.6%, respectively ($P < .001$). In multivariate analysis, inconsistent condom use and genital ulcer disease or genital warts were associated with prevalent HIV in FSWs. History of sexual contact with a partner with an STD was associated with HIV in non-FSWs.

Conclusions.—Infection with HIV is increasing in non-FSWs, previously thought to be at low risk in India. Since history of sexual contact with their only sex partner was the only risk factor significantly associated with HIV infection, it is likely that these women are being infected by their spouses. This underscores the need for strengthening partner-notification strategies and counseling facilities in India.

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MORE THAN 4 million people are estimated to be infected with human immunodeficiency virus (HIV) in Asia.¹ With nearly 1 billion people, India will have more infected people than any single country,^{1,2} currently estimated to be 2.5 million to 3.5 million. Prevalence of HIV has risen in female sex workers (FSWs) from less than 10% in 1990 to between 40% and 50% in 1996 in Mumbai (formerly Bombay), Pune, Madras, Vellore, and other cities^{3,4} and has risen in men attending sexually transmitted disease (STD) clinics to 20% to 30% in these cities.²⁻⁶

To assess spread of HIV infection from higher risk groups such as FSWs and clients, we studied prevalence of and risk determinants for HIV infection in women who did not report sex work activity who attended 2 STD clinics in Pune, India, a city of 2 million near Mumbai.

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Methods

Between May 13, 1993, and July 11, 1996, 11 605 men and women attending 2 STD clinics in Pune were offered serologic screening for HIV-1 and HIV-2 infection, of whom 6746 (58%) accepted. Patients with seronegative test results were invited to participate in a prospective study of HIV acquisition (seroprevalence and seroincidence of HIV-1 in this population have been reported).^{5,6} The project was approved by the Johns Hopkins Medical School and the National AIDS [acquired immunodeficiency syndrome] Research Institute review boards. Assurance of compliance with US Health and Human Services Regulations for Protection of Human Research Subjects was approved by the National Institutes of Health, Office for Protection From Research Risks. Following informed consent, using a structured questionnaire, data on demographics, STDs, medical and reproductive history, sexual behavior, HIV/AIDS knowledge, and HIV prevention practices were collected. Several methods were used to avoid rescreening. Names were checked against confidentially maintained registers, along with

identifying physical marks. Patients received a card with a patient identification number. If history of an STD was identified, location and date of previous treatment was ascertained. If treatment was sought at 1 of the 2 clinics, patients were asked about previous interviews.

See also p 2085.

At initial and follow-up screenings, subjects were tested for STDs. Clinical diagnosis of genital ulcer disease, cervicitis, or vaginitis was based on detailed physical examination made by the physician, without knowledge of HIV serostatus.⁶ Chlamydia antigen enzyme immunoassay, *Neisseria gonorrhoeae* culture, and wet preparations were also done. Blood was screened for syphilis using a rapid plasma reagent test and confirmed by fluorescent treponemal antibody absorption test. Patients were treated with standard therapy for STDs, using guidelines from the Centers for Disease Control and Prevention and the World Health Organization.

After patients had received counseling, their serum samples were screened using commercially available enzyme-linked immunosorbent assay (ELISA) kits for detection of HIV-1 and HIV-2 antibodies (Recombigen HIV-1/HIV-2 Rapid Test, Cambridge Biotech, Galway, Ireland), and positive test results were confirmed with the Recombigen HIV-1/HIV-2 Rapid Test Device. Test results that were positive by ELISA and the rapid test were confirmed by either HIV-1 or HIV-2 Western blot.

A cross-sectional analysis of the data collected at the initial screening was done to compare characteristics of FSWs and non-FSWs. Female sex workers were defined as those who reported ever receiving money in exchange for sex, or identified their occupation as sex workers or former sex workers. Differences in demographic, behavioral, and clinical characteristics were tested using χ^2 and Fisher exact tests. Yates correction for continuity was used for the 2x2 tables. Factors associated with HIV

seroprevalence at baseline were analyzed separately by groups. Univariate associations were tested with continuity-corrected χ^2 and Fisher exact tests. A multiple logistic regression model was used for each group with HIV status as a dependent variable.⁹ Covariates included were variables significant at the .10 level in univariate analysis and factors related to HIV seroprevalence in prior studies. Fit of the logistic regression model was assessed with Hosmer-Lemeshow statistics. SAS 6.11 software was used (SAS Institute Inc, Cary, NC).

Results

During the study period, 916 women attending the STD clinics were screened for HIV, of which 525 and 391 were FSWs and non-FSWs, respectively. Demographic and behavioral profiles of the women differed (Table 1). Non-FSWs were younger, more often married, and more often living with family compared with FSWs ($P < .001$) (Table 1).

Of non-FSWs, 360 (92.1%) reported 1 lifetime sex partner and 6 (1.5%) reported sex with more than 1 partner in the last 3 months. In contrast, 406 (77.3%) of FSWs reported more than 1000 lifetime sex partners and 492 (93.7%) had 2 or more in the past 3 months. Nearly two thirds (260) of non-FSWs did not use contraception compared with 223 (42.7%) of FSWs; 322 (91.5%) of non-FSWs never used condoms in the past 3 months compared with 85 (16.8%) of the FSWs (Table 1).

Previous history of STDs was more common in FSWs than non-FSWs (60% vs 35.6%) (Table 2). However, diagnosis of STDs characterized as genital ulcer, cervicitis, or vaginitis was more common in non-FSWs than FSWs (65% vs 42.7%, $P < .001$). Vaginitis and genital ulcer diseases were statistically significantly more frequent in non-FSWs than FSWs (Table 2). Only pelvic inflammatory disease was more common in FSWs (14.3%) than non-FSWs (5.1%).

Prevalence of HIV infection was 49.9% in FSWs compared with 13.6% in non-FSWs (Table 2). On univariate analysis, risk factors associated with HIV infection in FSWs included not being married ($P = .05$), inconsistent condom use ($P = .02$), more than 1000 lifetime sexual partners ($P = .01$), and current diagnosis of genital ulcer disease ($P = .03$), tinea cruris ($P = .01$), or genital warts ($P = .02$). The only variable statistically significantly associated with HIV infection in non-FSWs was clinic attendance due to sexual contact with a partner with an STD ($P = .02$), even though they may have been asymptomatic.

In multivariate analysis, inconsistent condom use (odds ratio [OR], 1.69), genital ulcer disease (OR, 1.89), genital molluscum contagiosum (OR, 5.28), tinea cruris

Table 1.—Demographic and Behavioral Characteristics of Female Sex Workers (FSWs) and Other Women (non-FSWs) Attending Sexually Transmitted Disease Clinics in Pune, India*

Characteristics	No. (%) of FSWs	No. (%) of Non-FSWs	P Value
Overall	525 (100)	391 (100)	..
Age, yr			
<20	35 (6.7)	93 (23.8)	..
20-29	294 (56.0)	207 (52.9)	..
≥30†	196 (37.3)	91 (23.3)	<.01
Formal education			
None	411 (78.3)	151 (38.6)	..
<High school	90 (17.1)	164 (41.9)	..
≥High school	24 (4.6)	76 (19.4)	<.01
Marital status			
Never married	208 (39.6)	6 (1.5)	..
Married	162 (30.9)	365 (93.4)	..
Widowed or divorced	155 (29.5)	20 (5.1)	<.01
Living with family	70 (13.3)	371 (94.9)	<.01
Currently employed	518 (98.7)	150 (38.4)	<.01
Lifetime no. of sex partners			
1	4 (0.8)	360 (92.1)	..
2-9	9 (1.7)	29 (7.4)	..
10-99	18 (3.4)	2 (0.5)	..
100-999	88 (16.8)	0 (0.0)	..
≥1000	406 (77.3)	0 (0.0)	<.01
Sex partners in past 3 mo			
0	17 (3.2)	38 (9.7)	..
1	16 (3.1)	347 (88.8)	..
≥2	492 (93.7)	6 (1.5)	<.01
Ever heard of HIV and/or AIDS	208 (39.7)	105 (26.9)	<.01
Currently pregnant	25 (5.0)	61 (16.2)	<.01
Currently using contraception	299 (57.3)	131 (33.5)	<.01
Condom use in past 3 mo			
Never	85 (16.8)	322 (91.5)	..
Sometimes	304 (60.0)	25 (7.1)	..
Always	118 (23.3)	5 (1.4)	<.01
Currently smoke cigarettes	118 (22.5)	49 (12.6)	<.01
Tattooed	432 (82.3)	271 (69.3)	<.01

*Ellipses indicate not applicable; HIV, human immunodeficiency virus; and AIDS, acquired immunodeficiency syndrome.

(OR, 3.59), and genital warts (OR, 7.29) were associated with HIV infection in FSWs. Interactions between pairs of STDs were nonsignificant. There was a statistically significant interaction between age and lifetime number of sex partners in FSWs. Younger FSWs with 1000 or more partners were statistically significantly more likely to be HIV infected than those with fewer partners. However, in other FSWs this relationship was not seen. In non-FSWs, only history of contact with a partner with an STD was predictive of HIV (OR, 2.64) (Table 3).

Comment

We compared 2 distinct groups of women attending STD clinics in Pune, India. The 13.6% HIV prevalence in women not engaged in sex work was disturbingly high given the relatively low-risk behavioral profile. Two findings from our study may address this issue. Non-FSWs had a higher rate of STDs than FSWs, a paradoxical result reflected in the second finding that some women were referred to the STD clinics by spouses recently diagnosed with an STD. In univariate and

multivariate analyses, the variable significantly associated with HIV infection in non-FSWs was sexual contact with the only partner, who had been diagnosed as having an STD. Many of these women may erroneously believe themselves to be at low risk because of a presumable "monogamous" relationship.

Epidemiologic studies suggest that genital ulcer disease is associated with 4-fold or greater risk of HIV infection and that nonulcerative STDs may carry a 2- to 3-fold greater risk of HIV infection.¹⁵ Thus, clinical diagnosis of genital ulcer disease or cervicitis or urethritis is important for identifying a biologic risk for HIV infection.

Indian culture discourages communication between men and women regarding sexual behavior.⁹⁻¹¹ Cultural norms promote monogamy and fidelity after marriage for both sexes, but particularly for women who are also expected to be virgins until marriage. While marital lack of communication likely hampers ability to discuss or negotiate reduced sexual partners or use of condoms, a pattern seen in much of the dev

Table 2.—Frequency of Sexually Transmitted Diseases (STDs) in Female Sex Workers (FSWs) and Other Women (Non-FSWs) Attending STD Clinics in Pune, India*

Diagnosis	No. (%) of FSWs	No. (%) of Non-FSWs	P Value
Chlamydia or cervicitis or vaginitis			
None	301 (57.3)	137 (35.0)	
≥1 Infection	224 (42.7)	254 (64.9)	.001
Cervicitis	64 (12.2)	56 (14.3)	.40
Menorrhoea	53 (10.1)	52 (13.3)	.16
Vaginitis	101 (19.2)	100 (25.6)	.03
Genital ulcer disease	102 (19.4)	159 (40.7)	<.001
Hanacroïd	60 (11.4)	80 (20.5)	<.001
Syphilis	29 (5.5)	59 (15.1)	<.001
Scabies	9 (1.7)	26 (6.7)	<.001
Acute inflammatory disease	75 (14.3)	20 (5.1)	<.001
Genital molluscum contagiosum	11 (2.1)	7 (1.8)	.93
Perigenital molluscum contagiosum	11 (2.1)	3 (0.8)	.18
Tinea cruris	33 (6.3)	15 (3.8)	.14
Genital warts	11 (2.1)	16 (4.1)	.12
History of any STD	312 (60.0)	139 (35.6)	<.001
History of GUD	248 (47.8)	116 (29.7)	<.001
History of discharge	184 (35.4)	73 (18.7)	<.001
History of genital warts	11 (2.1)	5 (1.3)	.48
Partner with STD	13 (2.5)	44 (11.3)	<.001
HIV status at screening			
Negative	263 (50.1)	338 (86.5)	...
Positive	262 (49.9)	53 (13.6)	<.001
HIV type (among positives)			
HIV-1 positive only	232 (88.6)	52 (98.1)	...
HIV-2 positive only	6 (2.3)	1 (1.9)	...
HIV-1 and HIV-2 positive	24 (9.2)	0 (0.0)	.04

*GUD indicates genital ulcer disease; ellipses, not applicable; and HIV, human immunodeficiency virus.

world.¹² Women in India who do not report engaging in sex work (non-FSWs, over half the sample) may be representative of a larger general population of married, lower-income, peri-urban women whose husbands have multiple partners.

Data from Zaire and Thailand have shown that intensive STD diagnosis and treatment coupled with a condom distribution program successfully decreased STD incidence and prevalence, including HIV in selected populations.^{13,14} The relatively young age of the non-FSWs (median, 22 years) suggests that an intensive STD and HIV education program must target females prior to marriage and onset of sexual activity. Better condom distribution programs and educational efforts to increase condom acceptance are needed. Development and use of effective vaginal microbicides may empower women in situations where men refuse to use condoms.^{1,15}

Steps to strengthen dissemination of information about STDs and HIV are warranted in India. Otherwise, an increasing proportion of women and infants in India will become infected with HIV.

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Table 3.—Multivariate Analyses of Risk Factors for HIV in Female Sex Workers (FSWs) and Other Women (Non-FSWs) Attending Sexually Transmitted Disease (STD) Clinics in Pune, India*

Characteristics	FSWs	Non-FSWs
Age, y		
<20	1.00 (Referent)	1.00 (Referent)
20-29	2.61 (0.58-11.8)	0.96 (0.45-2.06)
≥30	3.93 (0.81-19.1)	0.61 (0.23-1.60)
Formal education†		
None	...	1.00 (Referent)
<High school	...	0.67 (0.33-1.33)
≥High school	...	0.51 (0.18-1.41)
Marital status		
Never married	1.00 (Referent)	...
Married	0.76 (0.48-1.20)	...
Widowed or divorced	1.15 (0.73-1.83)	...
≥1000 Lifetime sex partners, age, y		
<20	11.87 (2.11-66.7)†	...
20-29	2.01 (1.09-3.71)	...
≥30	1.16 (0.56-2.42)	...
≥2 Lifetime sex partners	...	1.63 (0.58-4.61)
Ever heard of HIV and/or AIDS	...	0.43 (0.18-1.04)
Condom use in past 3 mo		
Never	1.00 (Referent)	1.00 (Referent)
Sometimes	1.69 (1.03-2.79)	1.81 (0.56-5.82)
Always	1.18 (0.65-2.14)	3.86 (0.36-41.0)
Genital ulcer disease	1.89 (1.16-3.06)‡	0.81 (0.42-1.55)
Cervicitis	1.23 (0.70-2.18)	1.20 (0.51-2.79)
Vaginitis	0.72 (0.44-1.18)	0.60 (0.28-1.29)
Genital molluscum contagiosum	5.28 (1.56-17.9)§	2.71 (0.61-12.1)
Tinea cruris	3.59 (1.57-8.20)§	...
Past or present genital warts	7.29 (2.03-26.2)§	...
Contact to partner with STD	...	2.64 (1.18-5.93)

*Values reported as odds ratio with 95% confidence intervals. Estimates are adjusted for variables shown. Likelihood ratio test for overall significance of model: $\chi^2=57.8$ (15 df), $P<.001$ for FSWs; $\chi^2=20.3$ (13 df), $P=.09$ for non-FSWs. Hosmer and Lemeshow goodness-of-fit test: for FSWs, $\chi^2=4.7$ (8 df), $P=.79$; for non-FSWs, $\chi^2=8.9$ (8 df), $P=.35$. Ellipses indicate not applicable; HIV, human immunodeficiency virus; and AIDS, acquired immunodeficiency syndrome. † $P<.05$. ‡ $P=.01$. § $P<.01$.

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