HIV testing and counseling among men attending sexually transmitted disease clinics in Pune, India: changes in condom use and sexual behavior over time

Margaret E. Bentley, Kai Spratt*, Mary E. Shepherd*, Raman R. Gangakhedkar[†], S. Thilikavathi[‡], Robert C. Bollinger* and Sanjay M. Mehendale[†]

Objectives: To describe changes in sexual behavior and condom use among male heterosexual clients at two public sexually transmitted disease (STD) clinics in Pune, after exposure to HIV testing, counseling, and condom promotion.

Design: From 13 May 1993 to 11 April 1997, 6819 heterosexual men were screened for HIV infection as part of the HIV Network for Prevention Trials study. A total of 1628 HIV-seronegative men agreed to return at 3-month intervals for repeated HIV counseling and testing. Counseling at each visit focused on reinforcing messages of monogamy, condom use with sexual partners, and provision of government-provided condoms.

Methods: Data were collected at baseline and at subsequent 3-month intervals, on demographics, previous STD diagnoses, medical history, sexual behavior, knowledge of HIV/AIDS, and practices related to the prevention of HIV. STD were assessed through physical examination and specimen collection, and blood was drawn for HIV-1 and HIV-2 antibody testing.

Results: The level of consistent condom use with sex workers increased proportionately with follow-up time: at 6 months men were 2.8 times more likely to consistently use condoms ($P < 0.001$), at 18 months they were 3.6 times more likely ($P < 0.001$), and after 24 months they were 4.7 times more likely to be using condoms every time. The risk of HIV seroconversion in men was lowest for those who reported 'always' using condoms (adjusted relative risk, 0.68; $P = 0.42$; HIV incidence, 4.0) compared with those who reported 'never' using a condom (adjusted relative risk, 2.94; $P < 0.001$; HIV incidence, 14.0).

Conclusion: Ongoing counseling and testing was positively associated with risk-reduction behaviors amongst a large proportion of men recruited for this study.

© 1998 Lippincott Williams & Wilkins

Introduction

The World Health Organization (WHO) has estimated that there are more than 1.5 million HIV-infected persons in India, and by the year 2000, India will have more people infected with AIDS than any other country in the world [1]. There is growing evidence that the HIV incidence and prevalence is rapidly increasing in India [1–5] with the number of cases doubling in less than 2 years [6]. A recent study by Brookmeyer *et al.* [6] demonstrated that the seroincidence rate in Pune, Maharashtra, the eighth largest city in India, was as high as 18% per year among patients attending two sexually transmitted disease (STD) clinics in the city. The predominant mode of transmission of the virus has been through heterosexual contact between female commercial sex workers (CSW) and their customers, so-called 'high risk' groups [7–9]. However, recent data from Pune has shown a relatively high prevalence rate among 'low risk', married, monogamous women whose only risk factor was sexual contact with a husband who had experienced an STD [10]. Past prevention strategies that focused solely on women in sex work have ignored women at risk for HIV due to their subordinate social status [11,12].

There is an urgent need to understand more about sexual behavior in India, particularly of individuals who have a history of STD or who have multiple sexual partners, or both. Research on sexual attitudes and practices amongst the diverse ethnic, cultural, religious, and socioeconomic groups in India is limited [13]. There is little research on homosexuality, sexual networks, and sexual exploitation of vulnerable groups such as street children, poor women and children, victims of child abuse, domestic violence, and rape [14] who are at risk for STD and HIV. Abstinence and monogamy have been acceptable options in AIDS prevention strategies in India, but open discussions about sex and sexual matters remain taboo [3,15,16]. The acceptability of sex education is publicly debated and promoting the use of condoms has been challenged on the grounds that it will encourage young people to have premarital sex [17].

India was a pioneer in the social marketing of condoms as a family planning method. Condom sales under the government-sponsored social marketing program increased by an average of 13% a year since 1968, but as a pregnancy prevention method it is used by about only 3% of couples of childbearing age [18]. Data from the National Family Health Survey in 1992–1993 showed that condom use among married couples was low, relative to other family planning alternatives [19]. Within India as a whole, only 7.1% of currently married women aged 13–49 years who were surveyed reported that they had ever used condoms for contraception. Within Maharashtra, the most industrialized state in

India with an urban population of 48%, only 8.1% of women surveyed reported ever having used a condom. When asked about current use, only 2.4 and 2.5% reported current condom use in India and Maharashtra, respectively. These percentages are only slightly higher in urban areas than in rural areas. In 1992, the average age of male condom users was approximately 33 years [18], suggesting relatively lower use by the highest risk group of men aged 18–25 years. Until the advent of the HIV/AIDS epidemic, the use of condoms for prevention of STD had not been a theme in condom promotion strategies in India [14,17].

Such low use of condoms among couples in India may reflect the emphasis in government family planning programs on permanent (as opposed to spacing) birth control methods or couple preference. Although family planning strategies changed in 1996 to promote child spacing, public perceptions that condoms are of poor quality, reduce pleasure, are difficult to obtain, problematic to store in joint households with little privacy, embarrassing to purchase, and misinformation about correct use [14,20,21] present significant challenges to programs promoting the use of condoms as an STD and HIV prevention strategy.

Counseling and testing services for HIV prevention are relatively limited in developing countries where the considerable resources needed to sustain such programs are beyond the capacity of most public health budgets [22]. Clinical and social services and antiviral therapies and prophylaxis needed to support HIV-positive individuals are generally unavailable [22–24]. Systematic research into the effects of counseling and testing on HIV and STD incidence and on changing risk behaviors in developing countries is scant and results are mixed [25]. Confidential HIV testing, counseling and condom promotion decreased the incidence of HIV and gonorrhea infection in Kigali, Rwanda [26]. A majority of persons given pre-HIV testing and counseling at an anonymous testing center in Thailand reported the intention to adopt at least one effective HIV prevention behavior prior to receiving test results [27]. Increased condom use following HIV testing and repeated counseling has been reported from several international sites [22,24]. Studies in the Democratic Republic of Congo (former Zaïre) and Rwanda revealed that counseling and testing had little impact on fertility rates in HIV-positive women, whereas studies in Uganda reported lower prevalence of pregnancy in seropositive women. However, the extent to which HIV counseling and testing, as opposed to higher pregnancy loss due to high prevalence of other STD amongst HIV-infected women, effected this outcome is not known [22]. In US and international studies, the most promising results of HIV testing and counseling has been on the increased use of condoms in serodiscordant couples [22].

In the Indian context, where public awareness and knowledge about HIV and AIDS is still relatively low [13,28], it is important to know whether HIV pre-test and post-test counseling will be associated with a change in sexual risk behaviors. This study describes changes in sexual behavior and condom use of a large cohort of male heterosexual clients at two public STD clinics in Pune, India after exposure to HIV testing, counseling, and condom promotion. Longitudinal, 3-month interval data allows an examination of changes in risk behaviors over time.

Materials and methods

Study population and methods

From 13 May 1993 to 11 April 1997, 6819 heterosexual men were screened for HIV infection as part of the HIV Network for Prevention Trials study, an investigation of the epidemiology of HIV in western India. The study was a joint collaboration between The Johns Hopkins University and the National AIDS Research Institute in Pune, India. The study sites were a large public hospital outpatient STD/dermatology clinic and a municipal STD clinic. Approximately 20% of the men tested HIV-positive at their screening visit [2,7] and were not enrolled in the study. All men who tested HIV-seronegative at screening were invited to participate in the longitudinal study: 1628 (30%) agreed to return at 3-month intervals for follow-up evaluations. Characteristics of non-enrollees have been described in detail elsewhere [6] but they tended to be less educated, less likely to have heard of AIDS, less likely to have used condoms in the 3 months prior to screening, and more likely to have had a genital ulcer disease. Follow-up visits occurred between 16 August 1993 and 17 June 1997.

After informed consent was given, participants were administered a structured questionnaire that included data on demographics, previous STD diagnoses, medical history, sexual behavior, knowledge of HIV/AIDS, and practices related to the prevention of HIV. Before having a physical examination by a clinic doctor and blood drawn for testing, patients received one-on-one pre-HIV test counseling with a clinic social worker, all of whom had Master's degrees in social work and participated in periodic seminars to develop HIV-focused counseling skills. Pre-test counseling included information about the routes of transmission of the virus, high-risk behaviors, prevention strategies, and a demonstration of the correct use of latex condoms using an anatomical model with a repeat demonstration by the patient. Sera was tested using commercially available enzyme-linked immunosorbent assay (ELISA) kits for detection of HIV-1 and HIV-2 antibodies (Genetic Systems HIV-1/HIV-2 EIA, Redmond,

Washington, USA). All blood positive by ELISA was confirmed by Western blot assay (Cambridge Biotech, Galway, Ireland). During screening and subsequent follow-up visits, all men were examined for evidence of STD during a detailed physical examination [2,7]: men were also counseled in abstinence or condom use with all sexual partners until their current STD was cured and their HIV test was confirmed as negative. At each 3-month interval visit, all clinical and behavioral assessments were repeated, in addition to on-going HIV prevention counseling, which focused on reinforcing messages of monogamy or, if monogamy was not possible, condom use with all extramarital sexual partners. At each visit all men were offered government-provided lubricated condoms at no cost and were free to take as many condoms as they wanted. Data on the number of condoms accepted and the number of patients refusing condoms were not collected.

Statistical analysis

The generalized estimating equations regression methods developed by Liang and Zeger [29] were used to analyze longitudinal trends in sexual behavior. Logistic regression models were developed for the outcomes of any condom use, CSW visits (post-screening), and consistent use of condoms with CSW. Men who returned for at least one follow-up visit were included in the analyses. To assess differential trends in behavior over follow-up time, interactions between each covariate and follow-up time were evaluated. Behavioral risk factors for acquisition of HIV infection were analyzed by calculating the HIV incidence rates stratified by various risk factors. Incidence rates were calculated as the ratio of the number of seroconverters over the person-years of follow-up, with 95% confidence intervals (CI) based on the Poisson distribution. For risk factors that may have varied over the course of follow-up (time-dependent covariates), the person-years of follow-up between the two visits were allocated to the risk category reported at the most recent visit. A Cox proportional hazards regression analysis with time-dependent covariates was performed to account for multiple risk factors that varied over time [30]. Time-dependent covariates included the following variables based on an individual's self-reported behavior in the prior 3 months: number of recent sexual partners, recent sex with a CSW, condom use with a CSW, current level of knowledge about HIV transmission, recent tattoo, recent medical injections, and recent blood transfusion. Version 6.12 of SAS was used to perform all statistical analyses (SAS Institute, Inc., Cary, North Carolina, USA).

Results

Table 1 shows characteristics of the men who were followed prospectively during the study, predictors of

continued visits to CSW after baseline counseling, and predictors of consistent condom use with CSW. At baseline, a majority of men (73%) were aged less than 30 years (median, 25 years; range, 18–70 years) and 46% had less than a high school education. The majority of the men were unmarried (60%) with only 3% of those being men who were widowed or divorced. Most of the unmarried men (75%) were residing with their family. Eighty-one per cent of the married men were residing with their spouse only or their spouse and extended family. Twenty-nine per cent were employed as unskilled laborers, 18% as skilled workers, 7% in business/professions/management, and 7% were unemployed. The median monthly income was Rs 375 (approximately US$ 10) per family member. Nearly one-third of the men had never heard of AIDS at their screening visit, and less than 25% were able to correctly answer more than nine out of 12 questions on modes of HIV transmission. Fifty-six per cent had a prior history of an STD and the majority (63%) had had sex

with a CSW in the 3 months before their baseline interview.

At the 6-month follow-up visit, the proportion reporting recent sex with a CSW had dropped to 16%, and remained steady until after 24 months, when a slight rise to 23% was observed. The independent predictors of men continuing to see CSW after baseline counseling were as follows: (i) being enrolled in the study before May 1996 ($P = 0.01$); (ii) having less than a high school education ($P = 0.02$); (iii) having a lower AIDS knowledge score after counseling ($P < 0.001$); (iv) being unmarried, regardless of living arrangements ($P < 0.001$), or married and not living with spouse ($P < 0.001$); (v) follow-up time longer than 24 months ($P = 0.02$); and (vi) the interaction of baseline history of STD and follow-up time. Amongst the 56% of men with a history of STD, the likelihood of visiting CSW increased as the follow-up time increased. At 6 months of follow-up they were no more likely to visit CSW

Table 1. Predictors of continued visits to sex workers after baseline counseling and consistent condom use with commercial sex workers (CSW) among men followed prospectively at two sexually transmitted disease (STD) clinics in Pune, India.

Predictors	No. (%) at baseline	Continued visits to CSW		Consistent condom use	
		OR (95% CI)	P	OR (95% CI)	P
Enrollment date					
May 1993–April 1994	523 (32.1)	1.00		1.00	
May 1994–April 1995	465 (28.6)	0.86 (0.67–1.10)	0.22	1.25 (0.86–1.81)	0.24
May 1995–April 1996	381 (23.4)	0.83 (0.63–1.10)	0.20	2.46 (1.67–3.63)	< 0.001
May 1996–April 1997	259 (15.9)	0.59 (0.40–0.89)	0.01	2.54 (1.51–4.26)	< 0.001
Age (years)					
< 30	1180 (72.5)	1.00		1.00	
≥ 30	448 (27.5)	0.97 (0.74–1.26)	0.80	0.74 (0.50–1.10)	0.13
Education*					
Less than high school	743 (45.7)	1.00		1.00	
High school or more	883 (54.3)	0.77 (0.62–0.96)	0.02	1.63 (1.21–2.19)	0.001
AIDS knowledge					
≤ 75%	1233 (75.7)	1.00		1.00	
> 75%	395 (24.3)	0.50 (0.41–0.61)	< 0.001	1.82 (1.34–2.46)	< 0.001
Marital status/living with whom					
Married					
Living with spouse or					
spouse and family	535 (32.9)	1.00		1.00	
Living alone	71 (4.4)	2.78 (1.75–4.41)	< 0.001	1.14 (0.56–2.33)	0.71
Living with other	53 (3.3)	2.46 (1.57–3.84)	< 0.001	0.78 (0.35–1.73)	0.54
Unmarried					
Living alone	198 (12.2)	3.48 (2.56–4.74)	< 0.001	1.83 (1.18–2.85)	0.007
Living with family/other	771 (47.4)	2.79 (2.18–3.57)	< 0.001	1.79 (1.22–2.62)	0.003
Follow-up time					
Baseline	1628 (100.0)	–		1.00	
≤ 6 months	1367 (84.0)	1.00		2.75 (1.92–3.95)	< 0.001
6–12 months	1136 (69.8)	1.11 (0.91–1.36)	0.31	3.65 (2.44–5.45)	< 0.001
12–18 months	772 (47.4)	1.24 (0.97–1.57)	0.08	3.56 (2.27–5.59)	< 0.001
18–24 months	499 (30.7)	1.29 (0.99–1.68)	0.06	3.44 (2.01–5.89)	< 0.001
> 24 months	307 (18.9)	1.38 (1.05–1.81)	0.02	4.65 (2.86–7.56)	< 0.001
History of STD during follow-up					
At baseline	917 (56.3)	–		1.38 (1.01–1.89)	0.04
At 6 months	755 (55.2)	1.27 (0.84–1.93)	0.26	–	
At 12 months	662 (58.3)	1.88 (1.20–2.95)	0.006	–	
At 18 months	461 (59.7)	2.56 (1.58–4.17)	< 0.001	–	
At 24 months	317 (63.5)	2.13 (1.13–4.03)	0.02	–	
At > 24 months	204 (66.4)	3.24 (1.88–5.60)	< 0.001	–	

*Two men were missing data on educational level, and two were missing data on recent condom use. OR, Odds ratio adjusted for other variables shown; CI, confidence interval.

than those entering the study with an initial episode of STD ($P = 0.26$), but by 18 months they were 2.6 times more likely to visit CSW ($P < 0.001$), and after 24 months of follow-up they were 3.2 times more likely to visit CSW ($P < 0.001$), indicating a more rapid recidivism rate in those with a prior history of STD.

Consistent condom use with CSW was predicted by (i) being enrolled in a later cohort ($P < 0.001$); (ii) having a high school or further education ($P = 0.001$); (iii) having a high AIDS knowledge score ($P < 0.001$); (iv) being unmarried and either living alone ($P = 0.007$) or with others ($P = 0.003$); (v) duration of follow-up; and (vi) reporting a history of prior STD at baseline ($P = 0.04$). After controlling for other factors, the level of consistent condom use with CSW increased proportionately with follow-up time: at 6 months, men were 2.8 times more likely to consistently use condoms ($P < 0.001$), at 18 months they were 3.6 times more likely ($P < 0.001$), and after 24 months they were 4.7 times more likely to be using condoms every time.

Logistic regression was used to examine the change in 'any' condom use with all partners over follow-up time. Independent predictors of any condom usage were (i) age less than 30 years ($P = 0.02$); (ii) high school or more education ($P < 0.001$); (iii) higher AIDS knowledge score ($P < 0.001$); (iv) being unmarried ($P < 0.01$); (v) having multiple sex partners ($P < 0.001$); (vi) having a prior STD history ($P = 0.03$); and (vii) the interaction of CSW contact and length of follow-up (Fig. 1). At baseline, 30% of men with CSW partners reported any condom use, compared to 17% of men without CSW partners (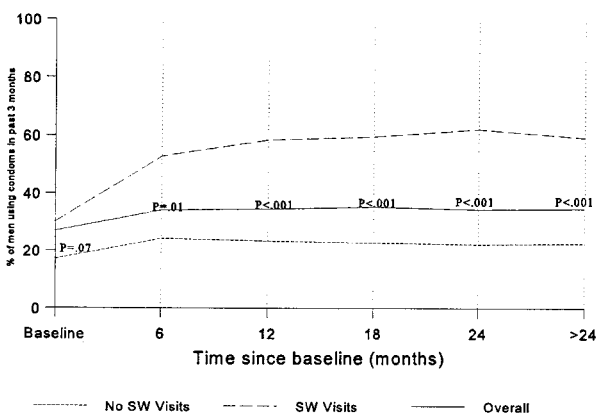$P = 0.07$). Throughout the follow-up period, men who continued to see CSW increased their use of condoms significantly compared with men without CSW partners. At 12 months of follow-up, 58% of men seeing CSW reported any condom use compared with 23% ($P < 0.001$), and by 24 months of follow-up, men with CSW partners still had condom use rates that were significantly higher than men with no CSW partners (62 versus 22%; $P < 0.001$).

'Any' condom use includes 'sometimes' and 'always' using condoms with sex partners. To examine changes between inconsistent and consistent use we graphed these categories of use with CSW and with other female partners over time (Fig. 2). At baseline, of those men with CSW partners, 19% reported sometimes using condoms and 10% reported always using condoms. Over the first 12 months of follow-up, reported use of condoms with CSW rose: at 6 months, 16% reported sometimes and 36% reported always using a condom with a CSW, and at 12 months 18% reported sometimes, and 40% reported always using a condom. These positive behaviors were maintained through 24 months with 41% reporting always and 18% reporting sometimes using condoms with CSW partners.

With Female Sex Workers

With Other Partners
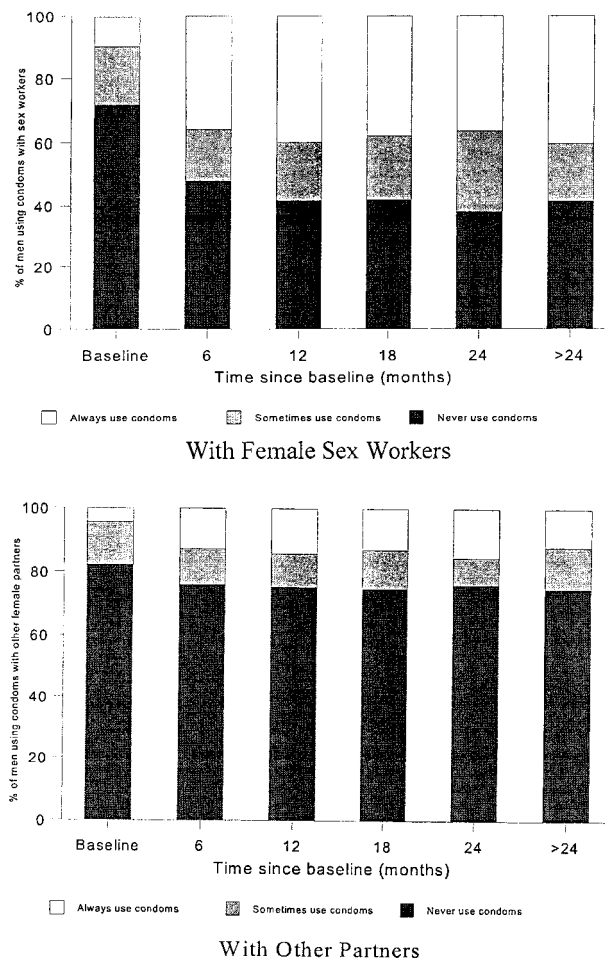
Fig. 2. Condom use over time by partner type.

Fig. 1. Any condom use over time by commercial sex worker (CSW) visits. *P* values shown test the difference in condom use between men visiting CSW and those not visiting CSW at each timepoint, after adjusting for year of enrollment, age, marital status, education, AIDS knowledge, multiple sex partners, and current or prior sexually transmitted disease by logistic regression analysis.

In general, the rate of condom use with other female partners was quite low. The rate of always using condoms with other female partners increased from 5% at baseline to 13% at 6 months and maintained that level throughout the 24 months. Use of condoms sometimes with other female partners remained essentially unchanged from the baseline rate of 13%. Predictors of consistent condom use with other partners were (i) having a high school or more education (P = 0.03); (ii) scoring more than 75% on the AIDS knowledge test (P = 0.007); (iii) being unmarried (P < 0.001); and (iv) follow-up time (data not shown).

In order to assess the validity of self-reported sexual behavior, the association between high-risk behavior and diagnosis of STD was examined (Fig. 3). A significant trend was found between reported level of recent condom use and a diagnosis of one or more of the following STD at the baseline visit: gonorrhea, nongonococcal urethritis, trichomonas, syphilis, chancroid, lymphogranuloma venereum, granuloma inguinal, and genital molluscum (P = 0.001). Those reporting no recent partners had the lowest prevalent STD rate of 22%, those who consistently used condoms in the prior 3 months had the next lowest rate of 28%, while 48% of those who sometimes used condoms and 53% of those who never used condoms were diagnosed with

an STD. This trend remained significant (P = 0.001) throughout the 24-month follow-up period. Similarly, self-reports of recent visits to CSW were associated with STD diagnosis. Those reporting CSW visits at baseline had double the STD rate (57%) of those reporting no recent CSW visits (28%; P = 0.001), and this trend was maintained throughout follow-up. These results indicate that while self-report of this sensitive information may not be completely accurate, the general trends are consistent with biological findings, and that consistency is maintained over the course of follow-up.

To assess the efficacy of condom use in preventing acquisition of HIV infection in this group of men, a proportional hazards regression analysis was performed with incident HIV infection as the outcome (Table 2). HIV incidence rates among men who reported having sex with CSW ranged from 4.0 per 100 person-years (95% CI, 1.5–8.7) in men who reported always using condoms to 14.0 (95% CI, 9.7–19.7) in men who never used condoms. After controlling for other risk factors, men who reported always using condoms with CSW were no more likely to acquire HIV infection than men who did not have sex with CSW [relative risk (RR), 0.68; P = 0.42]. Men who reported sometimes using condoms with CSW were less protected
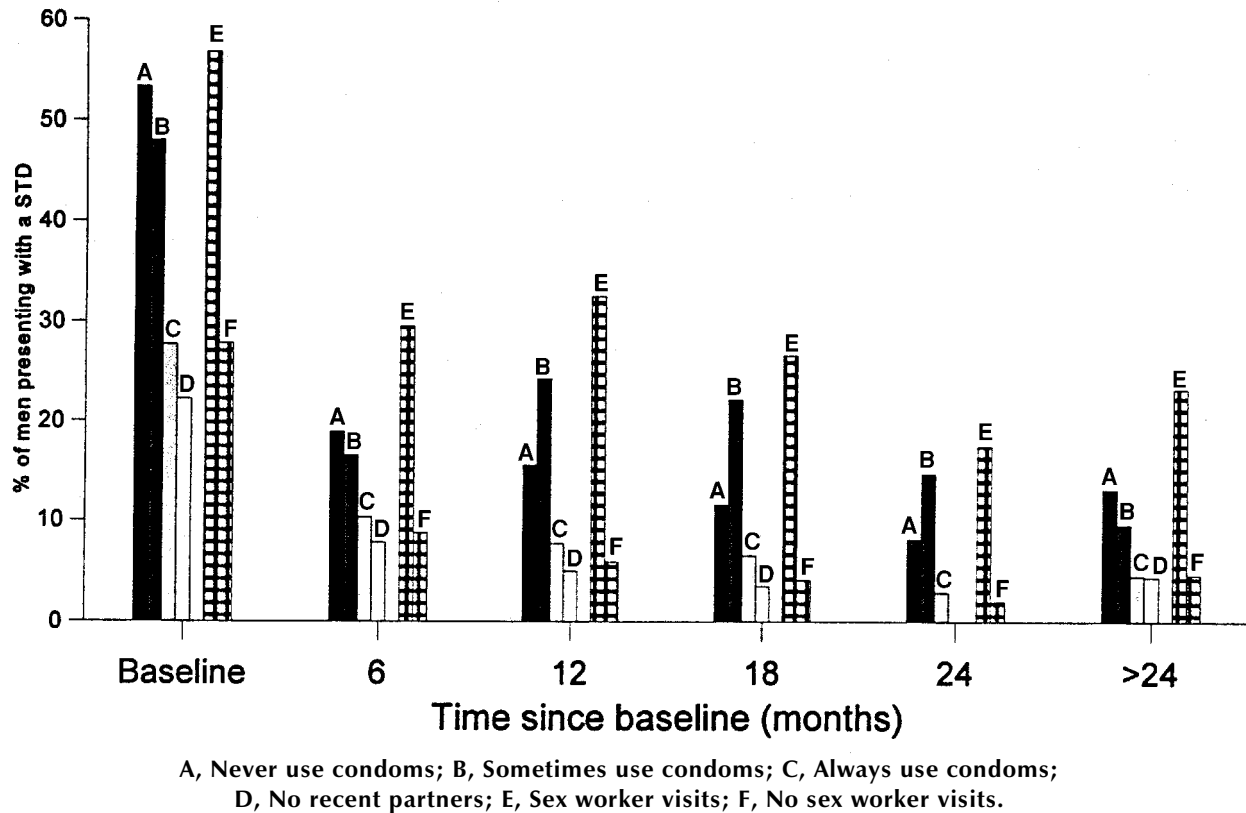

A, Never use condoms; B, Sometimes use condoms; C, Always use condoms;
D, No recent partners; E, Sex worker visits; F, No sex worker visits.

Fig. 3. Sexually transmitted disease (STD) rates over time by reported risk behaviors. P = 0.001 test for trend in STD rates by different levels of condom use and STD rates by sex worker visits at each timepoint.

Table 2. Risk of HIV seroconversion among men with recent commercial sex worker (CSW) visits, by condom use.

Characteristic	No. seroconversions	PY	HIV incidence (95% CI)	RR	P	Adjusted RR* (95% CI)	P
Recent sex with a CSW[†]							
No	78	1272.4	6.1 (4.9–7.7)	1.00	–	1.00	–
Always used condoms	6	150.1	4.0 (1.5–8.7)	0.65	0.41	0.68 (0.26–1.75)	0.42
Sometimes used condoms	10	106.4	9.4 (4.5–17.3)	1.53	0.28	1.52 (0.61–3.77)	0.37
Without condoms	33	235.4	14.0 (9.7–19.7)	2.29	< 0.001	2.94 (1.63–5.30)	< 0.001

*Adjusted for other factors (date of enrollment, age, living with family, AIDS knowledge, recent tattoo, multiple partners, recent injection, recent transfusion, circumcision) by Cox proportional hazards regression analysis. [†]In past 3 months. Seroconverters were missing data for the following variables: living with family (n = 7), recent tattoo (n = 8), recent medical injection (n = 7), recent blood transfusion (n = 7). PY, Person-years; CI, confidence interval; RR, relative risk.

(RR, 1.52; $P = 0.37$), but men who reported never using condoms with CSW were at high risk (RR, 2.94; $P < 0.001$). Among men with CSW exposure, there is a clear dose response between HIV acquisition and level of condom use.

Finally, we examined increases in AIDS knowledge and monogamy (data not shown). At baseline, 45% of men knew that condoms could prevent sexual transmission of HIV. At the 6-month follow-up visit, that proportion had increased to 89% and continued to increase with subsequent visits reaching 96% at 24 months of follow-up. A similar pattern was observed for general HIV transmission knowledge. At baseline, only 24% of men were able to correctly answer more than nine out of 12 HIV transmission questions. That percentage increased to 76% at 6 months, 83% at 12 months, and 90% at 24 months of follow-up. The individual changes in HIV knowledge over time were assessed. In the first 6 months of follow-up, the knowledge scores increased a mean of 33.3 percentage points from the prior visit. At 12 months, the mean increase was 12.1 percentage points, at 18 months it was 8.1 percentage points, and at 24 months of follow-up, the mean increase in knowledge scores was 5.0 percentage points. Monogamy in this cohort of men increased from 61% at baseline to 89% at 6 months. A slight but steady decrease in monogamy was subsequently observed. Eighty-seven per cent of men were monogamous at 12 months, as were 84% at the 24-month follow-up.

Discussion

Several studies have documented the continuing high incidence and prevalence rate of HIV in India, with the epidemic moving into groups previously considered at low risk [31]. Condoms have been used at low rates for both family planning and STD prevention and accurate knowledge of HIV and AIDS is low in the general public. In our study, only 10% of the men seen at their first clinic visit reported consistent condom use with CSW, 78% had one or more STD, and 20% were already HIV-positive. During the course of the study we saw several important changes.

First, we noted a sizable reduction in the number of men who reported visiting a CSW, from 63% at baseline to 16% at 6 months and to 23% at 24 months of follow-up. Second, a significant and sustained increase in condom use was noted over time among men continuing to visit CSW. At baseline 30% of men with CSW partners compared with 17% of men without CSW partners reported any condom use ($P = 0.07$). At 12 and 24 months of follow-up, these proportions had increased to 58 versus 23% ($P < 0.001$) and 62 versus 22% ($P < 0.001$), respectively. Third, a significant trend ($P = 0.001$) was found between reported level of recent condom use and diagnosis of an STD. Fourth, the risk of HIV seroconversion in men enrolled in our study was lowest for those who reported always using condoms (adjusted RR, 0.68; $P = 0.42$, HIV incidence 4.0 per 100 person-years) compared with those who reported never using a condom (adjusted RR, 2.94; $P < 0.001$, HIV incidence 14.0 per 100 person-years). However, even for men reporting always using condoms after being enrolled in the study, HIV incidence rate was high.

We found that study participants with less education, single or not living with a spouse, with less accurate information about HIV/AIDS, and who had a history of STD were most likely to continue to see CSW, and less likely to change behavior or maintain behavior especially as follow-up time increased. It is possible that some of these men, learning they were HIV-negative at screening and at each follow-up visit, may have had a false sense of security [32] and therefore continued to see CSW and not use condoms. It is also possible that secular trends, such as intensifying efforts by governmental and non-governmental organizations to provide AIDS education, along with increased coverage of the epidemic by mass media, had raised AIDS awareness, affecting men's willingness to adopt behavior change. We did find evidence of such secular trends in visits to CSW and consistent condom use with CSW. By the fourth year of the study (mid-1996) a significant decrease in visits to brothels was observed, and even

earlier (mid-1995) an increase in consistent condom use with CSW was found relative to those entering the study in prior years.

Condom use with other sex partners was low and remained virtually unchanged during the period of study, especially among men who reported never or sometimes using condoms with other sex partners. The change seen in men who reported always using condoms with other sex partners was encouraging, with condom use increasing from 4 to 12%. We are unsure whether this was related directly to counseling and testing, but this finding certainly demands focused behavioral assessment of counseling interventions that will motivate never or sometimes condom users into adopting more consistent condom use with long-term sexual partners.

In this study we found that although older men were no more likely than younger men to continue visiting brothels, they were less likely to adopt the use of condoms. Similarly, married men were less likely to use condoms, but they were also less likely to visit CSW after counseling (except those who were not living with their spouse). Men with a prior history of STD were more likely to visit CSW, and more likely to use condoms. Low education and lower HIV transmission knowledge were consistently related to continued visits to brothels and lack of condom use. These findings suggest that instead of generic counseling messages, counseling prevention messages should be focused more specifically to participant age, education, marital status, and previous STD history.

Of concern is the high rate of HIV incidence (4.0) in men who reported always using condoms with CSW. The number of men who reported always using condoms who seroconverted was quite small (n = 6) and this finding could be due to positive response bias in these men. It might also reflect behavior change prior to initiation into the study, so that men answered 'always' about behavior they had just adopted. Alternatively, respondents could be incorrectly using condoms.

The study had several limitations. Study participants were not a randomly selected sample of all men attending these two STD clinics in Pune: only 30% of eligible subjects were willing to be enrolled in the longitudinal study and participants tended to be younger, more knowledgeable about HIV/AIDS, more likely to have used a condom in the last 3 months, and less likely to have genital ulcer disease than non-participants. Although low participation rates have been found in other HIV studies based in STD clinics [33], this bias poses a threat to the generalizability of our study findings. Patient participation may have been limited by the daily challenges many of our patients face, such as difficulty getting to the clinics, loss of wages or diffi-

culty taking time off from work (most were low wage or daily wage earners), time needed in the clinic to complete study protocols (45 min on average), unwillingness to disclose to family their visit to an STD clinic, or fear of being stigmatized by being enrolled in a study concerned with HIV (even though participants were HIV-negative, others may assume they were HIV-positive) may have been contributing factors.

Study participants were not randomized into intervention or control arms of our study, which was originally focused on the epidemiology of HIV/AIDS in this region of India, not the effect of counseling on behavior. Although at the time the study was initiated (1993) absence of, or limited, pre- and post-test HIV counseling was the 'standard of care' in India, we felt that not providing counseling and instruction in correct condom usage, one of the few interventions that has been shown to stop transmission of HIV and other STD when used correctly, could not be ethically justified. Recent research in India has shown that even among men using condoms, they are often used incorrectly, putting men at risk for infection [21]. As a result all enrollees received pre-test and post-test counseling at each follow-up visit so we cannot directly assess the effect of counseling on risk behavior. Also, we did not assess study participants' maintenance of correct use of condoms so were unable to assess any decay in condom use skills. These important limitations need to be taken into consideration for future studies. However, this panel study was the first longitudinal study to examine the association between counseling and testing on subsequent HIV risk behavior in India and the study design strengthens the interpretation of our findings.

Men play a pivotal role in slowing the AIDS epidemic in India. Increasing condom use and decreasing high-risk behaviors in men is currently the best strategy for attenuating the AIDS epidemic in India. The potential effectiveness of such a strategy is exemplified in a recent report by the WHO where greater than 50% declines in HIV-1 rates in Uganda were attributed to greater condom use and changes in sexual behavior [34]. Individual counseling and testing approaches to STD/HIV prevention and condom use can bring about behavior change. We found that ongoing counseling that reinforced desired behaviors and aimed at sustaining those changes over time did have a positive outcome with a large proportion of the men recruited for this study. However, counseling and testing, which provides information about HIV transmission and serostatus, is not sufficient for changing behavior for the majority of the individuals seen in these clinics in India [35], as is the case in many other communities struggling to meet the challenge of the AIDS pandemic. Social and cultural factors, like poverty, lack of access to condoms, low self-efficacy of most Indian women to negotiate condom use, and belonging to

marginalized or stigmatized communities (such as CSW), make it difficult for individuals to fulfil the intention to change behavior [36,37]. The ultimate goal of HIV prevention efforts must also focus on efforts to change the behaviors and norms of entire communities [22].

Acknowledgments

References

1. Lalvani A, Shastri JS: **HIV epidemic in India: opportunity to learn from the past.** *Lancet* 1996, **347**:1349–1350.
2. Mehendale SM, Rodrigues JJ, Brookmeyer RS, *et al.*: **Incidence and predictors of human immunodeficiency virus type 1 sero-conversion in patients attending sexually transmitted disease clinics in India.** *J Infect Dis* 1995, **172**:486–491.
3. Jain MK, John TJ, Keusch GT: **Epidemiology of HIV and AIDS in India.** *AIDS* 1994, **8** (suppl 2):S61–S75.
4. Anthony B, Mertens TE, Lal S: **Estimation of adult HIV preva-lence as of the end of 1994.** *Indian J Public Health* 1995, **39**:79–85.
5. Solomon S, Kumarasamy N, Ganesh AK, Amalrau RE: **Prevalence and risk factors of HIV-1 and HIV-2 infection in urban and rural areas in Tamil Nadu, India.** *Intl J STD AIDS* 1998, **9**:98–103.
6. Brookmeyer R, Quinn TC, Shepherd M, Mehendale S, Rodrigues J, Bollinger RC: **A new method for estimating current HIV inci-dence rates.** *Am J Epidemiol* 1995, **142**:709–713.
7. Rodrigues JJ, Mehendale SM, Shepherd ME, *et al.*: **Risk factors for HIV infection in people attending clinics for sexually transmitted diseases in India.** *BMJ* 1995, **311**:283–286.
8. Jayaraman KS: **AIDS in position to ravage India.** *Nat Med* 1996, **2**:951.
9. Narain JP, Jha A, Lal S, Salunke S: **Risk factors for HIV trans-mission in India.** *AIDS* 1994, **8** (suppl 2):S77–S82.
10. Gangakhedkar RR, Bentley ME, Gadkari DA, *et al.*: **Spread of HIV infection in married monogamous women in India.** *JAMA* 1997, **278**:2090–2092.
11. Pachauri S: **Breaking the silence.** In *Whispers from Within: The Unheard Voices of HIV/AIDS.* Edited by Solomon S. Chennai: YRG CARE Centre for AIDS Research; 1997.
12. de Zoysa I, Sweat MD, Denison JA: **Faithful but fearful: reduc-ing HIV transmission in stable relationships.** *AIDS* 1996, **10** (suppl A):S197–S203.
13. Nag M: *Sexual Behavior and AIDS in India.* Delhi: Vikas; 1997:xv.
14. Nag M: **Sexual behavior and AIDS in India: state-of-the-art.** *Ind J Soc Work* 1994, **4**:503–546.
15. Basu DP: **Appropriate methodologies for studying sexual behavior in India.** *Ind J Soc Work* 1994, **4**:573–588.
16. JeJeebhoy SJ: **Adolescent sexual and reproductive behavior: a review of the evidence from India.** *Soc Sci Med* 1998, **46**:1275–1290.
17. Dasgupta PR, Jain MK, John TJ: **Government response to HIV/AIDS in India.** *AIDS* 1994, **8** (suppl 2):S83–S90.
18. Thapa S: *Social Marketing of Condoms in India: What do we know? [Briefing Paper].* New Delhi: Ministry of Health and Family Welfare/US Agency for International Development, Family Health International, Operations Research Group; 1992.
19. *National Family Health Survey, 1992–93. Chapter 6.* Pune/Bombay: Population Research Centre Gokhale Institute of Politics and Economics/International Institute for Population Sciences; 1995:77–105.
20. George A, Jaswal S: *Understanding Sexuality: An Ethnographic Study of Poor Women in Bombay, India (Research Report Series No. 12).* Washington, DC: International Center for Research on Women; 1995.
21. Sharma V, Dave S, Sharma A, Chauhan P: **Condoms: mis-use = non-use. The condom equation in Gujarat, India.** *AIDS Care* 1997, **9**:707–713.
22. Campbell CH Jr, Marum ME, Alwano-Edyegu M, Dillon BA, Moore M, Gumisiriza E: **The role of HIV counseling and testing in the developing world.** *AIDS Educ Prev* 1997, **9** (suppl B):92–104.
23. Colebunders R, Ndumbe P: **Priorities for HIV testing in devel-oping countries?** *Lancet* 1993, **342**:601–602.
24. de Zoysa I, Phillips KA, Kamenga MC, *et al.*: **Role of HIV coun-seling and testing in changing risk behavior in developing countries.** *AIDS* 1995, **9** (suppl A):S95–S101.
25. Wolitski RJ, MacGowan RJ, Higgins DL, Jorgensen CM: **The effects of HIV counseling and testing on risk-related practices and help-seeking behavior.** *AIDS Educ Prev* 1997, **9** (suppl B):52–67.
26. Allen S, Serulilira A, Bogaerts J, *et al.*: **Confidential HIV testing and condom promotion in Africa: impact of HIV and gonor-rhea rates.** *JAMA* 1992, **268**:3338–3343.
27. Phanuphak P, Müller O, Sarangbin S, Sittitrai W: **Knowledge, attitudes and behaviour among HIV-positive and HIV-nega-tive clients of a confidential HIV counselling and testing cen-ter in Thailand.** *AIDS* 1994, **8**:1315–1319.
28. Balk D, Lahiri S: *Awareness and Knowledge of AIDS among Indian Women: Evidence from 13 States [Working Paper No. 83].* Honolulu: East–West Center; 1996.
29. Liang KY, Zeger SL: **Longitudinal data analysis using general-ized linear models.** *Biometrika* 1986, **73**:13–22.
30. Cox DR: **Regression models and life tables.** *J R Stat Soc B* 1972, **34**:187–220.
31. Gangakhedkar RR, Bentley ME, Divekar AD, *et al.*: **Spread of HIV infection in married monogamous women in India.** *JAMA* 1997, **278**:2090–2092.
32. Zimmerman MA, Pham CT, Steinman KJ: *HIV/AIDS Education: National Surveys, Counseling and Testing Programs and the Role of Physicians [Background Paper].* Washington, DC: The Office of Technology Assessment, US Congress; 1995.
33. **CDC recommendations and reports, Jan 15, 1993.** *MMWR* 1993, **42** (RR-2).
34. Kigotho AW: **HIV-1 statistics bring good news for Uganda.** *Lancet* 1997, **350**:1456.
35. Rosenberg ML, Tolsma DD, Kolbe LJ, Kroger F, Cynamon ML, Bowen GS: **The role of behavioral sciences and health educa-tion in HIV prevention: experience at the US Centers for Disease Control.** In *AIDS Prevention through Education: A World View.* Edited by Septulveda J, Fineberg H, Mann J. New York: Oxford University Press; 1992:175–198.
36. O'Reilly KR, Piot R: **International perspectives on individual and community approaches to the prevention of sexually transmitted disease and human immunodeficiency virus infection.** *J Infect Dis* 1996, **174** (suppl 2):S214–S222.
37. Das M: **Bad medicine: AIDS, culture and women's health.** *Harvard Int Rev* 1996, **18**:72–73.