HIV prevalence, previous HIV testing, and condom use with clients and regular partners among Senegalese commercial sex workers

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Objectives: To assess HIV prevalence and risk factors for HIV infection, to investigate condom use among registered female commercial sex workers (CSWs) in Senegal, West Africa, and to examine the association between previous HIV testing, knowledge of HIV serostatus and condom use with both regular sex partners and clients within this population.

Methods: A cross-sectional study was conducted at three sexually transmitted disease clinics among 1052 Senegalese registered CSWs between 2000 and 2004. Inperson interviews soliciting information concerning demographic characteristics, medical history, sexual behaviour with clients and regular partners, and previous HIV testing history were performed. Blood samples were collected for determination of HIV-1 and/or HIV-2 serostatus. Multivariable, Poisson and log-binomial models were used to calculate prevalence ratios.

Results: The overall HIV prevalence was 19.8%. Over 95% of CSWs reported always using a condom with clients, but only 18% reported always using a condom with their regular partners. A history of previous HIV testing was not associated with condom use with clients (adjusted prevalence ratio (APR)=0.98, 95% confidence intervals, CI: 0.90 to 1.06). However, prior HIV testing was associated with decreased condom use with their regular partners (APR=0.44, 95% CI: 0.28 to 0.69), especially in women who tested HIV negative (APR=0.17, 95% CI: 0.08 to 0.36).

Conclusions: CSWs in Senegal have a high HIV prevalence; therefore preventing HIV transmission from this population to the general population is important. Condom use with regular partners is low among registered CSWs in Senegal, and a prior HIV negative test is associated with even less condom use with regular partners. Intervention efforts to increase condom use with regular sexual partners are needed.

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Senegal has been recognised by the United Nations as one of the first countries in Africa to launch a national STI control programme and successfully control the HIV epidemic at an early stage.¹ Although Senegal's epidemic began at the same time as other African countries, Senegal has experienced long-feted success in HIV control, maintaining an HIV prevalence below 2% among adults.^{1–2} However, this overall low and stable HIV prevalence obscures the HIV epidemic among some high-risk groups such as commercial sex workers (CSWs). According to sentinel surveillance data between 1989 and 2002, HIV seroprevalence rates have increased from approximately 5% to 20% among Senegalese female sex workers, a prevalence substantially higher than that in the general population.^{2–3} As a Western African country, Senegal's HIV epidemic comprises both HIV-1 and HIV-2 infections.⁴

CSWs are an important reservoir for HIV infection in many African countries.⁵ Their clients and regular sex partners serve as bridge populations for the spread of HIV to the general population, since both often have a high prevalence of HIV and are at high risk of contracting HIV.⁶ Therefore, preventing HIV transmission from CSWs to their partners as well as from sex partners to CSWs is important in maintaining the continued low HIV prevalence in Senegal. Consistent condom use is very effective in preventing sexual transmission of HIV.^{7–12} However, condom use varies widely, depending on the type of sexual relationship. With the development of rapid test technology, and the scale-up of antiretroviral treatment, the US CDC and WHO intend to increase the coverage of HIV testing in order to detect more HIV-infected individuals who may benefit from treatment by recommending routine HIV testing among various populations.^{13–14} However, cost-effectiveness, logistics and

human rights concerns have been raised regarding this strategy.

As a sexually transmitted disease (STD) control policy, commercial sex work has been legalised in Senegal since 1969. Legal CSWs, who must be 21 years or older, must register at an STD clinic and return for monthly STD screening and treatment.^{3–15} A number of CSWs in Senegal had been previously screened for HIV as part of the STD control programme or in the context of previous scientific studies. In this study, we describe the HIV prevalence and risk factors for HIV infection in registered Senegalese CSWs in three sites and examine the associations between previous HIV testing and knowledge of HIV serostatus and condom use with their clients and regular sex partners.

METHODS

Between 2000 and 2004, as part of a longitudinal study to assess the presence of HIV-1 and HIV-2 RNA in the oral mucosa, we conducted a cross-sectional study to identify sexual behaviours associated with HIV-1 and HIV-2 infection among Senegalese sex workers. A convenience sample of consecutively presenting CSWs was recruited from three STD clinics in Dakar, Mbour and Sebikotane, Senegal, which are under the direction of the National AIDS Control Programme for Senegal. Eligible study participants were at least 21 years of age (the minimum age to register legally as a CSW), currently working as a registered CSW and able to provide verbal informed consent. Study subjects received no monetary incentives to participate in

Abbreviations: APR, adjusted prevalence ratio; CSW, commercial sex worker; PR, prevalence ratio; STD, sexually transmitted disease

the project. However, as part of study procedures, a cervical Pap smear and dental exam, as well as treatment of cervical lesions and dental problems, were provided to study participants. All study procedures were approved by the institutional review boards at the University of Washington, the University of Dakar, and the Senegalese National AIDS Committee, and all subjects provided informed consent.

Data collection

At each study site, a standardised interview was conducted by a study social worker, which elicited general demographic characteristics, medical history, previous HIV test history and results and sexual behaviour with regular partners and clients. The specific questions regarding condom usage were asked without a historical timeline or reference to specific partners. With regular partners, the question was asked: How frequently do you use condoms? (never, rarely, sometimes, often, always). Similarly, with clients: How frequently do you use condoms? (never, rarely, sometimes, often, always). Blood samples were collected for HIV testing from all women, and those who tested positive for HIV were given both pre- and post-test counselling. Serum specimens were first screened for HIV antibodies using the Genetic Systems HIV-1/HIV-2 EIA (Genetic Systems, Redmond, WA). Positives were confirmed by HIV-1 and 2 western blots according to the manufacturer's instructions (Diagnostics Pasteur, Redmond, WA), and by peptide assays (Genetic Systems, Redmond, WA).

Data analysis

To identify risk factors associated with HIV-1 and HIV-2 seropositivity among CSWs, Pearson's chi-square test was used for categorical comparisons in univariate analyses. Continuous variables such as age, duration of commercial sex work and client number were categorised into two to four categories. Multivariate Poisson regression were applied using variables that showed significant association or potential confounding effects based on the univariate analyses, and adjusted prevalence ratios (APRs) were estimated.

To evaluate the association between previous HIV testing and current condom use, log-binomial models to estimate PRs and 95% confidence intervals¹⁶ were constructed separately for current condom use with regular partners and clients, using "always uses a condom" as the dependent variable, collapsing the other categories ("never", "rarely", "sometimes" and "usually" into a "not always" reference category, and "previous HIV testing" as the primary independent variable. We further investigated whether knowing the prior HIV test results, either positive or negative, had any influence on current condom use with regular partners and clients. Log-binomial models were constructed, comparing condom use between CSWs who had tested HIV positive, tested HIV negative, tested but did not know their results and those who had never tested for HIV. Participation in a previous study, study site, age, education, marital status, current genital ulcers and treatment history for STDs were considered as potential confounders based on previous reports in the literature.

All analyses were two-sided, and $p < 0.05$ was considered statistically significant. Analyses were performed using SAS 9.0 (SAS Institute, Cary, NC); Poisson regression and log-binomial models were fitted by the SAS PROC GENMOD command.¹⁷

RESULTS

In total, 1052 CSWs enrolled and completed interview questionnaires at the three study sites, including 623 women in Dakar, 311 women in Mbour and 118 women in Sebikotane (table 1).

The average age of the study participants was 35.0 years. Almost half (47.2%) had no education, and 36.6% had only a primary education. Most (93.5%) reported being Muslim (data not shown). The majority (68.6%) of CSWs were divorced or separated, while nearly a quarter (22.9%) had never married. The mean reported age of sexual debut was 16.4 years. The median duration of commercial sex work was 4 years; 40.9% had been working for less than 3 years, while 28.7% had been involved in commercial sex work for more than 10 years. The main venues for identifying clients included bars (51.8%) and hotels (34.2%) (data not shown). Four-hundred and fifty-two (43.2%) women reported at least one regular sexual partner at study entry, and of these, the median lifetime number of regular partners was two, with 18.2% reporting four or more lifetime regular sex partners (data not shown). Nearly three-quarters of women reported having sex with their regular partner on average once (43.3%) or twice (30.0%) per week, and 12.8% reported that their regular partner was uncircumcised (data not shown). Most women (70.3%) had received prior HIV testing; however 61 women (8.3%) were unsure whether or not they had ever been tested. Among those who had a prior HIV test, nearly half did not know their results, while 331 (44.8%) women reported that their most recent HIV test was negative, and 61 (8.3%) reported they were HIV positive.

The overall HIV prevalence across the three study sites was 19.8% (95% CI: 17.5 to 22.4%) and ranged from 15.4% at the Sebikotane clinic to 21.4% at the Dakar site. HIV-1 was more prevalent than HIV-2 infection (13.2% vs 4.8%), while co-infection with HIV-1 and HIV-2 was less common (1.9%). Parallel analyses were performed to evaluate the risk factors for HIV-1 and HIV-2 infection separately. Results were similar except when noted; for ease of presentation, we have reported risk factors for HIV infection, regardless of HIV type.

Demographic characteristics independently associated with HIV seropositivity (regardless of type) included age, education, marriage status, sex at an early age, current genital ulcers and a history of STD treatment, bleeding during sex or irregular vaginal bleeding history (table 2).

Compared with women in their 20s, women in their 30s and 40s were 1.5 times as likely to be HIV-infected. Further, women older than 50 were three times more likely to be HIV positive compared with women in their 20s (APR = 3.06, 95% CI: 1.80 to 5.21). This was especially true with respect to HIV-2 infection, as 14% of HIV-2-infected CSWs were over 50, compared with less than 3% of HIV-negative CSWs (data not shown). Married/cohabiting women were more likely to have HIV compared with women who were never married (APR = 1.95, 95% CI: 1.07 to 3.56). Having a current regular sex partner was not associated with being HIV-infected (APR = 0.99, 95% CI: 0.76 to 1.28), although among those with a current regular sex partner, having multiple lifetime regular sex workers was somewhat associated with increased risk for HIV (APR = 1.68, 95% CI: 0.95 to 2.97; data not shown). Women with a primary (APR = 0.69, 95% CI: 0.52 to 0.91) or secondary (APR = 0.59, 95% CI: 0.39 to 0.91) education were less likely to be HIV-1 and especially HIV-2 positive compared with women with no formal education. Women whose sexual debut was before age 16 were 1.35 times as likely to be HIV-infected compared with those who initiated sex at 16 or later.

In analyses adjusting for both demographic factors and other factors related to commercial sex work, being in commercial sex work for 3–10 years increased the risk of being HIV seropositive by 66% (APR = 1.66, 95% CI: 1.20 to 2.30) compared with less than 3 years' duration of commercial sex work. HIV-2 infection was more strongly associated with increased years of sex work, as women with 3 or more years of experience were more than five times as likely to be HIV-2-infected, respectively, compared

Table 1 Characteristics of registered commercial sex workers interviewed in Senegal between 2000 and 2004

Variable	Total N = 1052 (%)
Study site	
Dakar	623 (59.2)
Mbour	311 (29.6)
Sebikotane	118 (11.2)
Age, mean (SD)	35.0 (8.1)
Education	
None	495 (47.2)
Primary	384 (36.6)
Secondary or more	169 (16.1)
Marital status	
Never married	240 (22.9)
Married/cohabiting	32 (3.1)
Widowed	56 (5.4)
Divorced/separated	718 (68.6)
Age at first intercourse, mean (SD)	16.4 (3.1)
Years of commercial sex work, median (range)	4 (0, 31)
<3 years	425 (40.9)
3–10 years	316 (30.4)
10 years or more	299 (28.7)
HIV positive	208 (19.8)
HIV-1 only	138 (13.2)
HIV-2 only	50 (4.8)
Dual infection with HIV-1 and HIV-2	20 (1.9)
Always use a condom with a client	972 (95.4)
Have a regular partner at the study time	452 (43.2)
Always use a condom with regular partner	82/452 (18.2)
Previous HIV test	
Don't know	61 (5.8)
No	252 (24.0)
Yes	739 (70.3)
Previous HIV test results (if previous test, n = 739)	
Negative	331 (44.8)
Positive	61 (8.3)
Don't know	347 (47.0)

with women with less than 3 years of experience (data not shown). Women who had over 20 clients per month were twice more likely to be HIV positive than women who had fewer than 10 clients per month, and sex workers who charged less than 5000 CFA (approximately US\$10) for each service had 1.25 times the risk of being HIV positive (95% CI: 0.92 to 1.68), although this did not reach statistical significance. In contrast, HIV seropositivity was not associated with the venue (bars, hotels or other locations) used to identify clients or self-reported condom use with clients.

Overall, 95.4% of CSWs in this study reported always using a condom with their clients. However, only 82 out of 452 (18.1%) of the women with a current regular partner reported always using condoms with those partners, with rates varying from 13.5% to 21.5% at the three study sites. We observed that 62.1% of the CSWs always used condoms, 33.3% always used condoms with clients but not their regular partners, and 4.6% did not always use condoms even with their clients. In univariate analyses, women who reported that they always used condoms with their regular partner(s) were somewhat more likely to be older than women who did not (table 3).

Consistent condom users were also somewhat less likely to be born in Senegal, have secondary or higher education level, and drink and/or smoke, were less likely to have abnormal vaginal discharge (APR = 0.41, 95% CI: 0.26 to 0.64), but were more likely to report current irregular vaginal bleeding (APR = 2.86, 95% CI: 1.49 to 5.50). Women who always used condoms with their regular partners were significantly less likely to have multiple lifetime regular partners (APR = 0.21, 95% CI: 0.21 to 0.32) and were less likely to report sex more than once per week with their regular partner(s) (APR = 0.36, 95% CI: 0.23 to 0.56)

compared with women who did not always use condoms. Further, consistent condom users were more likely to have an uncircumcised partner (APR = 1.75, 95% CI: 1.09 to 2.81).

In multivariate analyses, condom use with clients was not associated with previous HIV testing history (APR = 0.98 95% CI: 0.90 to 1.06), or with knowing previous positive test results (APR = 0.99, 95% CI: 0.82 to 1.09), adjusting for previous study, study site, age, genital ulcers and treatment of STDs (table 4).

However, among women who had a current regular partner (n = 450), previous HIV testing was inversely associated with consistent condom use with their regular partners (APR = 0.44, 95% CI: 0.28 to 0.69), regardless of the previous HIV test result. Women who reported that they were HIV negative were approximately 80% less likely to always use condoms with their regular partner (APR = 0.17, 95% CI: 0.08 to 0.36) compared with women with no previous HIV testing. This appeared to be true even among women who reported that they were HIV positive and were somewhat less likely to always use condoms with their partner (APR = 0.44, 95% CI: 0.16 to 1.25) compared with women with no previous testing, although this association was not significant.

DISCUSSION

Although the HIV prevalence in the general population in Senegal remains low (less than 2%),¹⁸ the prevalence of HIV-1 and/or HIV-2 in registered sex worker populations has been increasing over time, from less than 10% in the late 1980s and early 1990s to approximately 20% by the early 2000s.^{2–3} Additionally, throughout West Africa, during the last 25 years, HIV-1 has replaced HIV-2 as the dominant type.^{19–20} In the current study, 19.8% of registered CSWs were infected with HIV-1 and/or HIV-2, and this was similar in the three study sites. This high and increasing HIV prevalence, especially the rapid growth of HIV-1 among CSWs in Senegal, accentuates the importance of HIV control among this population if Senegal's low overall HIV prevalence is to be maintained.²¹

We found that early initiation of sexual activity, longer duration of commercial sex work and a large number of clients per month were significantly associated with HIV-1 seropositivity, consistent with a recent study of sex workers in Kinshasa, Congo.²² In the current study, women older than 50 years of age had a much higher prevalence of HIV-1 and/or HIV-2 infection compared with women in their 20s, and this was especially true for HIV-2 infection. Women with more than 10 years of commercial sex work had a higher HIV-2 prevalence, but not a higher HIV-1 prevalence. This is not surprising, as over time, HIV-1 has replaced HIV-2 as the predominant type in West Africa;²⁰ CSW infected recently would be more likely to be infected by HIV-1, while CSW infected years ago would have been more likely to have been infected with HIV-2. Additionally, HIV-2 infection is associated with slower disease progression, and untreated HIV-1 infected women are not likely to have survived for more than 10 years.

Self-reported condom use with clients was very high (95%) and consistent with previous studies on condom use by Senegalese CSWs. In an anonymous questionnaire in 1995, 70–75% of all Dakar's registered CSWs reported always using condoms, 20–25% used condoms except in personal relationships, yet only 5% admitted that they would have unprotected sex if offered more money.²³ Although self-reported condom use could be inflated as study subjects may wish to be adherent with this socially desired behaviour, and condom use is difficult to quantify and evaluate,²⁴ data collected from both clients and CSWs in previous studies, using various study designs, have consistently reported very high condom use in commercial sex practices in Senegal. This high rate of condom use with clients is most likely due to the government-sponsored health

Table 2 Risk factors for HIV seropositivity among registered CSWs in Senegal between 2000 and 2004

Variables	HIV–	HIV+	Adjusted PR* (95% CI)
	N = 841 (%)	N = 208 (%)	
Age			
20–29	267 (31.8)	41 (19.7)	1.00 (reference)
30–39	334 (39.8)	86 (41.4)	1.48 (1.03 to 2.12)
40–49	216 (25.7)	60 (28.9)	1.49 (1.00 to 2.23)
50+	22 (2.6)	21 (10.1)	3.06 (1.80 to 5.21)
Education			
None	372 (44.4)	121 (58.5)	1.00 (reference)
Primary	321 (38.3)	62 (30.0)	0.69 (0.52 to 0.91)
Secondary or more	145 (17.3)	24 (11.6)	0.59 (0.39 to 0.91)
Marital status			
Never married	202 (24.2)	37 (17.9)	1.00 (reference)
Married/cohabited	20 (2.4)	12 (5.8)	1.95 (1.07 to 3.56)
Widowed	40 (4.8)	16 (7.7)	1.12 (0.62 to 2.00)
Divorced/separated	574 (68.7)	142 (68.6)	1.07 (0.75 to 1.52)
Current regular sex partner	370 (44.0)	83 (39.9)	0.99 (0.76 to 1.28)
Age at sexual debut <16	352 (43.5)	113 (57.4)	1.35 (1.03 to 1.77)
Current genital ulcers	59 (7.0)	24 (11.6)	1.59 (1.08 to 2.34)
Ever treated for STD	407 (48.4)	123 (59.4)	1.33 (1.02 to 1.74)
Bleeding during sex, past	43 (5.2)	17 (8.2)	1.51 (0.96 to 2.37)
Irregular bleeding, past	34 (4.1)	16 (7.7)	1.63 (1.03 to 2.59)
Commercial sex work†			
Years of commercial sex work			
<3 years	369 (44.5)	56 (27.1)	1.00 (reference)
3–10 years	232 (28.0)	82 (39.6)	1.66 (1.20 to 2.30)
10 years or more	229 (27.6)	69 (33.3)	1.01 (0.68 to 1.50)
Cost (CFA) (<5000)	160 (19.6)	67 (33.0)	1.25 (0.92 to 1.68)
Client location			
Bars	424 (52.3)	111 (54.9)	1.00 (reference)
Hotels	294 (35.6)	59 (28.6)	1.00 (0.74 to 1.35)
Others	109 (13.2)	36 (17.5)	0.96 (0.66 to 1.38)
Clients per month			
<10	404 (48.4)	79 (38.1)	1.00 (reference)
10–19	282 (33.8)	55 (26.6)	1.11 (0.80 to 1.54)
20+	149 (17.8)	73 (35.3)	2.04 (1.48 to 2.81)
<100% condom use with clients	30 (3.7)	16 (8.0)	0.76 (0.47 to 1.23)

*Prevalence ratios (PRs) adjusted for age, education, whether or not born in Senegal, religion, and study site.

†PRs were adjusted for age, education, whether or not born in Senegal, religion, and study site, as well as all other commercial sex-work-related factors in the table.

Table 3 Prevalence ratios associated with current consistent condom use with regular partners among Senegalese sex workers between 2000 and 2004

Variables	Always	Not always	Crude PR (95% CI)
	N = 82 (%)	N = 370 (%)	
Age (years)			
20–30	20 (24.4)	143 (38.8)	1.00 (reference)
30–40	36 (43.9)	156 (42.3)	1.53 (0.92 to 2.53)
40–50	25 (30.5)	62 (16.8)	2.34 (1.38 to 3.97)
50+	1 (1.2)	8 (2.2)	0.91 (0.14 to 6.01)
Born in Senegal	71 (86.6)	340 (92.4)	0.61 (0.36 to 1.05)
Marital status			
Single	26 (32.1)	89 (24.1)	1.00 (reference)
Married/cohabited	2 (2.5)	18 (4.9)	0.44 (0.11 to 1.72)
Widowed	0 (0)	15 (4.1)	0.00 (N/A)
Divorced/separated	53 (65.4)	247 (66.9)	0.78 (0.51 to 1.19)
Education			
None	36 (43.9)	155 (42.1)	1.00 (reference)
Primary	37 (45.1)	139 (37.8)	1.11 (0.74 to 1.68)
Secondary or more	9 (11.0)	74 (20.1)	0.58 (0.29 to 1.14)
Current smoke	45 (54.9)	236 (63.8)	0.74 (0.50 to 1.09)
Current drink alcohol	27 (32.9)	147 (39.7)	0.78 (0.52 to 1.19)
Age at sexual debut <16	30 (41.1)	158 (43.9)	0.91 (0.59 to 1.39)
Bleeding during intercourse, now	1 (1.2)	10 (2.7)	0.49 (0.08 to 3.24)
Bleeding during intercourse, past	3 (3.7)	26 (7.1)	0.55 (0.19 to 1.64)
Irregular bleeding, now	5 (6.1)	5 (1.4)	2.86 (1.49 to 5.50)
Irregular bleeding, past	4 (4.9)	17 (4.6)	1.05 (0.42 to 2.59)
Vaginal discharge	24 (29.3)	203 (54.9)	0.41 (0.26 to 0.64)
Genital ulcers	4 (4.9)	41 (11.1)	0.46 (0.18 to 1.20)
Prior treatment for STDs	45 (55.6)	175 (47.6)	1.30 (0.87 to 1.94)
>1 lifetime regular partner	23 (28.4)	271 (74.3)	0.21 (0.13 to 0.32)
Sex with regular partner more than once per week	23 (29.9)	218 (59.4)	0.36 (0.23 to 0.56)
Uncircumcised regular partner	16 (19.8)	41 (11.1)	1.75 (1.09 to 2.81)

Table 4 Effects of previous HIV testing and knowledge of HIV serostatus on condom use with clients and regular partners among Senegalese sex workers between 2000 and 2004

	Condom use with clients	Condom use with regular partners
	Adjusted PR* (95% CI)	Adjusted PR* (95% CI)
Ever tested for HIV	0.98 (0.90 to 1.06)	0.44 (0.28 to 0.69)
Knowledge of previous HIV test results		
No previous testing	1.00 (reference)	1.00 (reference)
Previously tested but results not known	0.97 (0.90 to 1.06)	0.73 (0.45 to 1.20)
Previous test Positive	0.95 (0.82 to 1.09)	0.44 (0.16 to 1.25)
Previous test Negative	0.99 (0.90 to 1.08)	0.17 (0.08 to 0.36)

*Prevalence ratio adjusted for participation in a previous study, study site, age, genital ulcers and treatment for STDs.

programmes at the study sites, which have a long history of providing health education, STD testing and free condoms to registered CSWs.³

The lack of consistent condom use with regular sex partners is cause for concern. Previous studies have shown that sex workers do feel at risk for AIDS, but usually from clients rather than from husbands or boyfriends.²⁵ This is similar to the findings of studies conducted in other populations which have reported that the CSWs had a relatively high condom use rate with their clients, but a rather low condom use with their regular partners.^{6, 26–33} However, regular sex partners of CSW are of particular concern due to their high numbers of partners, concurrency of partnerships with other CSWs, high HIV and STI prevalence, and low condom use.³⁴ Therefore, increasing condom use among CSWs during intercourse with their regular partners should be an important priority for HIV control in Senegal. In a small study of sexual behaviour in female sex workers in both urban and rural areas of Kenya, the mean number of unprotected sex acts was greater for regular partners compared with clients, suggesting that unsafe sex with regular partners may contribute more to HIV transmission than unsafe sex with clients.³³ However, condom promotion in the setting of regular nonpaying partners of sex workers has proved difficult. A peer-education HIV/AIDS programme in Malawi improved condom use with clients more than 20%, but failed to increase condom use with regular partners.²⁶

In our analysis, previous testing for HIV and knowledge of HIV status were not significantly associated with condom use with clients, although due to nearly universal self-reported consistent condom use, we had little power to detect factors associated with condom use. However, previous HIV testing was associated with a lower condom use rate with their regular partners, especially among women who reported that they were not infected. This suggests that prior HIV testing did not help to increase condom use with regular partners, and that a sex worker's knowledge that she was HIV negative may in fact result in decreased condom use with her regular partners, similar to what has been observed in Zimbabwe, where individuals testing negative were more likely to adopt more risky sexual behaviour.³⁵ Also troubling is the finding that nearly half of those with previous HIV tests did not know the results of those tests, which could be improved by introducing rapid HIV tests. There is inconsistent evidence regarding which behavioural risk reduction methods are effective in reducing high-risk sexual behaviour and preventing HIV transmission,^{36–42} especially in the developing world and/or in CSWs. Recently, in the international community, there has been a trend of universal HIV screening among high-risk populations and people who seek medical service.^{13, 14} Increasing the proportion of the population that is aware of their HIV serostatus may prevent transmission. However, our results suggest that HIV

post-test counselling in CSWs should encourage increased condom use with regular partners, regardless of HIV status.

Our study has a number of limitations. The cross-sectional design limits our ability to assess the temporal relationships between risk factors for HIV infection and condom usage. However, we can assume that current sexual behaviours took place after prior HIV testing. Condom use was self-reported, and this may be subject to social desirability bias. Additionally, there is potential uncontrolled confounding in the relationship between knowledge of HIV status and condom use due to a lack of information regarding the regular partner's HIV status. We had no partner-specific data regarding partners' HIV status. A study conducted in Benin suggests that boyfriends of female sex workers are of particular concern due to the high numbers of partners the boyfriends have, their very low condom use and their high HIV prevalence.⁶

This was a convenience sample of registered CSWs in Senegal. In Dakar, it is estimated that 1500 CSW are registered and that approximately 1000 regularly attend medical examinations,⁴³ so our sample of 623 CSWs from the clinic in Dakar may represent 40% of all registered CSWs, and 60% of all who regularly attend the Dakar clinic, and an unknown proportion of CSWs in MBour and Sebikotane. The actual participation and refusal rate of all CSWs who presented to the clinics during the study period is unknown, as we did not record information regarding the number of CSW who refused to be enrolled. However, the Senegalese social workers who conducted the interviews have reported that the vast majority of women who presented to the three clinics consented to participate.

Finally, unregistered Senegalese CSWs constitute another important high-risk group with respect to HIV transmission, although the numbers of clandestine CSWs is unknown.^{15, 43} Compared with condom use reported in unregistered CSWs in Dakar,⁴⁴ we found that registered CSWs were more likely to use condoms consistently with clients (95% vs 70%) but had similarly low rates of condom use with regular partners (18% vs 17%). The generalizability of our findings to unregistered sex workers is unclear, as they tend to be younger, have been engaging in commercial sex for less time, may have a lower HIV prevalence, but also may not have access to the educational and condom programmes and management of STIs provided to registered CSWs.^{15, 43, 44}

In summary, the prevalence of HIV has continued to increase among registered CSWs in Senegal during the past 20 years. In this population, self-reported condom use with clients was nearly universal, regardless of previous HIV testing. However, condom use by these same CSWs with their regular sex partners was low, and a prior HIV negative test was associated with dramatically lower condom use with regular sex partners. Health education policies that may help prevent HIV transmission from CSWs to the general population, as well as from

Key messages

- 19.8% of registered commercial sex workers were infected with HIV-1 and/or HIV-2; the prevalence was similar in the three study sites.
- Self-reported consistent condom use with clients was very high (95%), but only 18% reported always using condoms with regular sex partners.
- Prior HIV testing was associated with decreased condom use with their regular partners (APR=0.44, 95% CI: 0.28 to 0.69), especially in women who tested HIV negative (APR=0.17, 95% CI: 0.08 to 0.36).
- When providing HIV testing to commercial sex workers, post-testing counselling should additionally emphasise consistent condom use with regular sex partners, who may represent an important bridge population for HIV transmission.

clients and regular partners to CSWs, are needed. Effective interventions which provide education, increase condom use, and provide medications for sexually transmitted infections with CSWs' regular sex partners should reduce transmission of HIV in these important bridge populations. When providing HIV testing to CSWs, post-testing counselling should place emphasis on consistent condom use with regular sex partners.

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CONTRIBUTIONS

CW and SH were the lead authors of the manuscript. CW conducted the statistical analyses. LM and AW also provided significant input to the analysis and drafting of the manuscript. AG, PS and IN were responsible for the enrolment, data collection, and management of the study and subjects in Senegal. CC, SH, and NK were responsible for obtaining funding and management of the project in Seattle. All authors made comments and suggestions to the manuscript.

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