Background: We aimed to (1) estimate the prevalence of HIV and other sexually transmitted infections (STIs) among female sex workers (FSWs) in Bamako, Mali, and (2) identify factors associated with STIs including HIV infection in this population.

Methods: We analyzed baseline data from a prospective observational cohort study on cervical cancer screening, human papillomavirus, and HIV infections among FSWs 18 years or older recruited in Bamako. Multivariable log-binomial regression was used to estimate the adjusted prevalence ratios (APRs) with 95% confidence interval (95% CI) for HIV infection and STIs versus associated factors.

Results: Among 353 women participating in the study, mean age was 26.8 (±7.6) years. HIV prevalence was 20.4%, whereas 35.1% of the FSWs had at least one STI. Factors significantly associated with HIV were older age (P < 0.0001, test for trend), duration of sex work 26 years (APR, 1.92; 95% CI, 1.22–3.02), uneducated status (APR, 2.24; 95% CI, 1.16–4.34), less than 10 clients in the last 7 days (APR, 1.55; 95% CI, 1.02–2.34), and gonococcal (APR, 1.85; 95% CI, 1.21–2.82) and chlamydial (APR, 2.58; 95% CI, 1.44–4.62) infections. Younger age (P = 0.018, test for trend), having ≥10 clients in the last week (APR, 1.47; 95% CI, 1.11–1.94), and HIV infection (APR, 2.00; 95% CI, 1.49–2.69) were significantly associated with STIs.

Conclusions: HIV and curable STI prevalence are high among FSWs in Bamako. There is thus a need to enhance the efficiency of interventions toward FSWs in Mali to reduce the burden of HIV and STIs among them and prevent HIV spread to the general population.

Prevalence and Factors Associated With HIV and Sexually Transmitted Infections Among Female Sex Workers in Bamako, Mali

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In 2018, Sub-Saharan Africa countries supported the highest burden of the HIV epidemic, with 68% of the 37.9 million people living with HIV worldwide.1 However, HIV prevalence remains relatively low in several Sub-Saharan Africa countries, particularly in the Western part, where HIV prevalence in adult is less than 2% (except in Côte d’Ivoire, Togo, and Guinea-Bissau).2 Nevertheless, the epidemic is concentrated among key populations, including female sex workers (FSWs) who are considered highly vulnerable to HIV infection.3 HIV prevalence among FSWs in this region ranges from 15.9% to more than 40%.2,4 Female sex workers also accounted for 14% of new HIV infections in 2018.2 In addition, other sexually transmitted infections (STIs) are very common in FSWs who are characterized by high number of sexual partners, drug addiction, and unprotected sex as well as violence, stigma, and discrimination.5,6 The role of STIs in the dynamics of HIV acquisition and/or transmission has been well established.1 Thus, FSWs and their clients constitute a core group for the spread of HIV to the general population in countries where the HIV epidemic is driven by heterosexual transmission.8

Mali is a landlocked country in West Africa with a population estimated at 20.2 million inhabitants.7 It is one of the poorest countries in the world with security challenges in its northern regions. In Mali, the HIV epidemic has been overall stable since the early 2000s. Indeed, HIV prevalence in the general population first decreased from 1.7% in 2001 to 1.1% in 2012,9,10 but more recent data estimates suggest an increase to 1.4% in 2018.11 In Mali, like for most West African countries, the HIV epidemic is concentrated in key populations, especially FSWs. Integrated Biological and Behavioral Survey data reported a slight decrease in HIV prevalence among FSWs from 28.9% in 2000 to 24.2% in 2009,12 contrasting with an increase in STI prevalence. The prevalence of Neisseria gonorrhoeae increased from 3.2% in 2000 to 11.4% in 2009, and that of Chlamydia trachomatis increased from 4.6% to 10.5% during the same period.12 Recent Joint United Nations Programme on HIV and AIDS data reported that Mali is among the 4 West African countries that are lagging behind in their prevention efforts, with more than a 10% increase in new...
HIV infections between 2010 and 2018. Also, it is important to note that a number of HIV/STI prevention activities among FSWs have been halted because of insecurity concerns in some areas or lack of funding. There is now a need for updating the epidemiology of HIV infection and other STIs in FSWs in this country.

The objectives of this study were to (1) estimate the prevalence of HIV and other STIs among FSWs in Bamako, Mali, and (2) identify factors associated with STIs, including HIV infection, in this population.

**METHODS**

**Study Design and Settings**

We analyzed baseline data from a prospective observational cohort study on cervical cancer screening, human papillomavirus, and HIV infections. The study took place in Bamako, the capital city of Mali, from November 2017 to March 2018, in collaboration with 3 non-governmental organizations (NGOs), including ACARD-SIDA, SOUTOURA, and DANAYA SO, that are responsible for all HIV prevention activities targeting specifically FSWs in Bamako. These activities include a package of services adapted to FSWs such as behavior change communication through public meetings and peer education, HIV counseling and testing, condom distribution, and STI prevention and treatment. Each NGO has STI clinics for key populations with physicians trained in STI treatment using the syndromic approach and treatment of opportunistic infections caused by HIV. Each clinic also employs a number of former and current FSWs who act as advisors and peer educators (PEs). These PEs carry out STI and HIV prevention activities in hotels, bars, brothels, and others. Only ACARD-SIDA provides, in addition to STI treatment and through its 2 health centers, HIV treatment with antiretroviral therapy. Thus, HIV cases detected by the other 2 NGOs PEs are referred to those 2 centers, one being the STI clinic for key populations and the other one an HIV treatment center for both the general and key populations. ACARD-SIDA was the main partner of the present study. All activities took place at the ARCAD-SIDA STI clinic.

**Study Population**

An FSW was defined as any woman who receives money or gifts in exchange for sex. The inclusion criteria were (a) being an FSW in the city of Bamako since at least 6 months, (b) being referred by one of the PEs of the 3 NGOs, and (c) being between 18 and 65 years old. Given that the main study was on cervical cancer screening, 1 FSW who had previously been diagnosed with cervical cancer and 19 pregnant women were excluded from the study.

**Recruitment Procedures**

We adopted a recruitment strategy using PEs based on lessons gained in the field of HIV and STI prevention among hard-to-reach populations. We hired 4 PEs from each of the 3 NGOs. They received a 2-day training session about the study procedures. Through bars, brothels, streets, homes, and hotels, these PEs mobilized FSWs in the field, inviting them to come to the ARCAD-SIDA STI clinic for participating in the study.

**Data Collection**

Upon arrival of a potential participant at the clinic, eligibility criteria were verified. Then, the study procedures were explained to her, and written informed consent was obtained by the counselor. The questionnaire was translated into several languages and piloted before the survey. Face-to-face interviews were conducted in a private room by trained interviewers in French, English, or local languages. Data on demographic (age, educational level, marital status, etc.), sexual behavior and sex work characteristics (condom use, drug use and alcohol consumption, age at first sexual intercourse, number of clients in last 7 days, duration of sex work, etc.), and medical history (self-reported STIs in the previous 6 months) were collected. After the interview, a gynecological examination was performed by the physician to detect genital ulcers, abnormal vaginal discharge, vaginitis, and cervicitis, and for cervical cancer screening. Vaginal and cervical swabs as well as blood specimens were also collected for laboratory testing.

**Laboratory Procedures**

The ARCAD-SIDA STI clinic has an equipped laboratory that is sponsored by the Center for Disease Control and Prevention, Atlanta, GA. A number of tests were performed in this laboratory. Saline and potassium hydroxide mounts of the vaginal swabs were microscopically examined immediately for motile parasites standing for *Trichomonas vaginalis* and yeast and/or pseudoephyle for *Candida albicans*. Nugent score was assessed on a Gram-stained slide prepared from a fresh vaginal swab for the diagnosis of bacterial vaginosis as described elsewhere. According to Mali’s national HIV testing algorithm, HIV antibodies were detected by using the Alere Determine HIV-1/2 test (Alere Medical Co. Ltd), and positive specimens were then confirmed with a rapid and discriminatory test SD Bioline (Giheung-gu, Yongin-si, Korea). Syphilis serologic testing was performed using the nontreponemal Venerable Disease Research Laboratory test (VDRL; Chronolab systems S.L., Barcelona, Spain) for initial screening, and confirmation of all VDRL-reactive sera was done using a *Treponema pallidum* hemaggulatination assay (Chronolab systems S.L.). Sera positive for both VDRL and *T. pallidum* hemaggulatination assay indicated the presence of active syphilis.

For the diagnosis of *N. gonorrhoeae* and *C. trachomatis*, endocervical specimens were collected into 1.2 mL Specimen Transport Buffer (guanidine thioctanate in Tris buffer) and stored at 2°C to 8°C at the clinic before transportation to the laboratory. All specimens were tested at the ALGI laboratory using the Abbott Real-Time CT/NG assay as described elsewhere.

**Outcome Variables**

HIV infection and the presence of at least one of the other STIs were the 2 main outcomes. The latter variable was defined as the presence of at least one of the following laboratory-confirmed STIs: *N. gonorrhoeae, C. trachomatis, T. vaginalis*, or active syphilis.

**Statistical Analysis**

Data were analyzed using SAS version 9.4 (SAS institute, Inc., Cary, NC). Descriptive statistics were computed to summarize demographic, behavioral, and sex work characteristics. Categorical variables were expressed as percentages, and continuous ones as means with SDs or medians with interquartile ranges. To analyze potential factors associated with HIV infection, we carried out univariate and multivariate log-binomial regression models with a robust “sandwich” variance estimator to calculate the adjusted prevalence ratios (APRs) with 95% confidence intervals (95% CIs). All variables significant at $P \leq 0.2$ in univariate analysis or known from the literature as potential confounding variables were considered for inclusion in multivariate log-binomial regression models. Those variables were as follows: age of FSW, religion, educational level, marital status, number of children, last month income, ever used drugs, number of paying clients in the last 7 days of work, boyfriends, have sex with boyfriends, age at first sexual intercourse, condom use, place of sex.
TABLE 1. Demographic and Sex Work Characteristics of 353 Female Sex Workers in Bamako, Mali

| Characteristic                          | Value       |
|----------------------------------------|-------------|
| Age, mean (SD), y                      | 26.8 (7.6)  |
| Age, y                                 |             |
| <20                                    | 64 (18.1)   |
| 20–29                                  | 184 (52.1)  |
| 30–39                                  | 78 (22.1)   |
| ≥40                                    | 27 (7.7)    |
| Education level*                       |             |
| Uneducated                             | 140 (39.7)  |
| Primary                                | 147 (41.6)  |
| Secondary or higher                    | 66 (18.7)   |
| Marital status                         |             |
| Married                                | 27 (7.7)    |
| Separated/widow/divorced               | 82 (23.2)   |
| Single                                 | 244 (69.1)  |
| Nationality                            |             |
| Nigeria                                | 28 (7.9)    |
| Mali                                    | 262 (74.2)  |
| Burkina                                 | 29 (8.2)    |
| Others†                                | 34 (9.6)    |
| Religion                               |             |
| Catholic                               | 40 (11.3)   |
| Muslim                                 | 279 (79.0)  |
| Others‡                                | 34 (9.6)    |
| No. children                           |             |
| 0                                      | 110 (31.2)  |
| ≥1                                     | 243 (68.8)  |
| Last month income                      |             |
| <100,000 CFA§                          | 65 (18.5)   |
| 100,000–199,999 CFA                    | 143 (40.6)  |
| ≥200,000 CFA                           | 144 (40.9)  |
| Alcohol consumption frequency per week |             |
| Everyday                               | 63 (17.8)   |
| Several times a week                   | 23 (6.5)    |
| Once a week                            | 11 (3.1)    |
| Sometime                               | 62 (17.6)   |
| Never                                  | 194 (55.0)  |
| Drug use†                              |             |
| Yes                                    | 29 (8.2)    |
| Never                                  | 324 (91.8)  |
| Place of work                          |             |
| Bars, hotel, nightclub                 | 318 (90.1)  |
| Others‡                                | 35 (9.9)    |
| Age of first sexual intercourse, mean (SD), y | 15.3 (2.9) |
| Age at first paid sex, mean (SD), y    | 21.6 (7.0)  |
| Duration of sex work, mean (SD), y     | 5.3 (5.1)   |
| Years in a same sex place work, median (IQR) | 2 (2–7) |
| Latest week total number of sexual partners*, median (IQR) | 10 (5–20) |
| No. paying clients, last 7 d of work, median (IQR) | 10 (4–20) |
| No. clients, last day of work, median (IQR) | 3 (2–5) |
| Always used condom with paying clients (last 7 d of work) | 336 (95.7) |
| Used condom with client at last sex    | 351 (99.4)  |
| No. condoms removed during sex with clients, in last 7 d of work |             |
| 0                                      | 331 (94.6)  |
| ≥1                                     | 19 (5.4)    |
| No. condom failures in the last 7 d of work |             |
| 0                                      | 305 (87.1)  |
| ≥1                                     | 45 (12.9)   |

(Continued next page)

TABLE 1. (Continued)

| Characteristic                        | Value       |
|---------------------------------------|-------------|
| Had nonpaying partners††              | 14 (4.1)    |
| Had a boyfriend                       | 239 (67.7)  |
| Had at least one sexual intercourse with boyfriend, last 7 d | 227 (64.3) |
| Used condom with boyfriend at last sex, if has boyfriend, last 7 d | 43 (18.4) |

Values are presented as no. (%), unless otherwise indicated.

*Measured as the highest level of education attained.
†Benin, Togo, Ghana, Côte d’Ivoire, Guinea, Senegal, Mauritania.
‡Traditional, Methodist Protestant, other Christian, no religion.
§1USD ~588,671 CFA.
¶Home, street.
||Drug use was defined as ever having used cannabis/marijuana, cocaine sniffed, or smoked cracked, amphetamine, or opiate pills.
**Included all sexual partners.
††Regular nonpaying client is different from boyfriend or husband.
IQR indicates interquartile range; CFA, Communauté financière en Afrique.

Ethical Considerations

The project was approved by the ethics committee of the school of medicine of Bamako, Mali, and by the ethics committee of the CHU de Québec-Université Laval. The objectives, procedures, and potential risks related to participation in the project were explained to each woman, and written consent was obtained before enrolment. Consenting participants signed or apposed their fingerprint on the consent forms. Participants received 5000 CFA (approximately US$8.4) for compensation of transportation and the time spent at the clinic. Finally, condoms and lubricants were distributed to each woman.

RESULTS

Sociodemographic and Sex Work Characteristics

A total of 353 FSWs were included in the study. Most of them (74.2%) were Malian, and 52.1% were 20 to 29 years old (mean age, 26.8 ± 7.6 years; Table 1). Approximately 4 (39.7%) of 10 FSWs were unable to read or write. Most of them (69.1%) were currently single, whereas only 7.5% were married. Self-reported drug use was uncommon at 8.2%. A huge majority of the FSWs were bar based (90.1%). The mean duration of sex work was 5 (±5.1) years; the mean age at first sexual intercourse was 15.3 (±2.9) years, and the mean age at first paid sex was 21.6 (±7.0) years. More than 95% reported consistent condom use with paying clients in the last 7 days. However, only 18.4% used a condom with their boyfriend at last sex. The median number of the FSWs were unable to read or write. Most of them (69.1%) were currently single, whereas only 7.5% were married. Self-reported drug use was uncommon at 8.2%. A huge majority of the FSWs were bar based (90.1%). The mean duration of sex work was 5 (±5.1) years; the mean age at first sexual intercourse was 15.3 (±2.9) years, and the mean age at first paid sex was 21.6 (±7.0) years. More than 95% reported consistent condom use with paying clients in the last 7 days. However, only 18.4% used a condom with their boyfriend at last sex. The median number of paying clients in the last 7 days of work was 10.

HIV and STI Prevalence

The HIV prevalence was 20.4% (Table 2). Among the 72 cases of HIV infection, 39 (54.2%) learned their status for the first time. Furthermore, none of new diagnosis cases had ever been
TABLE 2. Prevalence of Sexually Transmitted, Bacterial, and HIV Infections Among 353 Female Sex Workers in Bamako, Mali

| STI                        | n/N  | Prevalence, % | 95% CI†, % |
|---------------------------|------|---------------|-------------|
| N. gonorrhoeae            | 85/351| 24.2          | 19.8–29.1   |
| C. trachomatis            | 49/351| 14.0          | 10.5–18.0   |
| T. vaginalis              | 13/353| 3.7           | 2.0–6.2     |
| Active syphilis*          | 11/353| 3.1           | 1.6–5.5     |
| At least one STI†         | 125/353| 35.1          | 30.4–40.7   |
| BV (Nugent score ≥7)      | 83/353| 23.5          | 19.2–28.3   |
| C. albicans               | 43/353| 12.2          | 9.0–16.1    |
| HIV                       | 72/353| 20.4          | 16.3–25.0   |

*Active syphilis was defined as positive sera for both tests non-treponemal Venereal Disease Research and Treponema pallidum hemagglutination assay Venereal Disease Research Laboratory.
†STI = N. gonorrhoeae or C. trachomatis or T. vaginalis or active syphilis.

BV indicates bacterial vaginosis; CI, confidence interval; n, number of positive specimens; N, total number of specimens tested; STI, sexually transmitted infection.

Factors Associated With Prevalent HIV Infection

Table 3 shows the results of the univariate and multivariate analyses of factors associated with HIV and includes all the variables kept in the final multivariate model. We observed a significant increase in HIV prevalence with increasing age (P value for trend <0.0001) and there was a 1.92-fold increase in HIV prevalence among FSWs who had been involved in sex work for at least 6 years. Being uneducated (APR, 2.24; 95% CI, 1.16–4.34) and a lower number of paying clients in the last week (<10; APR, 1.55; 95% CI, 1.02–2.34) were significantly associated with HIV prevalence. Finally, N. gonorrhoeae and C. trachomatis were strongly associated with HIV (APRs, 1.85 [95% CI, 1.21–2.82] and 2.58 [95% CI, 1.44–4.62], respectively). Moreover, when we compared women first tested positive for HIV during our study with those HIV negative, we observed similar risk factors to all HIV-positive women taken together (data not shown). Sex work duration and N. gonorrhoeae infection were the only risk factors not significantly associated with these new cases of HIV infection, but the APRs for these 2 variables were almost the same as those in Table 3.

Factors Associated With STIs

Table 4 shows the results of the univariate and multivariate analyses of factors associated with STIs and includes all the variables kept in the final multivariate model. Contrary to HIV, there was a significant decreasing trend in STI prevalence with increasing age (P = 0.018). The same contrast was also observed with the number of clients: women who reported ≥10 paying clients during the last 7 days of work were more likely to be STI positive compared with those who reported <10 paying clients (APR, 1.47; 95% CI, 1.11–1.94). Finally, there was a highly significant association between STI prevalence and HIV infection (P < 0.0001).

DISCUSSION

Female sex workers continue to bear a substantial burden of STIs and HIV infection in Bamako. Our analyses show an HIV prevalence of 20.4%, which is 15 times higher than the prevalence observed in the general population. These findings are consistent with those reported in other studies in developing countries, particularly in West Africa. The HIV prevalence in this study (20.4%) was slightly lower than that reported in the national survey (24.2%), which was a cluster random sample based on mapping of sex work sites with a wide variation of access to care. We used a convenience sample in Bamako with a better quality of care compared with the region.

In this study, HIV prevalence increased with age. Similar results have been reported in other studies. We also observed a strong association between the duration of sex work and HIV prevalence, with a 2-fold increase for women with duration of sex work ≥6 years as compared with those <6 years. These findings are also reported by other authors in Africa. Indeed, older age and longer duration in sex work increase the likelihood of frequent HIV exposure among FSWs.

We found that uneducated FSWs were more likely to be HIV positive compared with those who had at least a secondary education level. These findings can be explained by the fact that, compared with uneducated FSWs, educated FSWs generally have a good knowledge of HIV infection and have a greater ability to negotiate condom use. Although not measured in the study, we noted in the interviews that many educated FSWs were students or civil servants engaging in sex work as a part-time activity in order to increase their low income. This particular group of FSWs have special clients such as office executives, businessmen, and so on, who often have also a good knowledge of HIV prevention.

Surprisingly, our data showed a negative association between the number of paying clients and HIV prevalence. A possible explanation for this finding is the fact that FSWs who know their HIV status tend to adopt more protective sexual behavior as reported in a prospective study that evaluated sexual behavior among FSWs before and after HIV seroconversion. The authors of this study reported consistent condom use and fewer sexual partners in FSWs after HIV seroconversion. Also, we found that HIV-positive women had a longer duration of sex work at the same workplace compared with HIV-negative women. It is possible that their HIV status got known at their sex work site, which could have resulted in a reduction in the number of clients.

Our analyses showed a strong association between nonulcerative STIs, like N. gonorrhoeae and C. trachomatis, and HIV prevalence. Such associations have been known for a long time, and their possible mechanism is that STIs can cause disruption of epithelial or mucosal barriers, exposing subepithelial lymphocytes and Langerhans cells to HIV infection.

We found that more than one-third of our participants had at least one STI. This is very worrisome because the presence of STIs can be a surrogate marker of recent unprotected sex. The self-reported rate of protected sex with clients was very high (95.7%). In Mali, condoms are provided free of charge to FSWs by NGOs. These NGOs conduct regular HIV/STI prevention activities with FSWs in the field, with an emphasis on condom use. Also, during our focus group with bar managers (not reported in this article), we were told that a set of condoms was available in each room for free use. Beyond all these factors, FSWs often tend to overreport condom use. Indeed, because of social desirability bias, condom use is often overestimated by self-report. This has been observed by studies that validated self-reported data on condom use through the prostate-specific antigen test, a biologic marker of recent unprotected sex or incorrect condom use. In a study among FSWs in Benin, 26.0% reported unprotected sex, whereas 32.0% tested positive for prostate-specific antigen.

In contrast to what we found for HIV, STI prevalence was significantly higher among younger women and among those with a higher number of sexual partners. Concerning age, the main reasons for this association are explained by the immaturity of the
cervical mucosa and increased cervical ectopy.27 Concerning the number of clients, most studies report such an association between high number of clients and curable STIs.28

**Study Limitations**

There are several potential limitations to this study. The cross-sectional nature of this study has not permitted to assess a causal link between the independent variables and HIV/STI prevalence. Also, the recruitment strategy based on PEs is a limitation for our study and may induce a selection bias. Some other categories like clandestine FSWs are probably underrepresented, and their characteristics may be very different from those of enrolled FSWs. To deal with this selection bias, before the recruitment, we suggested to PEs to work tightly with the lead FSW in each area.

### TABLE 3. Risk Factors Associated With HIV Infection Among 353 Female Sex Workers in Bamako, Mali

| Variables                              | n/N | %HIV+ | Crude PR (95% CI) | Global P Value | APR (95% CI) | Global P Value |
|----------------------------------------|-----|-------|-------------------|----------------|--------------|----------------|
| Age, y                                 |     |       |                   |                |              |                |
| <20                                    | 4/64| 6.3   | 1.00              | 0.000          | 1.00         | <0.0001        |
| 20–29                                  | 34/184| 18.5 | 2.96 (1.09–8.01)  | 4.42 (1.67–11.66) |              |                |
| 30–39                                  | 23/78| 29.4 | 4.72 (1.72–12.94) | 7.36 (2.57–21.04) |              |                |
| ≥40                                    | 11/27| 40.7 | 6.52 (2.36–18.67) | 10.36 (3.50–30.68) |              |                |
| Trend P value                          |     |       |                   | <0.0001        |              |                |
| Educational level                      |     |       |                   | 0.064          | 2.24 (1.16–4.34) | 0.031          |
| Uneducated                             | 37/140| 26.4 | 1.93 (1.00–3.78)  |                |              |                |
| Primary                                | 26/147| 17.7 | 1.29 (0.64–2.61)  | 1.48 (0.78–2.82) |              |                |
| Secondary or higher                    | 9/66 | 13.6 | 1.00              | 1.00           | 0.064        | 0.008          |
| Trend P value                          |     |       |                   |                |              |                |
| Marital status                         |     |       |                   | 0.029          | 1.00         | 0.592          |
| Single                                 | 41/244| 16.8 | 1.00              | 1.00           |              |                |
| Married                                | 9/27 | 33.3 | 1.98 (1.09–3.62)  | 0.99 (0.51–1.94) |              |                |
| Separated/widow/divorced              | 22/82| 26.8 | 1.60 (1.01–2.51)  | 0.80 (0.50–1.27) |              |                |
| Religion                               |     |       |                   | 0.175          | 1.00         | 0.197          |
| Catholic                               | 63/279| 12.5 | 1.06 (0.31–1.29)  | 1.72 (0.44–6.62) |              |                |
| Muslim                                 | 4/34 | 24.6 | 1.91 (0.74–4.94)  | 2.57 (0.82–8.08) |              |                |
| Others*                                | 4/40 | 11.8 | 1.00              | 1.00           |              |                |
| Trend P value                          |     |       |                   | 0.064          | 0.064        | 0.008          |
| Income last month                      |     |       |                   | 0.042          | 1.00         | 0.156          |
| <100.000 CFA                           | 31/113| 29.2 | 1.99 (1.15–3.43)  | 1.53 (0.87–2.69) |              |                |
| 100.000–199,999 CFA                    | 21/143| 14.7 | 1.60 (1.01–2.51)  | 0.80 (0.50–1.27) |              |                |
| ≥200,000 CFA                           | 21/25| 25.2 | 1.06 (0.88–2.42)  | 1.59 (0.97–2.60) |              |                |
| Age of first sexual intercourse, y     |     |       |                   | 0.430          | 1.00         | 0.083          |
| <15                                    | 35/160| 21.9 | 0.65 (0.35–1.18)  | 0.53 (0.28–0.98) |              |                |
| 15–17                                  | 3/22 | 21.9 | 0.88 (0.53–1.44)  | 0.89 (0.59–8.82) |              |                |
| ≥18                                    | 16/89| 25.0 | 1.00              | 1.00           |              |                |
| Unknown                                | 4/64 | 13.6 | 0.55 (0.18–1.68)  | 0.39 (0.10–1.58) |              |                |
| Duration in sex work, y                |     |       |                   | 0.002          | 1.00         | 0.005          |
| 0–5                                    | 35/233| 15.2 | 1.00              | 1.00           |              |                |
| ≥6                                     | 36/112| 32.1 | 2.14 (1.42–3.21)  | 1.97 (1.22–3.02) |              | 0.038          |
| No, paying clients, last 7 d of work   |     |       |                   | 0.050          | 1.00         | 0.004          |
| <10                                    | 29/178| 16.3 | 1.52 (1.00–2.33)  | 1.55 (1.02–2.34) |              |                |
| ≥10                                    | 43/173| 24.9 | 1.00              | 1.00           |              |                |
| Consistent condom use                  |     |       |                   | 0.503          | 1.00         | 0.366          |
| Yes                                    | 70/336| 20.8 | 1.00              | 1.00           |              |                |
| No                                     | 2/15 | 13.3 | 0.64 (0.17–2.36)  | 0.53 (0.13–2.10) |              |                |
| N. gonorrhoeae                         |     |       |                   | 0.231          | 1.00         | 0.002          |
| Yes                                    | 50/266| 19.4 | 1.31 (0.84–2.06)  | 1.85 (1.21–2.82) |              |                |
| No                                     | 21/85| 18.8 | 1.00              | 1.00           |              |                |
| C. trachomatis                         |     |       |                   | 0.414          | 2.58 (1.44–4.62) | 0.002          |
| Yes                                    | 59/302| 24.5 | 1.25 (0.73–2.16)  |              |              |                |
| No                                     | 12/49| 19.5 | 1.00              | 1.00           |              |                |
| T. vaginalis                           |     |       |                   | 0.089          | 1.00         | 0.077          |
| Yes                                    | 67/340| 19.5 | 1.95 (0.95–4.01)  | 1.82 (0.94–2.69) |              |                |
| No                                     | 5/13 | 38.5 | 1.00              | 1.00           |              |                |
| Active syphilis*                       |     |       |                   | 0.549          | 1.00         | 0.887          |
| Yes                                    | 69/342| 27.3 | 1.35 (0.50–3.63)  | 0.93 (0.32–2.69) |              |                |
| No                                     | 3/11 | 20.2 | 1.00              | 1.00           |              |                |
| BV                                     |     |       |                   | 0.198          | 1.00         | 0.302          |
| Nugent score <7                        | 21/83| 18.9 | 1.00              | 1.00           |              |                |
| Nugent score ≥7                        | 51/270| 25.3 | 1.34 (0.85–2.09)  | 1.26 (0.82–1.93) |              |                |

Bolded results represent those that are statistically significant.

*Active syphilis was defined as positive sera for both tests nontreponemal Venereal Disease Research and Treponema pallidum hemagglutination assay Venereal Disease Research Laboratory.

#The corresponding text is Traditional, Methodist Protestant, other Christian, no religion.

APR, adjusted prevalence ratio; BV, bacterial vaginosis; CI, confidence interval; n, numerator, number of positive HIV cases; N, denominator, total number of each category; PR, prevalence ratio.
TABLE 4. Risk Factors Associated With Sexually Transmitted Infections (STI)* Among 353 Female Sex Workers in Mali

| Variables                        | n/N | %STI | Crude PR (95% CI) | Global P Value | APR (95% CI) | Global P Value |
|----------------------------------|-----|------|-------------------|----------------|--------------|----------------|
| Age, y                           |     |      |                   |                |              |                |
| <20                              | 40/64 | 62.5 | **2.41 (1.23–4.69)** | <0.0001        | **2.59 (1.17–5.72)** | 0.004          |
| 20–29                            | 58/184 | 31.5 | 1.22 (0.62–2.38)  | 1.48 (0.73–2.99) | 1.13 (0.56–2.27) |
| 30–39                            | 20/78 | 25.6 | 0.98 (0.47–2.07)  | 1.13 (0.56–2.27) | 1.00          |
| ≥40                              | 7/27  | 25.9 | 1.00              | 1.00           |              |
| P value trend test                |      |      |                   | 0.018          |              |
| Education                        |     |      |                   |                |              |                |
| Uneducated                       | 60/140 | 35.7 | 1.47 (0.91–2.38)  | 1.00 (0.59–1.69) | 1.47 (0.90–2.39) | 0.638          |
| Primary                          | 59/147 | 40.1 | 1.66 (1.03–2.64)  | 1.14 (0.68–1.90) | 1.22 (0.79–1.87) |
| Secondary or higher              | 16/66 | 24.2 | 1.00              | 1.00           |              |
| Marital status                   |     |      |                   |                |              |                |
| Married                          | 10/27  | 37.0 | 1.00 (0.59–1.68)  | 1.47 (0.90–2.39) | 1.00          |
| Separated/widow/divorced         | 25/82 | 30.5 | 0.82 (0.57–1.19)  | 1.22 (0.79–1.87) | 1.00          |
| Single                           | 90/244 | 36.9 | 1.00              | 1.00           |              |
| Nationality                      |     |      |                   |                |              |                |
| Mali                             | 103/262 | 39.3 | 1.00              | 1.00           | 1.00          | 0.077          |
| Nigeria                          | 6/28  | 21.4 | 0.54 (0.26–1.13)  | 0.64 (0.28–1.28) |              |
| Burkina Faso                     | 3/29  | 10.4 | 0.26 (0.09–0.77)  | 0.32 (0.12–0.93) |              |
| Others                           | 13/34 | 38.2 | 0.97 (0.62–1.53)  | 1.24 (0.81–1.89) |              |
| Alcohol consumption              |     |      |                   |                |              |                |
| Yes                              | 44/159 | 27.7 | 0.66 (0.49–0.89)  | 0.77 (0.56–1.05) |              |
| No                               | 81/194 | 41.6 | 1.00              | 1.00           |              |
| Age of first sexual intercourse, y|     |      |                   |                |              |                |
| <15                              | 39/99 | 39.4 | 1.49 (0.94–2.36)  | 1.11 (0.69–1.77) |              |
| 15–17                            | 60/160 | 37.5 | 1.42 (0.92–2.19)  | 0.96 (0.47–2.01) |              |
| ≥18                              | 19/72 | 26.4 | 1.00              | 1.00           |              |
| Unknown                          | 7/22  | 31.8 | 1.21 (0.59–2.49)  | 0.99 (0.45–2.17) |              |
| Duration in sex work, y          |     |      |                   |                |              |                |
| 0–5                              | 91/233 | 39.1 | 1.00              | 1.00           | 0.281        | 0.1378         |
| ≥6                               | 31/112 | 27.7 | 0.77 (0.54–1.09)  | 1.00           |              |
| No, paying clients, last 7 d of work|     |      |                   |                |              |                |
| ≥10                              | 72/178 | 40.5 | 1.35 (1.01–1.79)  | 1.47 (1.11–1.94) | 1.00          | 0.007          |
| <10                              | 52/173 | 30.1 | 1.00              | 1.00           |              |
| Consistent condom use            |     |      |                   |                |              |                |
| Yes                              | 119/336 | 35.4 | 1.00              | 1.00           | 0.871        | 0.727          |
| No                               | 5/15  | 33.3 | 0.94 (0.45–1.95)  | 0.88 (0.44–1.76) |              |
| Self-reported STI in last 6 mo   |     |      |                   |                |              |                |
| Yes                              | 68/15 | 41.2 | 1.36 (1.02–1.80)  | 1.32 (1.00–1.74) | 1.00          |
| No                               | 57/188 | 30.3 | 1.00              | 1.00           |              |
| HIV/                             |     |      |                   |                |              |                |
| Yes                              | 35/72 | 48.6 | 1.52 (1.13–2.03)  | **2.00 (1.49–2.69)** |              |
| No                               | 90/281 | 32.0 | 1.00              | 1.00           |              |

Bolded results represent those that are statistically significant.
*STI = N. gonorrhoeae or C. trachomatis or T. vaginalis or active syphilis.
APR, adjusted prevalence ratio; BV, bacterial vaginosis; CI, confidence interval; n, numerator, number of positive HIV cases; N, denominator, total number of each category; PR, prevalence ratio.

when available. These leaders are well informed about all categories of FSWs and constitute the best way to join them. Moreover, because of the level of trust in these leaders and their commitment, open discussions on sensitive topics are possible with FSWs. Finally, using the PEs from the 3 field-active NGOs working with FSWs did help including several categories of FSWs from different areas.

Misclassification bias may have concerned, as the measurement of sociodemographic and behavioral characteristics was based on face-to-face self-reported information. Indeed, because of the social desirability, some participants may have underreported some characteristics of their sexual behavior (e.g., unprotected sex, anal sex, number of sexual partners, drug and alcohol addiction, etc.). This bias is likely to be nondifferential and thus independent of the measured study outcomes. There is thus a possibility of underestimation of the associations observed in this study. In addition, a residual confounding bias cannot be ruled out because of the lack of adjustment for some unmeasured variables. However, we think that this bias would be minimal because we adjusted for most of the confounding factors reported in the literature. Finally, our data were collected from a particular population of FSWs with more than 70% of Malians. This population may not be representative of all FSWs, and the presence of modifying factors in the overall FSW population could prevent the generalization of the results. Despite these limitations, to our knowledge, this study is unique in that it is among the first ones in Mali to have investigated deeply HIV and other STI prevalence and associated factors among FSWs. It allowed us an in-depth analysis of risk factors that consequently conducted to public health recommendations.

FSWs HIV/STI Policy and Program Implications

To break the chain of HIV transmission between FSWs and their clients, and subsequently transmission to the general population, our findings call for strengthening STI and HIV prevention programs in these groups through better promoting protected sex
as well as regular HIV and STI screening and management. Although most FSWs reported condom use during the last week of sex work, our data showed a high rate of STIs, suggesting recent unprotected sex. All stakeholders involved in HIV/STI prevention in FSWs need to emphasize on innovative strategies shown to improve condom use. Furthermore, to help developing efficient prevention programs for Malian FSWs, there is a need for additional studies to objectively measure condom use and to identify the determinants of unprotected sex in Malian FSWs. Nowadays point-of-care tests for STI detection should be considered. These tests are generally more sensitive and more specific than the syndromic approach and allow for better management of STIs, which can secondarily have an effect on HIV transmission and/or acquisition in the sex work community and in the general population.

There is also a need to rethink the approach to promote HIV testing among FSWs by offering systematically HIV testing whenever possible, in order to fill in the gap of extremely low HIV testing rates. Almost half of the women found HIV positive in this study did not know their status, and all of them reported never having been tested for HIV. In order to achieve the Joint United Nations Programme on HIV and AIDS’ goals 90-90-90, it is imperative to develop better strategies to improve HIV routine testing among FSWs in Mali. Currently in this country, the indicator used to evaluate FSW-focused HIV prevention programs is the number of contacts made by PEs with FSWs in the field. However, there is no unique identification number to count the number of contacts with the same FSW. Because of the low education level in the prostitution milieu, repeated awareness messages for the same FSW are needed to increase FSWs’ knowledge of HIV and STIs. It would therefore be important to set a unique identification number, which can help to develop a targeted intervention encouraging regular screening among FSWs as demonstrated elsewhere.26

CONCLUSIONS
This study found high prevalence rates of STIs and HIV among FSWs in Bamako. Despite several interventions to prevent HIV and STIs in this group for decades, it is surprising to note that the prevalence of modifiable risk factors like STIs is still very high. Based on these findings, it is important to emphasize the importance of strengthening HIV education and prevention activities in this high-risk group through targeted information programs, including regular HIV and STI screening and implementation research program.

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