Title: Prevalence and Factors Associated with HIV and Sexually Transmitted Infections among Female Sex Workers in Bamako, Mali

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Short Summary

We found a high prevalence of HIV and other STIs among female sex workers in Bamako, Mali. Contrary association with age and number of clients were observed for these outcomes.

Abstract:

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 aged ≥18 years 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 years (± 7.6). HIV prevalence was 20.4%, while 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 ≥ 6 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) as well as 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.

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

Keywords. Female sex workers; HIV; STIs; Risk Factors; Bamako (Mali)

Word counts: Abstract (250) and main text (3716)

BACKGROUND

In 2018, Sub-Saharan Africa (SSA) 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 SSA 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 over 40% [2, 4]. FSWs 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 [7]. 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 [9]. 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 [10, 11], but, more recent data estimates suggest an increase to 1.4% in 2018 [2]. In Mali, like for most West African countries, the HIV epidemic is concentrated in key populations, especially FSWs. Integrated Biological and Behavioral Survey (IBBS) 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*, from 4.6% to 10.5% during the same period [12]. Recent UNAIDS data reported that Mali is among the four 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 [2]. Also, it is important to note that number of HIV/STI prevention activities among FSWs have been halted due to 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 objective of this study was 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

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 three 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, etc. Only ARCAD-SIDA provides, in addition to STI treatment, and through its two health centers, HIV treatment with antiretroviral therapy (ART). Thus, HIV cases detected by the other two NGOs PEs are referred to those two centres, one being the STI clinic for key populations, and the other one an HIV treatment centre for both the general and key populations. ARCAD-SIDA was the main partner of the present study. All activities took place at the ARCAD-SIDA STI clinic.

Study Population

A FSW was defined as any woman who receives money or gifts in exchange for sex. The inclusion criteria were (a) being a FSW in the city of Bamako since at least 6 months; (b) being referred by one of the PEs of the three NGOs; and (c) being aged between 18 and 65 years old. Given that the main study was on cervical cancer screening, one FSW who had previously been diagnosed with cervical cancer and nineteen 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 [13, 14]. We hired four PEs from each of the three NGOs. They received a two-day training session about the study procedures. Through bars, brothels, streets, homes, 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 six months) were collected. After the interview, a gynecological examination was performed by the physician to detect genital ulcers, abnormal vaginal discharge, vaginitis, 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 which is sponsored by the Center for Disease Control and Prevention (CDC), Atlanta, USA. A number of tests were performed in this laboratory. Saline and potassium hydroxide (KOH) mounts of the vaginal swabs were microscopically examined immediately for motile parasites standing for *Trichomonas vaginalis* and yeast and/or pseudohyphae for *Candida albicans*. Nugent score was assessed on a Gram-stained slide prepared from a fresh vaginal swab for the diagnosis of bacterial vaginosis (BV) as described elsewhere [15]. 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 non-treponemal Venereal 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 hemagglutination assay (TPHA, Chronolab systems S.L. Barcelona, Spain). Sera positive for both VDRL and TPHA 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 thiocyanate in Tris buffer) and stored at 2 - 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 [16].

Outcome Variables

HIV infection and the presence of at least one of the other STIs were the two 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, USA). Descriptive statistics were computed to summarize demographic, behavioral and sex work characteristics. Categorical variables were expressed as percentages, and continuous ones as means with standard deviations or medians with inter-quartile ranges (IQR). 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%CI). All variables significant at $p \leq 0.2$ in univariate analysis or known from the literature as potential confounding variables [5, 6] were considered for inclusion in multivariate log-binomial regression models. Those variables were: 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 work, sex work duration, *N. gonorrhoeae*, *C. trachomatis*, *T. vaginalis* and active syphilis. Manual backwards elimination procedures were applied to remove covariates from the full model if they were neither significant nor confounder. The statistical significance threshold was p-value ≤ 0.05. Confounding was evaluated as a change in any remaining parameter estimate greater than 10% as compared to the full model. Similar procedures were applied to identify factors associated with other STIs.

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 (about 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. The majority of them (74.2%) were Malian and 52.1% were aged 20-29 years old (mean age: 26.8 years ± 7.6), Table 1. About four FSWs out of ten (39.7%) were unable to read or write. The majority of them (69.1%) were currently single, while 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 years (± 5.1); the mean age at first sexual intercourse was 15.3 years (± 2.9) and the mean age at first paid sex was 21.6 years (± 7.0). Over 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 previously tested for HIV. On the other hand, the proportion of FSWs who had at least one STI was 35.1%. *N. gonorrhoeae* was the most prevalent STI at 24.2% (95%CI: 19.8% – 29.1%), followed by *C. trachomatis*, 14.0% (95% CI: 10.5 – 18.0). The prevalence rates of *T. vaginalis* and syphilis were 3.7% and 3.1%, respectively.

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 six years. Being uneducated (APR: 2.24; 95%CI: 1.16-4.34) as well

as 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 (APR: 1.85; 95%CI: 1.21-2.82 and APR: 2.58; 95%CI: 1.44-4.62, respectively). Moreover, when we compared women first tested positive for HIV during our study to those HIV negative, we observed similar risk factors as for 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 two 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

FSWs 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 [4].

The HIV prevalence in this study (20.4%) was slightly lower than that reported in the national survey (24.2%) [12], 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 to the region.

In this study, HIV prevalence increased with age. Similar results have been reported in other studies [17, 18]. 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 [19]. Indeed, older age and longer duration in sex work increase the likelihood of frequent HIV exposure among FSWs [20].

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 [21]. 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, etc., 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 which 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 [22]. 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 non-ulcerative STIs, like *N. gonorrhoeae* and *C. trachomatis*, and HIV prevalence. Such associations have been known for a long time [23] and their possible mechanism is that STIs can cause disruption of epithelial or mucosal barriers, exposing subepithelial lymphocytes and Langerhans cells to HIV infection [24].

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 [25]. 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 paper), we were told that a set of condoms was available in each room for free use. Beyond all these factors, FSWs often tend to over-report condom use. Indeed, due to 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 (PSA) 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 PSA [26].

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/STIs 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 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 three 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 socio-demographic and behavioral characteristics was based on face-to-face self-reported information. Indeed, because of the social desirability, some participants may have under-reported 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 non-differential, 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 due to 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 one in Mali to have investigated deeply HIV and other STIs prevalence and associated factors among FSWs. It allowed us an in-depth analyses of risk factors which 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 the majority of 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 [29] and allow 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 UNAIDS's 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 (ID) to count the number of contacts with the same FSW. Due to 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 ID number, which can help to develop a targeted intervention encouraging regular screening among FSWs as demonstrated elsewhere [30].

CONCLUSION

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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AUTHOR'S CONTRIBUTIONS

FKT had the main responsibility for the literature review and drafted the study protocol. She was involved in the study design and implementation, data collection in Mali, data analysis, and drafting of the manuscript. IT participated in the supervision of data collection and significantly contributed to data analysis and preparation of the manuscript. FAG and BD participated in the data collection and critically reviewed the content of the manuscript. MA was responsible for the overall study design and the implementation of the survey and contributed significantly to the preparation of the manuscript. He was also the principal

investigator of the grant that supported this study. All authors approved the final content of the manuscript.

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Table 1. Demographic and sex work characteristics of 353 female sex workers in Bamako, Mali.

Characteristic	Number (%)
Age in years, mean (± SD)	26.8 (7.6)
Age in years	
< 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)
Number of 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 FCA	144 (40.9)
Alcohol consumption frequency per week	
Every day	63 (17.8)
Several times a week	23 (6.5)

Characteristic	Number (%)
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)	15.3 (2.9)
Age at first paid sex; mean (± SD)	21.6 (7.0)
Duration of sex work in years, mean (± SD)	5.3 (5.1)
Median years in a same sex place work (IQR)	2 (2 – 7)
Latest week total number of sexual partners[&]; median (IQR)	10 (5 – 20)
Number of paying clients, last 7 days of work; median (IQR)	10 (4 – 20)
Number of clients, last day of work; median (IQR)	3 (2 – 5)
Always used condom with paying clients (last 7 days of work)	336 (95.7)
Used condom with client at last sex	351 (99.4)
Number of condoms removed during sex with clients, in last 7 days of work	
0	331 (94.6)
≥ 1	19 (5.4)
Number of condom failures in the last 7 days of work	
0	305 (87.1)
≥ 1	45 (12.9)
Had non-paying partners[©]	14 (4.1)
Had a boyfriend	239 (67.7)
Had at least one sexual intercourse with boyfriend, last 7 days	227 (64.3)
Used condom with boyfriend at last sex, if has boyfriend, last 7 days	43 (18.4)

Abbreviations: SD, Standard Deviation; IQR, interquartile range.

[®]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 non-paying client is different from boyfriend or husband.

Table 2. Prevalence of sexually transmitted, bacterial and HIV infections among 353 female sex workers in Bamako, Mali.

	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

n = Number of positive specimens
N = Total number of specimens tested
[*]95% CI = 95% of Confidence interval
[&]Active syphilis was defined as positive sera for both tests nontreponemal Venereal Disease Research and Treponema pallidum hemagglutination assay VDRL
BV = Bacterial vaginosis
[$]STI = *N. gonorrhoeae* or *C. trachomatis* or *T. vaginalis* or active syphilis

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, years				0.000		
< 20	4/64	6.3	1.00		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		<.0001	
Educational level				0.064		**0.031**
Uneducated	37/140	26.4	1.93 [1.00 – 3.78]		**2.24 [1.16 - 4.34]**	
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	
Trend p-value			0.064		0.008	
Marital status				0.029		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		0.197
Catholic	63/279	12.5	1.06 [0.31 – 1.29]		1.72 [0.44 - 6.62]	
Muslim	4/34	22.6	1.91 [0.74 – 4.94]		2.57 [0.82 - 8.08]	
Others[#]	4/40	11.8	1.00		1.00	
Income last month	19/65			0.047		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	1.00		1.00	
≥ 200.000 FCA		21.5	1.46 [0.88 – 2.42]		1.59 [0.97 - 2.60]	
Age of first sexual intercourse, years	18/72			0.430		0.083
< 15	35/160	16.2	0.65 [0.35 – 1.18]		0.53 [0.28 - 0.98]	

Variables	n/N	%HIV+	Crude PR [95%CI]*	Global p-value	APR [95%CI]	Global p-value
15 – 17	3/22	21.9	0.88 [0.53 – 1.44]		0.89 [0.59 - 8.82]	
≥ 18	16/99	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, years				0.002		**0.005**
0 – 5	35/233	15.2	1.00		1.00	
≥ 6	36/112	32.1	2.14 [1.42 – 3.21]		**1.92 [1.22 - 3.02]**	
Number of paying clients, last 7 days of work				0.050		**0.038**
< 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		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		**0.004**
Yes	50/266	24.7	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		**0.002**
Yes	59/302	24.5	1.25 [0.73 – 2.16]		**2.58 [1.44 - 4.62]**	
No	12/49	19.5	1.00		1.00	
T. vaginalis				0.089		0.077
Yes	67/340	38.5	1.95 [0.95 – 4.01]		1.82 [0.94 - 2.69]	
No	5/13	9.7	1.00		1.00	
Active Syphilis[&]				0.549		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		0.302
Nugent score < 7	21/83	18.9	1.00		1.00	
Nugent score ≥	51/270	25.3	1.34 [0.85 – 2.09]		1.26 [0.82 - 1.93]	

BV = Bacterial vaginosis.
[*]95% CI = 95% of Confidence interval.
PR = Prevalence Ratio; APR Adjusted Prevalence Ratio.
Bolded results represent those that are statistically significant.
n = numerator, number of positive HIV cases.
N = denominator, total number of each category.
[&]Active syphilis was defined as positive sera for both tests nontreponemal Venereal Disease Research and Treponema pallidum hemagglutination assay VDRL.

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, years				<.0001		0.004
< 20	40/64	62.5	**2.41 [1.23 – 4.69]**		**2.59 [1.17 - 5.72]**	
20 - 29	58/184	31.5	1.22 [0.62 – 2.38]		1.48 [0.73 - 2.99]	
30 - 39	20/78	25.6	0.98 [0.47 – 2.07]		1.13 [0.56 - 2.27]	
≥ 40	7/27	25.9	1.00		1.00	
p-value trend test					0.018	
Education				0.107		0.638
Uneducated	60/140	35.7	1.47 [091 – 2.38]		1.00 [0.59 - 1.69]	
Primary	59/147	40.1	1.66 [1.03 – 2.64]		1.14 [0.68 - 1.90]	
Secondary or higher	16/66	24.2	1.00		1.00]	
Marital status				0.586		0.279
Married	10/27	37.0	1.00 [0.59 – 1.68]		1.47 [0.90 - 2.39]	
Separated/widow/divorced	25/82	30.5	0.82 [0.57 – 1.19]		1.22 [0.79 - 1.87]	
Single	90/244	36.9	1.00		1.00	
Nationality				0.039		0.077
Mali	103/262	39.3	1.00		1.00	
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				0.008		0.099
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, years				0.334		0.854
< 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]	

Variables	n/N	%STI	Crude PR [95%CI]*	Global p-value	APR [95%CI]	Global p-value
≥ 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, years				0.281		0.1378
0 - 5	91/233	39.1	1.00		1.00	
≥ 6	31/112	27.7			0.77 [0.54 - 1.09]	
Number of paying clients, last 7 days of work				0.043		0.007
≥ 10	72/178	40.5	1.35 [1.01 – 1.79]		**1.47 [1.11 - 1.94]**	
< 10	52/173	30.1	1.00		1.00	
Consistent condom use				0.871		0.727
Yes	119/336	35.4	1.00		1.00	
No	5/15	33.3	0.94 [0.45 – 1.95]		0.88 [0.44 - 1.76]	
Self-reported STI in last 6 months				0.034		0.050
Yes	68/15	41.2	1.36 [1.02 – 1.80]		1.32 [1.00 - 1.74]	
No	57/188	30.3	1.00		1.00	
HIV				0.005		<.0001
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	

*95% CI = 95% of Confidence interval
$STI = N. gonorrhoeae or C. trachomatis or T. vaginalis or active syphilis
PR = Prevalence Ratio; APR Adjusted Prevalence Ratio
Bolded results represent those that are statistically significant.
n = numerator, number of positive STI cases.
N = denominator, total number of each category.