HIV and Other Sexually Transmitted Infections in a Cohort of Women Involved in High-Risk Sexual Behavior in Kampala, Uganda

Judith Vandepitte, MD, MSc, Justine Bukenya, MD, MPH,* Helen A. Weiss, PhD,† Susan Nakubulwa, BSc,* Suzanna C. Francis, MSc, MPH,† Peter Hughes, MSc, CSci,* Richard Hayes, DSc,† and Heiner Grosskurth, MD, PhD*†*

Background: Uganda has long been successful in controlling the HIV epidemic; however, there is evidence that HIV prevalence and incidence are increasing again. Data on the HIV/STI epidemic among sex workers are so far lacking from Uganda. This paper describes the baseline epidemiology of HIV/STI in a newly established cohort of women involved in high-risk sexual behavior in Kampala, Uganda.

Methods: Women were recruited from red-light areas in Kampala. Between April 2008 and May 2009, 1027 eligible women were enrolled. Sociodemographic and behavioral information were collected; blood and genital samples were tested for HIV/STI. Risk factors for HIV infection were examined using multivariate logistic regression.

Results: HIV seroprevalence was 37%. The prevalence of *Neisseria gonorrhoeae* was 13%, *Chlamydia trachomatis,* 9%; *Trichomonas vaginalis,* 17%; bacterial vaginosis, 56% and candida infection, 11%. Eighty percent had herpes simplex virus 2 antibodies (HSV-2), 21% were TPHA-positive and 10% had active syphilis (RPR+TPHA+). In 3% of the genital ulcers, *Treponema pallidum* (TP) was identified, *Haemophilus ducreyi* in 6%, and HSV-2 in 35%. Prevalent HIV was independently associated with older age, being widowed, lack of education, sex work as sole income, street-based sex work, not knowing HIV-status, using alcohol, and intravaginal cleansing with soap. HIV infection was associated with *N. gonorrhoeae*, *T. vaginalis*, bacterial vaginosis, HSV-2 seropositivity and active syphilis.

Conclusions: Prevalence of HIV/STI is high among women involved in high-risk sexual behavior in Kampala. Targeted HIV prevention interventions including regular STI screening, voluntary HIV testing and counseling, condom promotion, and counseling for reducing alcohol use are urgently needed in this population.

From the *MRC/UVRI Uganda Research Unit on AIDS, Entebbe, Uganda and the †MRC Tropical Epidemiology Group, London School of Hygiene and Tropical Medicine, London, United Kingdom

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Correspondence: Judith Vandepitte, MD, MSc, MRC/UVRI Uganda Research Unit on AIDS, PO Box 49, Entebbe, Uganda. E-mail: Judith.vandepitte@mrcuganda.org.

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Longitudinal studies from Uganda showed decreasing HIV prevalence and incidence in the general population between 1989 and 1999.[1–3] However, there is evidence that HIV prevalence and incidence may be increasing again since 2005.[4] In contrast to the well-documented HIV epidemic in the general population, there is surprisingly little data on HIV epidemiology among women involved in high-risk sexual behavior in Uganda. Further, specific HIV prevention interventions targeting these women are scarce.

Studies from other sub-Saharan African countries have documented high rates of HIV and other STI among women involved in high-risk sexual behavior, such as female sex workers and bar workers.[5–10] Several countries have responded successfully by designing HIV/STI prevention interventions for this group, including improved access to STI treatment, condom promotion, voluntary HIV testing and counseling (VCT), and risk reduction counseling.[11–15] For example, HIV prevalence among attenders of a sex worker clinic in Kinshasa, DRC, decreased from 35% to 12% between 1988 and 2002[11]; in Abidjan, Cote d'Ivoire, from 80% to 32% between 1992 and 1998[12]; and in Cotonou, Bénin, from 53% to 41% between 1993 and 1999.[13]

The first cohort of women involved in high-risk sexual behavior in Uganda was recently established in Kampala, to better understand the dynamics of HIV/STI infection and to implement future HIV prevention intervention trials in this core group.

In this article, we report on the design of the cohort study, the baseline characteristics, the prevalence of HIV/STI, and risk factors for prevalent HIV infection at enrolment.

METHODS

Setting

The project (hereafter called Good Health for Women Project, GHWP) is located in Kibuye, a densely populated slum area in southern Kampala. A stand-alone clinic was established, offering free general and reproductive health care facilities for eligible women and their children aged less than 5 years. An on-site laboratory was established to perform HIV rapid tests, malaria smears, and urine analysis.

Participant Recruitment

The 2 divisions of southern Kampala (Makindye and Rubaga) were mapped for hotspots, defined as clusters of bars, night clubs, local beer breweries, eating places, lodges, and guesthouses known to provide rooms for sex work, or selected street spots often frequented by sex workers in search of clients.

Collaboration was established with a local NGO, Women at Work International, who have been offering health education and condom promotion to female sex workers in the target area since 2004. Women at Work International-trained peer-educators (PEs) were invited to join the project and were enrolled as the first cohort participants. These PE subsequently mobilized other women involved in commercial sex or employed in surrounding entertainment facilities. The project field workers revisited the newly mobilized women at their workplace to confirm that they belonged to the eligible study population (prescreening) and invited them for an information meeting at the GHWP clinic. This meeting provided detailed information about the research program, addressed questions and queries, and gave the women the opportunity to see the clinic. Women willing to join the study were scheduled for their screening visit. As the number of study participants increased, additional PEs were selected among the enrolled women, based on their communication skills, commitment to the project, and peer recommendation. The PEs were offered a monthly allowance of 50,000 Ugandan Shillings (equivalent to £17).

Study Procedures

Screening. Screening activities were conducted from March 2008 to March 2009. All women attending the clinic for screening were offered VCT, health-education counseling, free condom supplies, and free access to the general care clinic for the total duration of the project, whether enrolled into the cohort study or not. HIV-positive blood samples were sent for confirmation to the MRC clinical laboratories in Entebbe.

Women were eligible for enrolment into the cohort if aged $\geq$18 years, involved in commercial sex work (defined as receiving money, goods, or other favors in exchange for sex), or employed in entertainment facilities and living or working in Kampala. Women between 15 and 18 years were eligible if found to be mature minors (i.e., catering for their own livelihood, being pregnant, or already having children).

Eligible women were scheduled to return for the enrolment visit within 1 week. Women who delayed enrolment for more than 1 month after being screened were reassessed for eligibility.

Cohort Enrolment. Enrolment started in April 2008. An experienced nurse counselor undertook the consent procedures: a comprehension check list was filled in and only after full understanding of study procedures had been established, written or thumbprint informed consent was obtained for participation in the study. Consent procedures were witnessed if participants were illiterate.

Data were collected on sociodemographic and economic status, sexual risk behavior, alcohol and illicit drug use, intravaginal practices, reproductive health, and STI symptoms, using interviewer-administered structured questionnaires. The alcohol drinking pattern was determined using CAGE indicators.[16] Positive responses to at least 2 of the 4 CAGE questions are defined as indicative of problem drinking.

All consenting women were tested for HSV-2 and syphilis serology, underwent a gynecological examination, and were examined for STI syndromes. An endocervical sample was collected to test for *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. A high posterior fornix swab was taken to test for *Trichomonas vaginalis* and a swab from the lateral vaginal walls for diagnosis of candidiasis and bacterial vaginosis (BV). From women presenting with a genital ulcer, an additional swab was collected for identification of the etiology (*Treponema pallidum* [TP], *Haemophilus ducreyi* [HD], HSV-1, HSV-2, and lymphogranuloma venereum). Women diagnosed syndromically with any STI were managed following the Ugandan national guidelines and were reassessed after the etiological diagnosis was known. Risk reduction counseling and free condoms were provided at all visits, and all participants had the opportunity to see a clinician for any health care issue.

Follow-Up Visits. Enrolled women were scheduled to return trimonthly to the clinic. To ensure high retention rates, meetings were organized for all women expected for their next follow-up visit in the coming 2 weeks. The study procedures during follow-up visits were similar as for enrolment.

General and HIV Care. Study participants and their children aged <5 years had free access to the general care clinic, family planning, and antenatal care services and VCT throughout the study. Participants with confirmed HIV infection had CD4-counts, complete blood, liver, and renal function tests. Participants with a CD4-counts <250 cells/μL were precounseled on antiretroviral therapy (ART) at the GHWP clinic, and then accompanied to an HIV-care centre of their choice for initiation of antiretroviral therapy. Those not eligible for antiretroviral therapy were provided with cotrimoxazole prophylaxis and CD4-counts were repeated at subsequent follow-up visits.

Laboratory Methods

A single HIV rapid test (Abbott Determine HIV-1/2) was performed at the GHWP laboratory. Negative results were given to the participant immediately. Positive samples were sent to the MRC/UVRI serology laboratory in Entebbe for confirmation using 2 EIA tests performed in parallel (Vironostika Uniform II plus O, Murex HIV 1.2.O). If results were discordant or equivocal, a Western Blot Test (Cambridge Calypte Western Blot) was performed to resolve the status. Syphilis serology was assessed using a quantitative rapid plasma reagin (RPR Biotec) test and the *Treponema pallidum* hemagglutination test (TPHA Biotec). Active syphilis was defined as having both RPR and TPHA tests positive, whereas a RPR titer of 1:8 or above was considered as high-titer active syphilis. HSV-2 serology was performed using a HSV Type 2-IgG ELISA (Kalon Biologic Ltd). *N. gonorrhoeae* and *C. trachomatis* were diagnosed using the Amplicor *C. trachomatis/N. gonorrhoeae* PCR test (Roche diagnostic Systems Inc, Branchburg, NJ).

The first vaginal swab was inoculated for culturing *T. vaginalis*, using InPouch (Biomed Diagnostics, San Jose, CA). The second vaginal swab was used to prepare a Gram stained slide for the diagnosis of bacterial vaginosis using Nugents scoring method and to examine for candida infection.

For the identification of the etiology of GUD, single assays were run on a Roche Real Time PCR Light Cycler. HSV 1/2 was run using LightMix kit HSV-1/2 supplied by TIB Molbiol (TIB Molbiol Eresburgstrafse 22–23 D-12103 Berlin, Germany), whereas TP, LGV, and HD was run using in-house assays with probes and primers also supplied by TIB Molbiol.

The inoculated Trichomonas InPouch and vaginal smears were kept at room temperature and all other specimens were stored at 4°C until they reached the MRC/UVRI laboratories in Entebbe. All samples were transported within 12 hours of collection.

Statistical Methods

Sample Size. A sample size of 1000 women provides good precision for the expected prevalence of all infections of

interest at enrolment. It is also sufficient to estimate a 10% incidence rate of HIV after 1 year of follow-up with a precision of ±3% (with 95% confidence) assuming 15% loss to follow-up in the same period and an initial HIV prevalence of 50%.

Analysis of Baseline Data. All variables were first described using summary statistics. Then factors associated with HIV prevalence were analyzed using logistic regression to estimate odds ratios (OR) and 95% confidence intervals (CI). *P* values were obtained using likelihood ratio tests. A hierarchical conceptual framework was used, with variables grouped as follows: sociodemographic and economic variables, behavioral variables, and other STI.[17] The univariate association of HIV infection with each sociodemographic and economic variable was assessed first. Variables associated with HIV ($P < 0.10$) were included in a multivariable logistic regression model and were retained only if independently associated with the outcome ($P < 0.10$) after adjusting for the other variables. This resulted in a core group of sociodemographic and economic variables independently associated with HIV. Next, the association of HIV infection with each behavioral variable, adjusted for this core group, was assessed. Behavioral variables remaining independently associated with HIV ($P < 0.10$) after adjusting for each other and the core sociodemographic and economic variables were retained in the model. Finally, these same steps were repeated for the assessment of the association of HIV infection with STI results, after adjusting for core sociodemographic, economic, and behavioral factors.

Ethical Considerations

Ethical approval was obtained from the Science and Ethics Committee of the Ugandan Virus Research Institute and from the Ugandan National Committee for Science and Technology.

RESULTS

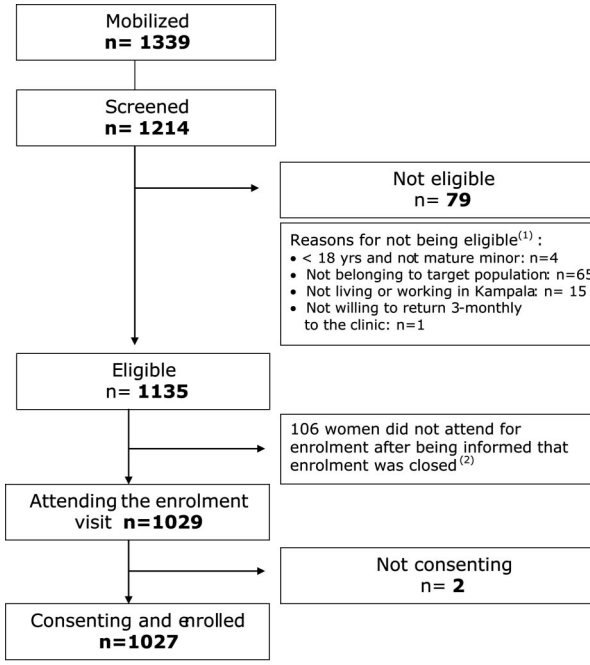
Between February 2008 and April 2009, 1339 women were mobilized, of whom 1214 (91%) attended the screening visit and 1135 (94%) of these women were eligible for cohort enrolment (Fig. 1). By May 2009, 1027 women had been enrolled. The remaining 106 eligible women were not enrolled because the sample size of 1000 was met.

Sociodemographic and Economic Characteristics

The mean age of participants was 26 years (standard deviation ±5.7 years), with 23 (2.2%) younger than 18 years. Only 8% of the participants were currently married or were living as married (hereafter called "married") (Table 1). Most (67%) of the married women had a regular extraspousal partner, and most (71%) of the nonmarried women reported having a stable partner. Sex work was the sole source of income for 34% of participants, 61% had another income besides sex work, and 5% were not involved in sex work.

Risk Behavior and Risk Perception

The majority (85%) of participants reported more than 1 sexual partner in the last month and 66% of those involved in sex work reported having at least 5 paying clients in the past month (Table 2). Reported consistent condom use in the last month with paying clients was 60%, but just 6% used condoms consistently with the marital partner. The majority (78%) of participants reported using alcohol (30% on a daily basis), and 71% of users were classified as problem drinkers. Overall, 78



[1] Some women were ineligible for more than one reason
[2] It was decided to stop enrolment after the first 1027 consenting women were enrolled, as the expected sample size of the cohort was met. The 106 eligible women not invited for enrolment as well as the 2 not-consenting women got access to the free general care services offered by the GHWP.

Figure 1. Recruitment flow.

(8%) participants reported ever using marijuana and/or khat and 2 (0.2%) women ever injected heroin.

Vaginal cleansing, defined as cleaning inside the vagina with water or other substances, was very common (94%), mainly for daily hygiene (99%), but also to prepare for sex (58%), to clean immediately after sex (91%), or to treat vaginal irritation (58%). The insertion of substances to dry or lubricate the vagina was also common.

Only 58% of the study population knew their HIV status when joining the project.

Prevalence of HIV and Other STI

HIV prevalence was 37% (95% CI, 34%–40%), increasing from 29% among those aged <25 years to 48% among those aged ≥35 years ($P < 0.001$) (Table 1). *N. gonorrhoeae* prevalence was 13% (95% CI, 11%–15%); *C. trachomatis,* 9% (95% CI, 7%–11%); *T. vaginalis,* 17% (95% CI, 15%–19%); BV, 56% (95% CI, 53%–59%); and candida infection, 11% (95% CI, 9%–13%). Antibodies for HSV-2 were detected in 80% (95% CI, 78%–82%). The prevalence of TPHA positivity was 21%, 10% were TPHA+/RPR+, and 3% had a RPR titre ≥1:8, indicating high-titer active syphilis.

TP was identified in 3% of the 62 genital ulcer disease (GUD) specimens, HD in 6%, and HSV2 in 35% specimens. LGV and HSV1 were not detected. No etiology could be identified in 55% of the specimens.

About 58% of the study participants reported not having symptoms of vaginal discharge syndrome (VDS). However, 11% of these asymptomatic women were diagnosed with gonorrhoea, 9% with Chlamydia infection, and 14% with trichomoniasis.

TABLE 1. Association of Sociodemographic Factors With HIV Infection Among Women Involved in High-Risk Sexual Behavior in Kampala, Uganda

	N	HIV+ (%)	OR (95% CI)	Adjusted OR* (95% CI)
Age (yr)			$P < 0.001$	P-trend = 0.02
<25	412	121 (29.4)	1	1
25–34	505	208 (41.2)	1.68 (1.28–2.22)	1.35 (0.99–1.83)
35+	110	53 (48.2)	2.24 (1.45–3.44)	1.72 (1.07–2.76)
Religion			$P = 0.28$	$P = 0.28$
Catholic	440	177 (40.2)	1	1
Anglican	284	102 (35.9)	0.83 (0.61–1.14)	0.88 (0.63–1.22)
Muslim	265	88 (33.2)	0.74 (0.54–1.02)	0.72 (0.51–1.00)
Other	38	15 (39.5)	0.97 (0.49–1.91)	0.86 (0.41–1.82)
Tribe[‡]			$P = 0.17$	$P = 0.39$
Muganda	608	213 (35.0)	1	1
Other Ugandan	371	147 (39.6)	1.22 (0.93–1.59)	1.12 (0.84–1.49)
Non-Ugandan	46	21 (45.7)	1.56 (0.85–2.85)	1.53 (0.79–2.94)
Education level			$P < 0.001$	P-trend < 0.001
Higher than primary level	106	24 (22.6)	1	1
Primary completed	418	138 (33.0)	1.68 (1.02–2.77)	1.52 (0.91–2.54)
Primary uncompleted	418	168 (40.2)	2.30 (1.40–3.77)	2.04 (1.22–3.41)
Never went to school	85	52 (61.2)	5.38 (2.87–10.11)	4.57 (2.37–8.81)
Current marital status			$P < 0.001$	$P < 0.001$
Married/cohabiting	83	31 (37.4)	1	1
Widowed	59	40 (67.8)	3.53 (1.74–7.14)	3.38 (1.61–7.10)
Separated/divorced	656	260 (39.6)	1.10 (0.69–1.76)	1.03 (0.62–1.69)
Single	229	51 (22.3)	0.48 (0.28–0.83)	0.58 (0.33–1.03)
Length of stay in current location			$P = 0.13$	$P = 0.79$
≤1 yr	264	94 (35.6)	1	1
>1–3 yr	290	97 (33.5)	0.91 (0.64–1.29)	0.91 (0.63–1.32)
>3 yr	473	191 (40.4)	1.22 (0.90–1.67)	1.01 (0.72–1.42)
Intending to move within the next 12 mo[‡]			$P = 0.27$	$P = 0.14$
No	785	285 (36.3)	1	1
Yes	218	88 (40.4)	1.19 (0.87–1.61)	1.28 (0.92–1.78)
No. people to support financially			$P = 0.08$	$P = 0.47$
Only myself	96	26 (27.1)	1	1
≤2 other people	477	180 (37.7)	1.63 (1.00–2.65)	1.18 (0.69–2.00)
>2 other people	454	176 (38.8)	1.70 (1.05–2.78)	0.99 (0.57–1.72)
Reported source of income			$P = 0.009$	$P = 0.03$
Sex work only	346	151 (43.6)	1	1
Sex work and other job	632	213 (33.7)	0.66 (0.50–0.86)	0.70 (0.51–0.96)
Other job only	49	18 (36.7)	0.75 (0.40–1.39)	0.81 (0.26–2.49)
Place of recruiting male clients[§]			$P = 0.003$	$P = 0.008$
Bar, club or restaurant	382	143 (37.4)	1	1
Street	152	76 (50.0)	1.67 (1.14–2.44)	1.42 (0.92–2.20)
Home or on phone	70	22 (31.4)	0.76 (0.44–1.32)	0.89 (0.49–1.60)
Several places	374	123 (32.3)	0.82 (0.61–1.10)	0.72 (0.52–0.99)
How often sex for money[¶]			$P = 0.01$	$P = 0.01$
Daily	482	184 (38.2)	1	1
At least once a week	402	157 (39.1)	1.04 (0.79–1.36)	1.34 (0.98–1.82)
Less than once a week	70	14 (20.0)	0.40 (0.22–0.75)	0.50 (0.26–0.99)
Average amount of money paid per sex act[§]			$P = 0.05$	$P = 0.79$
<5000 UgSh	231	99 (42.9)	1	1
5000–10,000 UgSh	620	227 (36.6)	0.77 (0.57–1.05)	0.91 (0.65–1.27)
>10,000 UgSh	127	38 (29.9)	0.57 (0.36–0.90)	0.83 (0.50–1.39)

*Adjusted for age, level of education, marital status, reported source of income, place of recruiting male clients, and frequency of sex for money in past 3 months.
[†]Missing for 2 individuals.
[‡]Missing for 24 individuals.
[§]Excludes the 49 women who did not report sex work.
[¶]Excludes the 49 women who did not report sex work and another 24 women who did not answer this question.
UgSh indicates Ugandan Shillings (1£ = 3,400 UgSh).

Factors Independently Associated With Prevalent HIV

In the final multivariable model, HIV was strongly associated with older age (OR = 1.62; 95% CI, 0.99–2.42 for women aged ≥35 years vs. 14–24 years; P trend = 0.02), lower levels of education (OR = 4.19; 95% CI, 2.12–8.28 for no education vs. higher than primary level; P trend <0.001), being widowed (OR = 3.14; 95% CI, 1.46–6.76 vs. married

TABLE 2. Association of Behavioral Factors With HIV Infection Among Women Involved in High-Risk Sexual Behavior in Kampala, Uganda

	Total N	HIV+ N (%)	Adjusted OR* (95% CI)
Sexual risk behavior			
Total no. lifetime partners			$P = 0.20$
<10	129	34 (26.4)	1
10–19	75	27 (36.0)	1.38 (0.71–2.69)
20–49	80	22 (27.5)	1.10 (0.55–2.22)
50+	63	21 (33.3)	1.14 (0.54–2.44)
Don't remember	680	278 (40.9)	1.65 (0.97–2.82)
Age at first sex (yr)			$P = 0.81$
<15	355	135 (38.0)	1
15+	637	232 (36.4)	1.07 (0.79–1.44)
Don't remember	35	15 (42.9)	1.24 (0.60–2.59)
First sexual partner			$P = 0.64$
First husband/fiancée	257	112 (43.6)	1
Boyfriend	657	230 (35.0)	1.05 (0.76–1.45)
Casual acquaintance	31	13 (41.9)	1.01 (0.45–2.26)
Rapist	82	27 (32.9)	0.75 (0.43–1.30)
No. sexual partners in the last month			$P = 0.31$
0–4	323	116 (35.9)	1
5–9	134	49 (36.6)	0.81 (0.50–1.31)
10–19	173	59 (34.1)	0.70 (0.44–1.12)
20–49	236	87 (36.9)	0.77 (0.49–1.23)
≥50	87	33 (37.9)	0.74 (0.40–1.37)
Don't remember	74	38 (51.4)	1.29 (0.70–2.36)
No. paying clients in the last month†			$P = 0.33$
<5	231	79 (34.2)	1
5–9	124	41 (33.1)	0.70 (0.42–1.19)
10–19	171	62 (36.3)	0.81 (0.50–1.32)
20–49	217	80 (36.9)	0.80 (0.49–1.32)
≥50	87	33 (37.9)	0.76 (0.40–1.44)
Don't remember	75	39 (52.0)	1.35 (0.72–2.52)
Condom use with paying clients in last month‡			$P = 0.03$
Never	43	16 (37.2)	1
Sometimes	90	38 (42.2)	1.09 (0.49–2.46)
Most of time	230	97 (42.2)	0.96 (0.45–2.03)
Always	540	183 (33.9)	0.64 (0.31–1.32)
HIV testing			
Knowledge of HIV status			$P < 0.001$
Yes	595	177 (29.8%)	1
No	45	26 (57.8%)	3.77 (1.94–7.30)
Never tested	387	179 (46.3%)	2.11 (1.58–2.81)
Alcohol and illicit drug use			
Frequency of alcohol use			$P = 0.005$
Never	224	64 (28.6)	1
Less than once a week	71	36 (50.7)	2.54 (1.42–4.55)
At least once a week	489	193 (39.5)	1.70 (1.18–2.46)
Daily	243	89 (36.6)	1.54 (1.01–2.36)
Drinking pattern following CAGE indicators			$P = 0.005$
Not user	224	64 (28.6)	1
Not problem drinker	231	93 (40.3)	1.88 (1.23–2.85)
Problem drinker	572	225 (39.3)	1.67 (1.16–2.40)
Intravaginal practices			
Cleansing inside the vagina in last 3 mo			$P = 0.58$
No	64	20 (31.3)	1
Yes	963	362 (37.6)	1.18 (0.66–2.10)
Cleansing inside vagina using soap in last 3 mo			$P = 0.05$
No	445	151 (33.9)	1
Yes	582	231 (39.7)	1.32 (1.00–1.73)
Inserting any substance inside the vagina in last 3 mo			$P = 0.77$
No	456	169 (37.1)	1
Yes	571	213 (37.3)	1.04 (0.79–1.38)

*Adjusted for age, level of education, marital status, reported source of income, place of recruiting male clients, and frequency of sex for money in past 3 months.
†Excluding the 49 women who were not sex workers, and 73 women with missing data for this variable.
‡Among 903 participants with paying clients in past month.
HIV indicates human immunodeficiency virus; OR, odds ratio; CI, confidence interval.

TABLE 3. Multivariable Model for Socioeconomic and Behavioral Characteristics, Independently Associated With HIV

Characteristics	Adjusted OR* (95% CI)
Age (yr)	*P*-trend = 0.02
14–24	1
25–34	1.41 (1.02–1.94)
35+	1.62 (0.99–2.42)
Education level	*P*-trend < 0.001
Higher than primary level	1
Primary completed	1.42 (0.83–2.41)
Primary uncompleted	1.79 (1.05–3.05)
Never went to school	4.19 (2.12–8.28)
Current marital status	*P* < 0.001
Married/cohabiting	1
Widowed	3.14 (1.46–6.76)
Separated/divorced	0.91 (0.54–1.54)
Single	0.49 (0.27–0.88)
Reported source of income	*P* = 0.01
Sex work only	1
Sex work and other job	0.65 (0.46–0.90)
Other job only	0.57 (0.16–2.02)
Place of recruiting male clients	*P* = 0.001
Bar, club or restaurant	1
Street	1.80 (1.14–2.84)
Other	0.94 (0.50–1.76)
Several places	0.76 (0.54–1.07)
How often sex for money	*P* = 0.006
Daily	1
At least once a week	1.26 (0.91–1.74)
Less than once a week	0.40 (0.20–0.81)
Condom use with paying clients in last month†	*P* = 0.05
Never	1
Sometimes	0.99 (0.43–2.26)
Most of time	0.88 (0.41–1.89)
Always	0.60 (0.29–1.26)
Knowledge of HIV status	*P* < 0.001
Yes	1
No	4.00 (2.04–7.82)
Never tested	2.06 (1.53–2.75)
Drinking pattern: following CAGE indicators	*P* = 0.008
Not user	1
Not problem drinker	1.90 (1.23–2.91)
Problem drinker	1.64 (1.13–2.38)
Cleansing inside vagina using soap in last 3 mo	*P* = 0.08
No	1
Yes	1.29 (0.97–1.70)

*Adjusted for age, level of education, marital status, main job, reported source of income, place of recruiting male clients, frequency of sex for money in past 3 months, condom use with paying clients in past 3 mo, CAGE score, and intra-vaginal cleansing with soap.
†Among 903 participants with paying clients in past month.

TABLE 4. Multivariable Model for the Association Between STI and HIV, Adjusted for Socioeconomic and Behavioral Characteristics

	Total N	HIV+ N (%)	Adjusted OR* (95% CI)
HSV-2 serology†			*P* < 0.001
Negative	205	19 (9.3)	1
Positive	821	362 (44.1)	5.72 (3.40–9.62)
Syphilis‡			*P* = 0.005
No infection (RPR−TPHA−)	807	275 (34.1)	1
Old infection (RPR−TPHA+)	113	54 (47.8)	1.30 (0.84–2.01)
Active infection (RPR+TPHA+)	103	53 (51.5)	1.98 (1.25–3.13)
NG PCR‡			*P* < 0.001
Negative	889	304 (34.2)	1
Positive	134	77 (57.5)	2.53 (1.67–3.82)
CT PCR†			*P* = 0.98
Negative	934	352 (37.7)	1
Positive	92	30 (32.6)	1.01 (0.61–1.67)
TV culture			*P* = 0.001
Negative	851	295 (34.7)	1
Positive	176	87 (49.4)	1.83 (1.27–2.63)
BV			*P* < 0.001
Negative	354	94 (26.6)	1
Intermediate	100	43 (43.0)	2.39 (1.44–3.98)
Positive	573	245 (42.8)	2.09 (1.53–2.87)
Candida			*P* = 0.19
Negative	915	335 (36.6)	1
Positive	112	47 (42.0)	1.35 (0.86–2.11)

*Adjusted for age, level of education, marital status, reported source of income, place of recruiting male clients, frequency of sex for money in past 3 months, condom use with paying clients in past 3 months, CAGE score, and intra-vaginal cleansing with soap.
†Excluding 1 woman with missing results.
‡Excluding 4 women with missing results.
STI indicates sexually transmitted infections; HIV, human immunodeficiency virus; OR, odds ratio; CI, confidence interval; HSV, herpes simplex virus; RPR, rapid plasma reagin; TPHA, *Treponema pallidum* hemagglutination; NG, *Neisseria gonorrhoeae*; CT, *Chlamydia trachomatis*; TV, *Trichomonas vaginalis*; BV, bacterial vaginosis; PCR, polymerase chain reaction.

women), recruiting clients on the street (OR = 1.80; 95% CI, 1.14–2.84), not knowing HIV status (OR = 4.00; 95% CI, 2.04–7.82 vs. knowing HIV status), having never been tested for HIV (OR = 2.06; 95% CI, 1.53–2.75 vs. knowing HIV status); and alcohol use (OR = 1.90; 95% CI, 1.23–2.91 for a nonproblem drinker vs. nondrinker) (Table 3). HIV was less prevalent among women for whom sex work was not the sole occupation (OR = 0.65; 95% CI, 0.46–0.90 for those with sex work and another job vs. sex work only), and those who had sex for money less than once a week (OR = 0.40; 95% CI, 0.20–0.81 vs. those who had sex for money daily).

Except for chlamydial and candida infection, all other STI were associated with HIV infection after adjustment for sociodemographic, economic and behavioral factors (Table 4). The strongest association was with HSV-2 infection (OR = 5.72; 95% CI, 3.40–9.62), and there were also associations with active syphilis (OR = 1.98; 95% CI, 1.25–3.13), *N. gonorrhoeae* (OR = 2.53; 95% CI, 1.67–3.82), and intermediate or positive BV (OR [int] = 2.39; 95% CI, 1.44–3.98; OR [pos] = 2.09; 95% CI, 1.53–2.87).

DISCUSSION

The GHWP cohort enrolled women at high risk of HIV/STI because of their likely involvement in commercial sex. We recruited either self-acknowledging sex workers or women employed in local entertainment facilities such as bars, night clubs, guesthouses, and lodges. Almost all (95%) had some income from exchanging sex for money. Our study population was relatively young, with very little schooling, predominantly

unmarried, and living with dependent children. The prevalence of HIV is very high (37%) compared with the national prevalence (6.4%) and with the prevalence among general population women from Kampala (12%)[18] but similar to prevalence in a high-risk cohort in Mombasa, Kenya, in 2009 (35%).[19] HIV prevalence was highest (44%) among women for whom sex work was the sole source of income but was still 34% among women reporting another income besides sex work. Among the 49 women who denied being involved in sex work, 37% were HIV positive. This would confirm that women working in entertainment facilities are equally at high risk, although it is very likely that these women may just have been reluctant to disclose their real source of income.

Other STIs were also highly prevalent, suggesting inadequate STI treatment in the past, either because of poor access to existing health services and/or to inappropriate management of STI. The screening questionnaire revealed that 94% of participants had never been examined with a speculum.

HSV-2 was the main cause of GUD (35%). However some cases of TP (3%) and HD (6%) were identified, indicating that currently recommended GUD management including treatment for all 3 pathogens is still justified. In 55% of the GUD specimens no etiology could be identified which is consistent with results from other studies[21,22]: it is possible that lesions caused by mechanical trauma or itching may have been misdiagnosed as GUD.

Among the 58% of women attending the enrolment visit without symptoms of VDS, high prevalences of curable STI were detected by the laboratory. Nearly half (46%) of these asymptomatic cases had confirmed VDS after gynecological examination using speculum. Despite the known limitations of the syndromic approach especially for VDS, this target population would benefit from regular screening and treatment for STI as has already been reported before in other high-risk settings.[23]

Alcohol use is common in this population, with more than 70% of participants reporting alcohol use on a regular basis and 56% having a drinking problem as defined by the CAGE scale. Similar high prevalences of problem drinking have been reported from sex workers in Mombasa (33%)[24] and in facility workers in Moshi (35%).[25] Use of alcohol, whether problem drinker or not, was independently associated with HIV infection, as has been found in other African studies.[26] Alcohol is known to reduce inhibitions and to diminish perception of risk and may therefore lead to increased unsafe sex practices. In our setting, 66% of the nondrinkers consistently used condoms with their clients, compared with 61% in nonproblem drinkers and 57% in problem drinkers ($P = 0.04$), although both variables are subject to misreporting. Participants expressed on several occasions their need for alcohol to cope with sex work. Client-centered counseling interventions have been used with some success in South-Africa to reduce alcohol intake and risky sexual behavioral patterns[27] and further such interventions are needed to assist women involved in sex work to adopt safer drinking patterns.

There was only weak evidence for the effect of condom use on HIV infection. However, condom use is difficult to measure, it is subject to misreporting,[28] and the reported condom use pattern may not be the same as at time of HIV infection. Also, condom use is often confounded with type and number of partners, and may be a marker for exposure to "high-risk" partners. Furthermore, nearly half of the women were not aware of their HIV status at enrolment which may indicate low risk perception.

Intravaginal cleansing and insertion are very common in this population. Cleansing of the vagina using soap was independently associated with HIV infection and consistent with findings from Mombasa.[29]

There are several limitations of our study. First, we were relying on reported behaviors. Our participants may have been reluctant to disclose information during this initial contact before rapport is established, or may not have been able to recall the precise information needed. Second, because of the cross-sectional design of the baseline study, we cannot analyze the temporal relationship between variables, which makes it impossible to interpret fully the associations between risk behavior, STI, and HIV infection.

Core groups with high rates of sexual partner change, such as sex workers, are thought to play an important role in the initial establishment of HIV epidemics in populations. It has been postulated that such core groups may also play an increasingly important role in later phases of HIV epidemics as prevalence declines and HIV transmission again becomes more concentrated in groups at higher risk.[30] In Uganda, with its mature HIV epidemic, this suggests that studies of the size, dynamics, and determinants of the epidemic in high-risk groups are very important.

The high prevalence of HIV/STI combined with the high-risk behavior among our enrolled women urges for specific HIV prevention interventions in vulnerable population groups such as sex workers. The established general care health services may not cater adequately for their specific needs and accessibility may be hampered due to perceived stigma and misconceptions. The wide establishment of clinics covering and targeting high-risk groups, offering regular screening and adequate treatment for STI, risk reduction counseling, and providing free condoms are needed to reinforce the control of the HIV epidemic in Uganda.

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