

High HIV Prevalence among Female Refugee Sex Workers in Kampala, Uganda, Linked to Behavioural and Structural Risks

Gerald Pande^{1,2,4*}, John Bosco Isunju³, Peter Kyambadde^{1,2}, Atulomah Nnodimele Onuigb⁴, Peter Mudiope², Herbert Kadama², Matsiko Livingstone¹, Hudson Balidawa², Moses Okumu⁵

¹Most at Risk Population Initiative (MARPI) Kampala, Uganda

²Department of AIDS Control Program, Ministry of Health, Kampala, Uganda

³Department of Disease Control and Environmental Health, Makerere University School of Public Health, Kampala, Uganda

⁴Department of Public Health, Texila American University, Guyana

⁵Department of Social Work, University of Illinois at Urbana-Champaign

*Correspondence to be addressed: E-mail - pandegerald12@gmail.com

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Abstract Female sex workers bear a disproportionate burden of HIV globally, yet little is known about HIV epidemiology among refugee sex workers in urban African settings. This study estimated HIV prevalence and examined behavioral and structural factors associated with HIV among female refugee sex workers in Kampala, Uganda. We conducted a cross-sectional study of 686 female refugee sex workers recruited through hotspot-based outreach and peer-referral networks in February and March 2026. Participants completed structured questionnaires and underwent HIV testing in accordance with national guidelines. Overall HIV prevalence was 21.0% (144/686; 95% CI: 18.1–24.3). HIV prevalence increased with age ($\chi^2 = 11.52$, $p = 0.003$) and duration in sex work ($\chi^2 = 7.86$, $p = 0.02$). In multivariable models, inconsistent condom use (APR = 1.87, 95% CI: 1.42–2.46), higher client volume (APR = 1.52, 95% CI: 1.12–2.05), alcohol use before sex (APR = 1.32, 95% CI: 1.04–1.67), exposure to work-related violence (APR = 1.39, 95% CI: 1.08–1.80), and police harassment (APR = 1.28, 95% CI: 1.00–1.63) were associated with HIV infection. These findings align with previous evidence that condomless sex, violence, alcohol use, stigma, and punitive work environments increase HIV vulnerability among female sex workers. Female refugee sex workers in Kampala face a substantial HIV burden driven by intersecting behavioral and structural vulnerabilities. Interventions addressing violence, substance use, and condom negotiation may reduce HIV risk in this population.

Keywords HIV Prevalence, Refugees, Sex Work, Structural Vulnerability, Uganda

Introduction

HIV remains a major global public health challenge, despite substantial progress in testing, treatment, and prevention. The burden of infection is not evenly distributed across populations. Female sex workers continue to face a disproportionate risk of HIV due to multiple, overlapping vulnerabilities, including economic dependence on sex work, difficulty negotiating condom use, exposure to violence, stigma, criminalization, and limited access to friendly health services [1-3]. In sub-Saharan Africa, these vulnerabilities are often worsened by poverty, mobility, alcohol use, and punitive legal or social environments that make HIV prevention, treatment, and care less accessible [4, 5].

Refugees and forcibly displaced persons face additional challenges that may increase HIV vulnerability. Displacement can disrupt family networks, income sources, education, housing, and access to healthcare [6, 7]. In urban settings, refugees may live outside formal settlements and may be less visible to humanitarian and public health programmes. Women who engage in sex work after displacement may do so under conditions of economic pressure, insecure housing, language barriers, fear of arrest, police harassment, and limited social protection [8, 9]. These conditions can make it harder to refuse unsafe sex, report violence, negotiate condom use, or maintain regular engagement with HIV prevention and treatment services.

Problem Statement

Uganda hosts a large refugee population and has made important progress in HIV prevention and treatment. However, female refugee sex workers remain underrepresented in routine HIV surveillance and research. Most available evidence on sex workers focuses on citizens or mixed groups of sex workers, without clearly identifying refugee status. As a result, programs may overlook the specific realities of women who are both refugees and sex workers. This evidence gap can weaken targeted HIV

prevention, reduce service equity, and leave structural drivers of infection unaddressed.

Study Rationale

Understanding HIV prevalence and its determinants among female refugee sex workers is essential to designing inclusive and equitable HIV programs. While individual behaviors, such as condom use, number of clients, and alcohol use before sex, are important, they occur within a broader risk environment shaped by violence, policing, stigma, poverty, and economic insecurity [10, 11]. A narrow focus on individual behavior alone may blame women for risks that are partly produced by structural conditions. This study therefore, estimated HIV prevalence and examined behavioral and structural factors associated with HIV among female refugee sex workers in Kampala, Uganda.

Study Objective

The primary objective was to estimate HIV prevalence and identify behavioral and structural determinants of HIV among female refugee sex workers in Kampala, Uganda.

Specific Objectives

1. To describe the sociodemographic, behavioral, and structural characteristics of female refugee sex workers in Greater Kampala.
2. To estimate HIV prevalence among female refugee sex workers.
3. To assess factors associated with HIV infection using bivariate and multivariable analysis.
4. To estimate the potential contribution of selected exposures to HIV burden using population attributable fraction analysis.

Methods

Study Design

This study employed a mixed-methods approach, combining a cross-sectional design with quantitative and qualitative interviews.

Phase 1 (Quantitative): A cross-sectional survey was conducted with approximately 686 female refugee sex workers (FRSWs) in Kampala. Participants were recruited at popular locations known as hotspots (hotspot: a geographic location where high-risk activities occur or are concentrated, or where female refugee sex workers gather or operate, such as pick-up points or locations where sex work takes place). Recruitment occurred at sites serviced by the MARPI clinic, including outreach sites and refugee sex workers accessing HIV services at the clinic, through snowball sampling. Participants completed a brief questionnaire, and those with unknown HIV status provided a blood sample for testing. Phase 2 (Qualitative): This phase included about 20 in-depth or key informant interviews and 10 focus group discussions. Participants were purposively selected from Phase 1 to explore and clarify key quantitative findings (e.g., HIV prevalence). Insights from the survey guided the purposive selection of participants and topics for the qualitative phase, using quantitative results to inform and shape the inquiry.

Study Site

This study was conducted in Greater Kampala, which includes the Kampala, Wakiso, and Mukono Districts. These three districts form the main urban and peri-urban area of central Uganda and together host the largest number of refugees living outside formal settlements. Greater Kampala is also the country's primary commercial and transportation hub, creating conditions that attract both internal and refugee sex workers because of the availability of clients, nightlife, and informal economic spaces. In these districts, the study focused on mapped sex-work hotspots and the MARPI clinic, where female refugee sex workers commonly operate, live, or seek services. Key hotspots include Kabalagala, Kisenyi, Rubaga, and other locations identified through consultations with peer educators, outreach teams, and local partners such as

MARPI. These hotspots were selected for their high concentration of refugee sex workers, active nightlife, and ongoing interventions, making them significant points for sampling and engagement.

Study Population

The study population consisted of female refugee sex workers (FRSWs) aged 18 years or older who reside and work in Greater Kampala (Kampala, Wakiso, and Mukono). This study defines a female refugee sex worker as a woman who:

1. Born outside Uganda and currently living in the country as a recognized refugee, asylum seeker, or with a pending asylum application (self-report is accepted to avoid excluding undocumented refugees).
2. Has exchanged sexual services for money, goods, or other material benefits within the past three months; and
3. Is 18 years of age or older.

The study also included service providers, peer educators, and key informants from institutions such as the Ministry of Health, the Uganda AIDS Commission, the Kampala Capital City Authority, MARPI, and implementing partners. These informants provided contextual information on policies, service delivery, and structural factors that affect refugee sex workers' access to HIV services.

Population and Sample Size Computation

We used the Kish Leslie formula (1965) for a quantitative study, with a 95% confidence interval and a 5% margin of error. Z is 1.96, corresponding to the 95% confidence level of the standard normal distribution, while D is the tolerable sampling error of 5%.

If $p = 50$, because the prevalence of HIV among refugee sex workers is unknown, the following is the calculation.

Confidence level: 95% $\rightarrow Z = 1.96$

Anticipated prevalence:

$p = 0.50 \rightarrow q = 1 - p = 0.50$ (not 0.67)

Precision: $d = 0.05$

Non-response: 10% (i.e., 90% response rate)

$$\begin{aligned}n_0 &= \frac{Z^2 pq}{d^2} \\&= \frac{1.96^2 \times 0.50 \times 0.50}{0.05^2} \\&= \frac{3.8416 \times 0.25}{0.0025} \\&= 384.16 \approx 384\end{aligned}$$

However, because recruitment occurred through hotspots, outreach venues, and snowball/referral mechanisms rather than simple random sampling, a design effect of 1.5 was applied to account for clustering within recruitment chains. This increases the sample size to:

$$n_{\text{DEFF}} = 384 \times 1.5 = 576$$

To accommodate potential non-response, incomplete interviews, or mobility-related attrition, an additional 10% inflation factor was included by dividing the adjusted sample by 0.9:

$$n_{\text{final}} = \frac{576}{0.9} \approx 640$$

Sampling for Female Refugee Sex Worker

Stage 1: Identification of Sites and Hotspots

In collaboration with known service providers and peer educators from MARPI, all districts within the greater Kampala area (Kampala, Wakiso, and Mukono) where MARPI is implementing the HIV prevention, care, and treatment intervention for female sex workers were included in the study. These districts were selected because MARPI actively implements HIV prevention, care, and treatment interventions for female sex workers in these areas. Within each district, all mapped hotspots, outreach points, and designated MARPI clinic sites where refugee sex workers

regularly operate or seek services were included. Hotspots were identified through existing MARPI outreach data, peer-led mapping, and consultation with community-based organizations working with FSWs.

Stage 2: Approach to Potential Participants

Selection of refugee FSW hotspots or outreach sites: All refugee hotspots, outreach sites, and MARPI clinics that provide HIV prevention, care, and treatment services to refugee FSWs in each district were included. At each hotspot, outreach site, or MARPI clinic, trained peer educators and trusted service providers approached potential participants during the data collection period (February to March 2026). All locations where MARPI routinely engages refugee sex workers, whether through outreach, drop-in services, or daytime clinic visits, served as recruitment points to minimize selection bias by recruiting participants from multiple operational environments.

Stage 3: Eligibility Screening

All eligible female refugee sex workers present at selected hotspots or outreach locations during the approximately one-month data collection period who agreed to be approached were invited to participate in the study. Each woman first underwent a brief eligibility screening conducted by a trusted service provider or a trained peer educator from MARPI. The screening confirmed that she is at least 18 years old, identifies as a refugee, and has engaged in sex work within the past six months.

Women who met the eligibility criteria received clear information about the study in a language they understood: English, Luganda, or their preferred home language (Kinyarwanda, Kirundi, Tigrinya, French, or Swahili). Those who expressed interest were guided through the informed consent process by a trained data collector in a private, safe space at the outreach site or the MARPI clinic. Only participants who

provided written consent for both the interview and the optional biological testing were included in the study.

Once consent was received, interviews were conducted in a private, secure space at the hotspot or outreach location. All women who met the inclusion criteria: female refugee sex workers aged 18 or older who have sold sex in the past six months and can communicate in any of the translated languages are eligible to participate. Women who did not meet these criteria or chose not to give consent were thanked and did not take part in the survey.

Participant Eligibility Criteria

Willing clients were screened for eligibility by study staff using the 'Participant Screening Form'. The interviewer obtained informed consent by reading the consent form in the client's preferred language (English, Luganda, or their native language: Kinyarwanda, Kirundi (Burundian), Tigrinya (Eritrean), French, Swahili) in a private, safe place. All eligible participants were provided informed consent before joining the study.

Inclusion Criteria

1. Female refugee.
2. Aged 18 years or older.
3. Has received money or goods in exchange for sexual services, regularly or occasionally, in the past 6 months.
4. Able to communicate in English, Luganda or in their native language: Kinyarwanda, Kirundi (Burundian), Tigrinya (Eritrean), French, Swahili, including English and Luganda.

Exclusion Criteria

1. Inability to provide informed consent.
2. Any person who is too sick to be interviewed.
3. Any mentally impaired person.
4. Inability to comprehend the questions.

Participant Recruitment Process

Recruitment proceeded consecutively with clients who arrived at designated service delivery points or outreach activities. When a client arrived, the known service provider conducted a brief eligibility screening using the Participant Screening Form.

Clients who met the eligibility criteria were invited to participate in the study. For those interested, the study team directed them to a private, secure space either within the facility or, during community outreach, to a location that ensured proper confidentiality.

The study team clearly explained the purpose of the study, addressed any questions or concerns the client had, and then requested informed consent before starting the interview. Individuals who chose not to participate were respectfully recorded as having declined. If they were comfortable, they were asked to provide the reason for their refusal, which was noted on the consent form. They were thanked for their time, with no repercussions for declining.

Participants who gave written informed consent were moved on to the interview in a private and confidential setting.

Consecutive Recruitment of Clients Attending Selected Services

During the one-month recruitment period (Feb to March 2026), all female refugee sex workers who visited the MARPI clinic or were reached through community outreach activities were invited to participate in the study, provided they met the eligibility criteria.

Snowball (Chain Referral) Recruitment

All study participants recruited through HIV services, either during service delivery at MARPI or through outreach activities, received four to five referral coupons to share with individuals in their network who have not yet participated in the study and have not been in contact with HIV programs or outreach services. Once eligibility was confirmed, participants

were read the consent form in their preferred language, and informed consent was obtained. All eligible participants who completed the interview were awarded transportation compensation of UGX 5,000.(\$1.35).

When a person with a study coupon visited a recruitment or outreach site to participate, a designated staff member administered the Participant Screening Form. If eligible, informed consent was secured; ineligible individuals were documented.

Consent

Once eligibility was confirmed, interviewers obtained written informed consent from participants. Eligible participants either read the consent form in their preferred language or had it read aloud to them by the interviewer. Interviewers received training on how to obtain written informed consent and how to address any questions participants may have.

During the consent process, participants were informed about the purpose of the survey, which is to fulfill the academic requirements for a PhD at Texila American University. It also aims to generate evidence on access to and utilization of HIV prevention and treatment services among refugee female sex workers in greater Kampala, to inform both academic understanding and potential improvements in services. The details of the survey procedures, potential risks and benefits, and contact information for reporting complaints or concerns were provided. They were also notified that a biological sample would be collected for HIV-related testing as part of the study and that the information obtained from the test and survey would be used by the Ministry of Health to improve health outcomes in Uganda.

Participants were assured that their participation would remain confidential and voluntary, with the right to withdraw at any time without providing a reason. They were given the opportunity to separately consent to completing the survey and to providing a

biological specimen for testing. A copy of the information and consent forms was provided to participants who wished to keep them.

For individuals who choose not to provide informed consent, interviewers would complete a refusal form documenting their reasons for refusal, if they were willing to share them. This data was used to monitor refusal rates and to understand reasons for non-participation.

Questionnaire

A structured questionnaire was administered to participants under the supervision of an interviewer. The questionnaire covered a range of topics, including demographics, sex work history, knowledge of HIV and services, attitudes and beliefs, risk perception, , and use of HIV prevention and testing services. The interview lasted between 30 and 45 minutes.

To ensure accuracy and cultural relevance, the questionnaires underwent a translation and back-translation process. Additionally, they were pretested before field implementation to account for language, cultural, and peer norms.

The questions included in the questionnaire were carefully selected and aligned with the study's objectives.

Biological Sample

Healthcare providers at MARPI conducted HIV testing in accordance with Ugandan national guidelines. The study participants were asked about their HIV serostatus. For those whose HIV status was known to be positive and who were in care on ART, their suppression rate was ascertained from the source ART care card or viral load test result form during a review of their medical/treatment history. Those with unknown status expressed interest in HIV testing. Those who consented to HIV testing had up to 1 mL of venous blood drawn from the ring finger or the arm. The blood was used to test for HIV using the rapid HIV testing procedure (Figure 1). The remainder of the blood was discarded after the test.

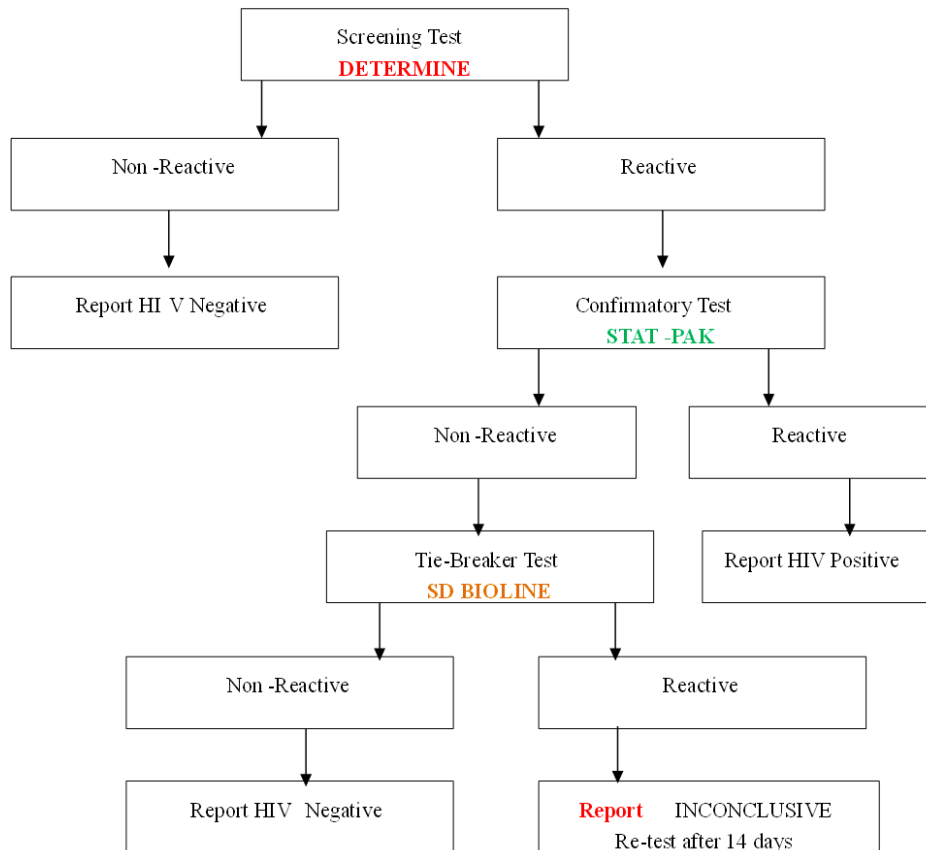


Figure 1. The National HIV Testing Algorithm

National guidelines will be followed for providing test results and post-test counselling.

Counselling and Referral

Post-test HIV counselling: Post-test counseling messages were tailored to recruits' HIV results and risk profiles. Uganda MOH guidelines for counseling were followed for HIV counseling, testing, and referral services. Post-test counseling included goals, means, and strategies for behavioral risk reduction, maintenance of risk reduction, and explanations of risk reduction methods (e.g., condom use, drug use). Counseling for HIV-infected participants included an assessment of psychosocial needs, a discussion of living with HIV infection, treatment and care, and issues related to discrimination. The risk of HIV transmission to partners was discussed, and strategies for behavioral change were addressed. Counseling was performed face-to-face. PrEP, STI commodities, condoms, and lubricants (as available) were provided.

Dependent Variable

HIV Status

1. Measured through voluntary HIV testing following national algorithms OR self-reported HIV status where testing is declined.
2. Categorised as: *Positive / Negative*.

Associated Factors (Independent Variables)

Measured through structured questionnaire items: All associated factors will be examined using bivariate and multivariable regression to identify predictors of HIV positivity.

1. Demographic Variables

- Age (continuous / categories)
- Nationality (categorical)
- Education level (categorical)
- Marital status (categorical)

2. Behavioural Variables

- Number of clients per week (continuous / categories)

- Condom use consistency (Always / Sometimes / Never)
- Substance use (Yes/No; frequency scale)
- Experience of violence (Yes/No; perpetrator type)

3. Contextual Variables

- Duration in Uganda (continuous / categories)
- Living conditions (categories)
- Police encounters / harassment (Yes/No)

Survey Period

The recruitment period for the consecutive survey-based recruitment was 4 weeks (February to March 2026) in length, with an additional 2 weeks during which individuals were referred through snowball.

Data Collection Techniques and Instruments

To collect data, we recruited and trained 10 interviewers with experience working with key populations, including refugee female sex workers and other HIV-vulnerable groups. The interviewers received orientation and sensitivity training to prepare them for effective engagement and rapport-building with these groups.

These data collectors were responsible for establishing relationships and trust with refugee female sex workers, screening for eligibility, recruiting participants, obtaining consent, providing transportation refunds, and collecting blood samples for HIV testing. They also administered questionnaires, directed clients during specimen collection for HIV screening, initiated antiretroviral therapy (ART) or pre-exposure prophylaxis (PrEP) as needed, and facilitated linkages to care, which were handled by an outreach health worker from MARPI.

HIV testing and counseling were offered on-site to individuals with unknown HIV status, following the national testing algorithm. Each team leader was responsible for maintaining a

registration log that recorded all invited individuals, including the number of eligible participants and those who declined.

Interviews were conducted face-to-face at selected hotspots or outreach sites using questionnaires created in Kobo Collect, a mobile data collection app. The app was configured with field validation to prevent errors and included skip patterns. Data was entered directly into tablets during interviews and uploaded daily to the Kobo Collect server via Wi-Fi. The survey team then retrieved the data from the server for further processing and analysis.

Selection of Data Collectors

Research assistants fluent in English and their native languages (Kinyarwanda, Kirundi [Burundian], Tigrinya [Eritrean], French, and Swahili) with prior experience working with sex workers, especially refugee sex workers, in each hotspot were identified. These research assistants were thoroughly trained on study aims, research protocol, interview skills, data management, and research ethics.

Quality Control and Assurance for Quantitative

Data collectors participated in a three-day training program focused on collecting high-quality data. The training highlighted research ethics, especially the need to protect the privacy and sensitivity of female refugee sex workers during interviews. To ensure the reliability and consistency of the data collection tools, they were pretested in Kampala at one of the hotspots that was not included in the study area. Repetitions, vague questions, overlapping response options, and other inconsistencies in the tools were identified and corrected. Findings from the pretesting process were used to guide editing of the tools to enhance their validity. To improve data quality and completeness, the data collection tools included checks and restrictions. Both virtual and in-person meetings were held daily to verify

consistency and completeness and to ensure proper data collection.

HIV Testing, Referral, and Linkage

All HIV-infected post-test-counseling recruits were provided with a referral form for services and linked to the preferred point of care. We collaborated with health care providers willing to accept these referral letters and to provide further care and treatment as necessary. On a case-by-case basis, study staff offered to

accompany participants to obtain highly needed referral services (examples: HIV treatment services, gender-based violence services, etc.). Clinics to which HIV-positive persons were linked were asked to retain the referral forms received. A system was put in place to track the number of people who were offered, accepted, and were escorted to a treatment facility (table below). An explanation for why each of the events did not occur was documented.

Participant ID	Was the Participant Offered an Escort?	Did the Participant Accept?	Was the Participant Escorted?
	☐ Yes ☐ No, why? _____	☐ Yes ☐ No, why? _____	☐ Yes ☐ No, why? _____
	☐ Yes ☐ No, why? _____	☐ Yes ☐ No, why? _____	☐ Yes ☐ No, why? _____

Potential Risks

The blood draw could involve minimal risk, including pain from injection-site injury. The risk of pain at the venipuncture site was minimized by the use of appropriate MOH and WHO infection control and testing procedures. Physical discomfort at the venipuncture site was minimal. However, participants who experienced mild pain were reassured that this was temporary and would subside within a few minutes. Participants who experienced any other untoward effect after leaving the study site were encouraged to seek medical advice at the nearest health facility and/or get in touch with the provided contact details for any further help.

Participants who learn of their HIV infection through survey participation may experience psychological and emotional problems, ongoing uncertainty about their health, and worries about having infected others. In this study, post-test counseling was offered by study-trained staff to address the concerns of participants who tested positive. The team

referred and linked newly HIV-positive participants to ART treatment initiation and further care and support at the client's preferred point of care.

HIV serostatus and disclosure of sex work use may also subject participants to stigma, discrimination, and potential legal sanctions. To minimize the risk of these disclosures, the survey restricted access to study materials. Only the Principal Investigator had access to participants' information, and no other study team member did.

Potential Benefits

Direct benefits of participating in this survey included learning your HIV status. If you tested positive, referrals to care and treatment were provided. Study staff also connected you with appropriate organizations for other issues, as needed. For some participants, taking part in the survey might have been their first opportunity to access HIV services or to reconnect with them.

Confidentiality

Confidentiality was a key priority in this study because refugee female sex workers face high levels of stigma, legal vulnerability, and social risks. To protect participants, all screening, consent, and interviews were conducted in private, secure locations, either in facility rooms or in discreet settings during outreach, ensuring conversations could not be overheard. Participants were not asked for names or any direct identifying information; instead, each refugee sex worker was assigned a unique study ID code used for all data.

Collection Tools

Consent forms were stored separately from interview data to prevent linking identities to responses. All screening, consent, and interviewing were conducted by trusted peer educators, community outreach workers, or known service providers with established relationships with the refugee sex work community. These staff members received training in confidentiality, trauma-informed communication, research ethics, and the sensitive handling of personal information. Interviews were conducted in the participant's preferred language, including English, Luganda, Kinyarwanda, Kirundi, Tigrinya, French, or Swahili, to avoid the need for untrained interpreters and minimize the risk of accidental disclosure.

Study staff consistently ensured that participants' identities remained secure, preventing accidental disclosures of their relationships with those they referred to the study and of their status as female refugee sex workers (FRSW). To this end, all staff members signed confidentiality agreements.

Data was uploaded using a unique study ID, which was used in the data uploaded to the database and on laboratory forms. This allows test results to be linked to participants' survey data while keeping their identities confidential. No personally identifiable information was

included in the data uploaded to the database, further protecting participants' confidentiality.

Identifying, Managing, and Reporting Adverse Events

No adverse events were expected from this study, but participants might have experienced emotional distress after receiving a new HIV diagnosis. To address this, trained counselors were available at all study sites for support. During sample collection, although the risk was low, there was a possibility of adverse events related to blood collection, such as infection or minor bleeding from heel-stick or finger-prick procedures. The Principal Investigator was responsible for reporting any adverse events to the Ministry of Health and to relevant ethics review groups, including the National Institutional Review Board.

There was a potential risk of data loss if a device used for data collection was lost or stolen. To address this risk, study personnel were required to immediately report any such incident to the study coordinator, including details of when and where it occurred. The study coordinator would then notify the Principal Investigator and the data manager to ensure that the affected device was disabled and replaced promptly. In addition, the Principal Investigator would report the incident to the Ministry of Health and the relevant ethics committees.

Although data loss was possible under such circumstances, the study minimized this risk by uploading data in real time or at regular intervals whenever internet connectivity was available. Any data that could not be recovered would have been treated as missing data during analysis. Furthermore, no identifiable participant information was stored on the devices, thereby ensuring that participant confidentiality would not be compromised in the event of device loss or theft. During the course of this study, no data were lost.

Participants received the Principal Investigator's contact information for any

study-related questions or concerns. They were also given contact details for the Research Ethics Committee to report any adverse events. The study team was expected to report any unexpected or adverse events to the Principal Investigator within 24 hours and to the relevant ethics committees within 5 to 10 days, depending on severity and the need for additional information. Follow-up reports were submitted as needed. However, no events were reported during the study period.

Survey staff and the principal investigator oversee protocol monitoring and compliance to ensure adherence to study protocols and ethical standards.

Data Processing and Information Analysis

Quantitative Data Management

To improve data security, the KoboCollect data collection tool was configured to use encryption. A public key was included in the XLS form uploaded to KoboCollect, while the private key was used locally with ODK Briefcase to decrypt data after downloading from the server. The private key, kept confidential by the principal investigator and data manager, ensured secure access. The tool was designed to automatically encrypt data on mobile devices once survey assistants marked it as finalized. Submitted data was stored encrypted on the KoboToolbox server and was accessible only with the private key.

Data Analysis

Descriptive Analysis: Descriptive statistics were used to summarize participants' socio-demographic characteristics, HIV testing history, knowledge about HIV and related services, attitudes and beliefs, risk perception.

Bivariate Analysis: Chi-square or Fisher's exact tests were used to assess associations between socio-demographic factors.

Multivariate Analysis: Logistic regression may be used to identify factors HIV prevalence

among female refugee sex workers in greater Kampala.

Qualitative Perspective

Data Collection Methods and Techniques

Socio-demographic: Socio-demographic characteristics of participants included age in complete years (continuous), marital status (never married, married, divorced, widowed, or separated), and the highest level of education attained (no education or primary, secondary, university, or tertiary). Other characteristics included occupation, defined as the primary means by which the participant supports themselves. Surveys: Structured surveys were administered to explain findings, such as HIV prevalence.

Methods and Techniques for Data Processing and Information Analysis

We processed and analyzed qualitative data using a systematic, rigorous approach that ensured accuracy and depth. Our process includes:

Transcription and Data Cleaning

We transcribed all audio-recorded interviews and focus group discussions verbatim. Transcripts were reviewed and cleaned to ensure accuracy and to remove any identifying information.

Coding

We applied an iterative coding process using qualitative data analysis software (e.g., NVivo or Atlas.ti). Initial open coding identified key concepts, which we then refined through axial coding to organize related codes into broader categories.

Thematic Analysis

We conducted a thematic analysis by examining the coded data to identify recurring themes and patterns. This process involved constant comparison, allowing us to capture both anticipated and emergent themes that

elucidate barriers and facilitators to accessibility of HIV prevention, care, and treatment.

Interpretative Analysis

We analyzed the data contextually, interpreting how social, cultural, and structural factors influence participants' experiences. We triangulate insights from in-depth interviews, focus groups, and key informant discussions to validate our findings.

Member Checking and Validation

We incorporated feedback from participants (member checking) and peer debriefing sessions to enhance the credibility and trustworthiness of the analysis. This step ensured that the interpretations accurately reflected the participants' perspectives.

Ethical Considerations

To conduct the survey, ethical approval was obtained from the Kabale University Institutional Review Board and the survey was registered with the Uganda National Council of Science and Technology (UNCST). Additionally, permission was secured from the Most at Risk Population Initiative (MARPI). Participation in the survey was voluntary, and participants were fully informed about the study procedures, including the use of the ODK tool for quantitative data and audio recorders for

qualitative data. Written informed consent was obtained from all participants using consent forms before any data collection interviews.

Measures were taken to safeguard personal identifiers and survey data involving human subjects. Participants' names were not linked to their responses, and all data files were stored on password-protected devices accessible only to authorized members of the survey team. All staff involved in the study completed training and certification through the Collaborative Institutional Training Initiative (CITI), specifically the Information Privacy & Security (IPS) module and other relevant modules, such as Good Clinical Practice (GCP). Survey assistants without prior GCP training were required to complete it before participating in data collection training to ensure compliance with ethical standards throughout the survey.

Survey assistants also received training in interviewing techniques tailored for key and priority populations, with a focus on creating a supportive environment for interviews. All collected data will be securely stored and destroyed five years after the completion of survey activities.

Results

Socio-Demographic Characteristics

The socio-demographic characteristics of the respondents are shown in Table 1 below.

Table 1. Sociodemographic, Behavioral, and Structural Characteristics of Female Refugee Sex Workers in Greater Kampala (N = 686)

Characteristic	N	%
Age group (years)		
18–24	208	30.3
25–34	321	46.8
≥35	157	22.9
Nationality		
Democratic Republic of Congo	286	41.7
South Sudan	173	25.2
Rwanda	112	16.3
Burundi	79	11.5
Other	36	5.3
Education level		

No formal education	96	14.0
Primary education	283	41.3
Secondary education	259	37.8
Post-secondary	48	7.0
Clients per day		
1–2 clients	295	43.0
3–5 clients	274	39.9
≥6 clients	117	17.1
Condom use with clients		
Always	338	49.3
Sometimes	271	39.5
Never	77	11.2
Alcohol use before sex		
Yes	327	47.7
No	359	52.3
Drug use before sex		
Yes	104	15.2
No	582	84.8
Experienced work-related violence		
Yes	308	44.9
No	378	55.1
Police harassment related to sex work		
Yes	261	38.0
No	425	62.0

A total of 686 female refugee sex workers participated in the study. Nearly half, 46.8% (321/686), were between 25 and 34 years old; 30.3% (208/686) were between 18 and 24 years old; and 22.9% (157/686) were 35 years or older. The median age was 27 years (IQR 22–33). Participants primarily originated from the Democratic Republic of Congo (41.7%, 286/686), South Sudan (25.2%, 173/686), Rwanda (16.3%, 112/686), Burundi (11.5%, 79/686), and other countries, such as Ethiopia and Eritrea (5.3%, 36/686). A good number of the refugee sex workers had primary education (41.3%, 283/686); secondary education (37.8%, 259/686); 14% (96/686) had no formal education; and 7.0% (48/686) had attained post-secondary education. Nearly half, 43.0% (295/686), of the participants reported having sex with 1–2 clients per day; a good number,

39.5% (274/686), reported having sex with 3–5 clients per day; and about 17.1% (117/686) reported having sex with 6 or more clients per day. Less than half, 49.3% (338/686), reported consistent condom use with clients; about 39.5% (271/686) reported inconsistent use of condoms; and 11.2% (77/686) never used condoms while selling sex. Almost half, 47.7% (327/686), of the respondents reported alcohol use before work. A good number, 44.9% (308/686), reported work-related violence, and 38.0% (261/686) reported experiencing police harassment during sex work.

Prevalence of HIV Among Refugee Sex Workers

The overall HIV prevalence was 21.0% (144/686; 95% CI: 18.1–24.3), as shown in Table 2.

Table 2. HIV Prevalence by Participant Characteristics

Variable	Total (N)	HIV Positive n (%)	χ^2	p-value
Age group			11.52	0.003
18–24	208	31 (14.9)		
25–34	321	71 (22.1)		
≥35	157	42 (26.8)		
Duration in sex work			7.86	0.020
<2 years	214	31 (14.5)		
2–5 years	268	59 (22.0)		
>5 years	204	54 (26.5)		
Condom use with clients			32.44	<0.001
Always	338	45 (13.3)		
Sometimes	271	70 (25.8)		
Never	77	29 (37.7)		
Clients per day			14.78	<0.001
1–2	295	48 (16.3)		
3–5	274	62 (22.6)		
≥6	117	34 (29.1)		
Alcohol use before sex			8.36	0.004
Yes	327	83 (25.4)		
No	359	61 (17.0)		
Drug use before sex			10.49	0.001
Yes	104	33 (31.7)		
No	582	111 (19.1)		
Work-related violence			10.11	0.002
Yes	308	82 (26.6)		
No	378	62 (16.4)		
Police harassment			8.71	0.003
Yes	261	71 (27.2)		
No	425	73 (17.2)		

HIV prevalence increased with age ($\chi^2 = 11.52$, $p = 0.003$), duration in sex work ($\chi^2 = 7.86$, $p = 0.02$), condom use in sex work ($\chi^2 = 32.44$, $p = 0.001$), the number of clients per day ($\chi^2 = 14.78$, $p = 0.001$), alcohol use during sex work ($\chi^2 = 8.36$, $p = 0.004$), drug use before sex ($\chi^2 = 49$, $p = 0.001$), experience of work-related violence ($\chi^2 = 11$, $p = 0.002$), and police harassment ($\chi^2 = 8.71$, $p = 0.003$). These

factors were also significantly associated with HIV positivity.

Sequential Modified Poisson Regression Models of Factors Associated with HIV Infection

The sequential modified Poisson regression models examining factors associated with HIV prevalence is presented in Table 3.

Table 3. Sequential Modified Poisson Regression Models of Factors Associated with HIV Infection

Variable	Model 1 APR (95% CI)	Model 2 APR (95% CI)	Model 3 APR (95% CI)
Age ≥ 35 years	1.72 (1.28–2.32)	1.63 (1.20–2.22)	1.58 (1.18–2.12)
No formal education	1.49 (1.11–2.00)	1.46 (1.08–1.96)	1.44 (1.07–1.93)
≥ 6 clients/day	–	1.61 (1.20–2.17)	1.52 (1.12–2.05)
Inconsistent condom use	–	2.03 (1.55–2.66)	1.87 (1.42–2.46)
Alcohol use before sex	–	1.39 (1.10–1.75)	1.32 (1.04–1.67)
Drug use before sex	–	1.41 (1.05–1.90)	1.36 (1.01–1.84)
Work-related violence	–	–	1.39 (1.08–1.80)
Police harassment	–	–	1.28 (1.00–1.63)
Notes: Model 1: demographic variables Model 2: demographic + behavioral variables Model 3: demographic + behavioral + structural variables APR = Adjusted prevalence ratio			

In Model 1, which included only demographic variables, participants aged 35 years and older had a significantly higher HIV prevalence than those under 35 (APR = 1.72, 95% CI: 1.28–2.32). Likewise, participants with no formal education had higher HIV prevalence than those with some education (APR = 1.49, 95% CI: 1.11–2.00).

In Model 2, after adjusting for behavioral factors, age ≥ 35 years (APR = 1.63, 95% CI: 1.20–2.22) and lack of formal education (APR = 1.46, 95% CI: 1.08–1.96) remained significantly associated with HIV infection. Behavioral factors, including having six or more clients per day (APR = 1.61, 95% CI: 1.20–2.17), inconsistent condom use (APR = 2.03, 95% CI: 1.55–2.66), alcohol use before sex (APR = 1.39, 95% CI: 1.10–1.75), and drug use before sex (APR = 1.41, 95% CI: 1.05–1.90), were also notably associated with higher HIV prevalence.

In the final model (Model 3), which included demographic, behavioral, and structural

variables, age ≥ 35 years (APR = 1.58, 95% CI: 1.18–2.12) and lack of formal education (APR = 1.44, 95% CI: 1.07–1.93) remained significantly associated with HIV infection. Behavioral factors such as ≥ 6 clients per day (APR = 1.52, 95% CI: 1.12–2.05), inconsistent condom use (APR = 1.87, 95% CI: 1.42–2.46), alcohol use before sex (APR = 1.32, 95% CI: 1.04–1.67), and drug use before sex (APR = 1.36, 95% CI: 1.01–1.84) also remained significant predictors. Additionally, structural factors such as work-related violence (APR = 1.39, 95% CI: 1.08–1.80) and police harassment (APR = 1.28, 95% CI: 1.00–1.63) were independently associated with higher HIV prevalence.

Population Attribution Fractions for Selected HIV Risk Factors

The population attribution fractions for selected HIV risk factors are shown in Table 4 below.

Table 4. Population Attributable Fractions for Selected HIV Risk Factors

Exposure	Prevalence of Exposure (%)	APR	Population Attributable Fraction (%)
Inconsistent condom use	50.7	1.87	30
Violence exposure	44.9	1.39	24
Alcohol use before sex	47.7	1.32	22

Presents the estimated contribution of selected risk factors to HIV infection in the study population. Inconsistent condom use had the highest exposure prevalence (50.7%) and the highest adjusted prevalence ratio (APR = 1.87). It also had the largest population attributable fraction (PAF) of 30%, suggesting that nearly one-third of HIV infections in this population could be prevented if inconsistent condom use were eliminated, assuming a causal relationship. Violence exposure was also common, reported by 44.9% of participants. It had an APR of 1.39 and a PAF of 24%, indicating that violence may be an important structural and social driver of HIV risk. This finding highlights the need to integrate violence prevention, protection, and response services into HIV prevention and care programs.

Alcohol use before sex was reported by 47.7% of participants and was associated with higher

HIV prevalence (APR = 1.32). Its PAF was 22%, suggesting that reducing alcohol-related sexual risk behaviors could meaningfully reduce HIV infections.

Overall, the table shows that inconsistent condom use, exposure to violence, and alcohol use before sex are important contributors to HIV risk. These findings support the need for combination HIV prevention strategies that address individual behaviors, such as condom use and alcohol-related risk, as well as broader structural factors, such as violence.

Interaction Between Violence Exposure and Condom Use in Relation to HIV Infection

The Interaction Between Violence Exposure and Condom Use in Relation to HIV Infection is shown in Table 5.

Table 5. Interaction Between Violence Exposure and Condom Use in Relation to HIV Infection

Condom Use	Violence Exposure	HIV Positive n/N (%)	Adjusted PR	95% CI
Always	No	20/184 (10.9)	Reference	–
Always	Yes	25/154 (16.2)	1.44	0.85–2.44
Sometimes	No	28/138 (20.3)	1.78	1.05–3.02
Sometimes	Yes	42/137 (30.6)	2.94	1.72–5.03
Never	No	17/60 (28.4)	2.31	1.19–4.48
Never	Yes	12/28 (42.9)	4.86	2.41–9.82

Interaction term p = 0.01

HIV positivity increased as condom use decreased, and the risk was higher among participants who had experienced violence. The lowest HIV prevalence was observed among participants who always used condoms and had

no violence exposure, at 10.9%, which served as the reference group.

Participants who sometimes used condoms had higher HIV prevalence, especially when they had also experienced violence. HIV

positivity increased from 20.3% among those with no violence exposure to 30.6% among those exposed to violence. Similarly, among participants who never used condoms, HIV positivity was much higher among those exposed to violence, at 42.9%, compared with 28.4% among those not exposed to violence.

The adjusted prevalence ratios show the same pattern. The highest HIV risk was observed among participants who never used condoms and had experienced violence, with an adjusted PR of 4.86. This means they had nearly five times the prevalence of HIV compared with those who always used condoms and had no violence exposure.

The significant interaction term, $p = 0.01$, suggests that violence exposure strengthens the relationship between inconsistent condom use and HIV infection. These findings indicate the need for HIV prevention interventions that combine condom promotion with violence prevention and response services.

Discussion

This study found a high burden of HIV infection among female refugee sex workers in Greater Kampala, Uganda. The overall HIV prevalence was 21.0%, substantially higher than the 5.1% reported among adults aged 15 years and older in the general population in Uganda, according to the Uganda Population-based HIV Impact Assessment 2020–2021 [1]. This large difference indicates that female refugee sex workers continue to experience a much higher HIV burden than the general population. However, the HIV prevalence observed in this study was lower than the 33% prevalence previously reported among female sex workers in Kampala by the Crane Survey conducted by Makerere University School of Public Health and the Ministry of Health [2]. This difference may reflect variations in study populations, sampling methods, geographic settings, refugee status, age structure, duration in sex work, and access to HIV prevention and treatment services. Some refugee sex workers

in this study may also have been younger or had spent fewer years in sex work than those included in earlier Kampala-based surveys. However, an HIV prevalence of 21.0% remains very high and represents a serious public health concern.

This finding confirms that female refugee sex workers remain a highly vulnerable population within Uganda's national HIV response. Their vulnerability stems not only from sexual behavior but also from displacement, poverty, limited education, violence, alcohol and drug use, police harassment, stigma, and reduced power to negotiate safer sex. These overlapping challenges create an environment in which HIV risk is not simply a matter of individual choice. A woman may understand the importance of condom use yet still be unable to use condoms consistently because of client pressure, fear of violence, financial need, alcohol use, or harassment by law enforcement. This finding aligns with global evidence showing that female sex workers bear a disproportionate HIV burden due to structural determinants such as violence, criminalization, stigma, unsafe working conditions, and limited access to quality health services [3, 4, 12, 20].

The qualitative findings provide important context for understanding these quantitative results. Participants linked HIV vulnerability to the conditions of being refugee women with limited livelihood options. Many explained that they entered sex work not because they wanted to, but because they needed to survive, feed children, pay rent, or meet basic needs. One participant explained that refugee women are at higher risk because they often lack social support and may face language barriers: *"A refugee who doesn't know the language very well can be used without knowing what they have negotiated... even if she says that she wants to take the person to police, he will win her because she will not speak the language."* Another participant described how poverty pushes women into unsafe sex: *"Most of the sex*

workers do it not because they want but they are looking for a living, so that is how most of them acquired HIV.” These accounts show that HIV risk is strongly linked to social and economic hardship. Hunger, rent, school fees, lack of employment, and the responsibility of caring for children limit women's ability to protect themselves.

The participants' refugee status is therefore important for interpreting these findings. Refugees and forcibly displaced persons may experience disrupted family networks, loss of income, unstable housing, food insecurity, language barriers, limited livelihood options, and reduced access to health information and services [7, 8]. For women who enter sex work after displacement, these vulnerabilities may be intensified by economic pressure, insecure living conditions, social exclusion, and a lack of legal protection. In such circumstances, the ability to refuse unsafe sex, insist on condom use, report violence, or access health facilities may be limited. Therefore, HIV prevention messages that focus only on individual behavior are insufficient. Interventions must also address the broader realities of displacement, poverty, stigma, and insecurity.

Inconsistent condom use was among the strongest factors associated with HIV infection in this study. Participants who used condoms inconsistently had a higher prevalence of HIV than those who used them consistently. In the final adjusted model, inconsistent condom use remained independently associated with HIV prevalence. The population attributable fraction analysis also showed that inconsistent condom use accounted for the largest share of HIV infections among the selected risk factors. This suggests that improving consistent condom use could prevent a substantial proportion of HIV infections in this population.

However, condom use among sex workers should not be viewed as a simple matter of personal decision-making. Condom negotiation is often shaped by unequal power dynamics between sex workers and clients, client refusal,

offers of higher payment for condomless sex, alcohol use, fear of violence, and pressure to meet daily survival needs [9, 10, 13]. In addition, police harassment may make it unsafe for sex workers to carry condoms, especially where condoms are treated as evidence of sex work. Therefore, condom programming should go beyond condom distribution. It should include peer-led risk-reduction counseling, negotiation skills, client engagement, access to lubricants, PrEP, post-exposure prophylaxis, and safer working environments.

The study also found that HIV prevalence increased as condom use declined. HIV positivity was lowest among women who always used condoms and highest among those who never used them. This finding is biologically plausible and consistent with evidence that correct and consistent condom use reduces heterosexual transmission of HIV and other sexually transmitted infections [11]. In sex work settings, where women may have repeated sexual exposure with multiple clients, even occasional condomless sex can increase cumulative risk. Therefore, continuous availability of condoms and lubricants at hotspots, clinics, drop-in centers, refugee-serving organizations, and community outreach points is essential.

Exposure to violence was another important factor associated with HIV infection. Nearly half of participants reported work-related violence, and those who experienced violence had higher HIV prevalence than those who did not. This finding aligns with previous studies showing that violence against sex workers increases HIV vulnerability and undermines prevention efforts [12, 13]. Violence can increase HIV risk directly through forced sex, condomless sex, and genital trauma. It can also increase risk indirectly by reducing a woman's ability to negotiate condom use, lowering self-esteem, increasing fear, discouraging service uptake, and contributing to harmful alcohol or drug use.

The qualitative findings further demonstrate how violence increases HIV vulnerability. Participants described serious experiences of sexual violence, deception, and abuse from clients. Some women reported being taken by one client but later finding several men waiting to have sex with them. In such situations, they were often unable to refuse, escape, or negotiate condom use. One participant explained: *"You can go with one person, and he says that we are going to my home, but when you reach there, you find more than 6 people, and automatically they all have sex with you... None will put on a condom."* Another participant described being trapped in a room: *"You find some under the bed, others behind the door. You have entered, and there is nowhere to exit. They locked it and kept the keys."* These accounts show that HIV risk is strongly connected to violence and lack of control during sexual encounters. The women's vulnerability is not only due to condomless sex, but also to coercion, group sexual violence, non-payment, and inability to seek justice.

The interaction between violence exposure and condom use is one of the study's most important findings. HIV prevalence was lowest among participants who always used condoms and had no exposure to violence. However, HIV prevalence increased sharply among women who used condoms sometimes or never, especially when they had also experienced violence. The highest HIV prevalence was observed among women who never used condoms and had experienced violence. These women had almost five times the HIV prevalence of those who always used condoms and had no exposure to violence. The significant interaction term suggests that violence amplifies the harmful effect of inconsistent condom use on HIV infection.

This finding has important program implications. It suggests that condom promotion alone may not adequately protect women who continue to work in violent conditions. A sex worker may understand HIV

prevention messages and even prefer to use condoms, but violence can strip her of the power to negotiate safer sex. HIV prevention among female refugee sex workers must therefore treat violence prevention and response as central components of HIV programming, not as separate or optional services. Programs should include routine screening for violence, emergency post-violence care, post-exposure prophylaxis, psychosocial support, legal aid, safe reporting systems, and confidential, nonjudgmental referral pathways.

Alcohol use before sex was also independently associated with HIV infection. Almost half of the participants reported drinking before sex, and those who did so had higher HIV prevalence than those who did not. Alcohol can increase HIV risk by impairing judgment, reducing condom negotiation, increasing exposure to violent clients, and making it harder for women to leave unsafe situations [14, 15]. However, alcohol use should be interpreted with empathy. For some women, alcohol may be used to cope with stress, trauma, stigma, fear, or the emotional burden of sex work. Others may work in bars, lodges, or entertainment venues where alcohol use is part of client interactions. Interventions should therefore avoid blame and instead offer harm-reduction counselling, mental health support, safer-sex planning, and referrals to friendly substance-use services.

The qualitative findings support this interpretation. Alcohol was described both as a coping mechanism and as a risk factor. Some participants reported drinking before sex work to reduce fear, stress, or shame. However, alcohol also reduced their ability to negotiate condom use or assess unsafe situations. One issue raised during focus group discussions was summarized as follows: *"We drink alcohol because we don't want to be sober while engaging in this business of sex work, which makes it hard for you to think about putting on a condom when you are drunk."* Another

participant described a situation in which alcohol was involved before unprotected sex: *“Within this week... I was with a man. We first boozed, then went to his place, and he told me we were going to have sex. I asked for condoms, but the client did not have any. Because of money, I ended up doing it, though I didn’t want to.”* This shows that alcohol, poverty, and client refusal to use condoms interact to increase HIV risk.

Drug use before sex was also associated with HIV infection. Although fewer participants reported drug use than alcohol use, those who did had a higher prevalence of HIV. Drug use may increase vulnerability by reducing risk perception, weakening condom negotiation, increasing dependence on clients or partners, and exposing women to unsafe environments [16]. HIV services for key populations should therefore include screening for harmful alcohol and drug use, brief counseling, referral to treatment where needed, and non-stigmatizing harm-reduction support [6].

Older age was significantly associated with HIV infection. Participants aged 35 years and older had higher HIV prevalence than younger participants. This may reflect cumulative exposure to HIV risk over time, longer duration in sex work, repeated exposure to condomless sex, and prior experiences of violence or sexually transmitted infections. Older sex workers may also face reduced bargaining power in some settings, especially where clients prefer younger women or where older women have fewer livelihood alternatives. Similar patterns have been observed in other studies, with HIV prevalence increasing with age among female sex workers [2, 17].

Lack of formal education was also independently associated with HIV infection. Participants with no formal education had higher HIV prevalence than those with some education. Education may influence HIV vulnerability through access to health information, the ability to understand prevention messages, economic opportunities,

self-confidence, and the power to negotiate safer sex [18]. Low education may also limit access to formal employment, increasing dependence on sex work for survival. HIV programs for this population should therefore use clear, simple, culturally appropriate, and language-sensitive communication approaches. Peer-led discussions, visual materials, local languages, and repeated interpersonal counseling may be more effective than written messages alone.

Having six or more clients per day was associated with higher HIV prevalence. A higher number of clients increases the number of potential HIV exposure events, especially in settings where condom use is inconsistent or where violence, alcohol use, and police harassment are present. However, high client volume may also reflect economic pressure. Refugee sex workers may accept more clients because they need money for rent, food, school fees, transportation, healthcare, or support for family members. This finding suggests that HIV prevention should be linked with economic strengthening, social protection, and livelihood support where possible [19].

Police harassment was also independently associated with HIV infection. This finding highlights the role of the legal and social environment in shaping HIV vulnerability. Police harassment can drive sex work into hidden and unsafe settings, disrupt peer outreach, increase fear, reduce condom carrying, and deter women from seeking help after violence [12, 20]. Criminalization and punitive policing have been shown to increase HIV vulnerability among sex workers by limiting access to prevention and care services [21]. In this study, police harassment should therefore be understood not only as a human rights concern but also as a public health issue.

Qualitative interviews showed that fear of arrest and lack of justice were key structural barriers. Some women feared moving freely because sex workers are often suspected of theft or other criminal activity. Others reported that

when they experienced violence or non-payment by clients, police did not support them. One participant said: *“We walk in fear of being arrested because people know that we sex workers are thieves.”* She added that reporting clients to police was difficult: *“You can go to police to report a client... he didn’t give me my money and they are like no, as long as they see that you are a refugee.”* Another participant described being arrested while pregnant: *“They caught me and arrested me... I asked them that what if I am hungry, can’t my child in the womb die, I have to get what to eat.”* These findings show that criminalization, police harassment, and lack of legal protection increase vulnerability. When women cannot report violence safely, abusive clients continue to exploit them, and women remain exposed to forced sex, condomless sex, and untreated injuries or infections.

The population attributable fraction findings offer useful guidance for programming. Inconsistent condom use had the highest population attributable fraction, followed by exposure to violence and alcohol use before sex. This suggests that addressing these three factors could meaningfully reduce HIV infections among female refugee sex workers. However, these risk factors are interconnected. Alcohol use may increase vulnerability to violence; violence may reduce condom negotiation; police harassment may push women into unsafe working conditions; and poverty may make it difficult to refuse condomless sex when clients offer more money. Therefore, HIV risk among female refugee sex workers should be understood as a cluster of overlapping vulnerabilities rather than as isolated behaviors.

The findings support the need for combination HIV prevention. For female refugee sex workers, combination prevention should include condoms and lubricants, HIV testing, antiretroviral therapy, PrEP, post-exposure prophylaxis, sexually transmitted infection screening and treatment,

contraception, violence response services, mental health support, harm-reduction services, legal support, and social protection [6, 22, 23]. These services should be delivered through accessible and acceptable models for refugee sex workers, including peer-led outreach, drop-in centers, mobile clinics, hotspot-based services, and differentiated service delivery.

The study also has important implications for PrEP programming. Women who report inconsistent condom use, exposure to violence, alcohol or drug use before sex, high client volume, or police harassment may benefit from intensified PrEP counseling and access. PrEP is particularly important because some women may not always be able to control condom use. However, PrEP should not replace condoms, as condoms also prevent other sexually transmitted infections and unintended pregnancy [23]. PrEP services should therefore be integrated with condom promotion, STI services, contraception, HIV testing, and violence response.

Trauma-informed care is also essential. Many refugee sex workers may have experienced violence before, during, and after displacement. Some may have experienced conflict-related trauma, intimate partner violence, client violence, police abuse, or community stigma. Health services should therefore be delivered in ways that promote safety, privacy, trust, choice, and respect. Judgmental treatment by health workers may discourage women from returning for HIV testing, ART refills, PrEP follow-up, STI treatment, or post-violence care. Therefore, training health workers in stigma reduction, key population-friendly care, and trauma-informed service delivery is necessary.

Some participants reported in qualitative interviews that health workers treated them badly because they were refugees, sex workers, or living with HIV. These experiences caused shame, fear, and avoidance of health facilities. One participant described a painful encounter at a health facility: *“I went to Naguru, I found a*

health worker... she said that 'Of what importance are you Congolese to Uganda? Why don't you die?'" The participant explained that after being humiliated, she left without receiving services: *"I got ashamed and actually I left without getting them."* Another participant described how health workers sometimes abuse refugee women publicly: *"When some health workers get to know that you are a refugee, they abuse you before people, when everyone is hearing especially if you are positive."* Participants also reported being denied or discouraged from receiving services because of their nationality or sex work status. One participant who had gone for PEP said: *"I had gone to get PEP but she saw a Rwandese in me, she said that you Rwandese take our men... I left without getting it."* These experiences show that stigma and discrimination are major barriers to HIV prevention and treatment. Women may avoid services not because they do not need them, but because they fear humiliation, abuse, and exposure.

From a policy perspective, the study calls for stronger integration among HIV services, refugee health services, and protection systems. Female refugee sex workers often fall through the cracks of these systems. Refugee services may not be designed to address sex work-related risks, while key population programs may not fully address refugee-specific barriers such as documentation, language, mobility, and displacement-related trauma. Therefore, collaboration is needed among the Ministry of Health, Uganda AIDS Commission, Office of the Prime Minister, UNHCR, district health teams, implementing partners, sex worker-led organizations, and refugee-led organizations.

The findings also support community empowerment approaches. Evidence shows that community-led and community-empowerment interventions can improve condom use, increase service uptake, reduce violence, and strengthen collective agency among sex workers [10, 24]. For refugee sex workers, empowerment should include peer

education, leadership development, legal literacy, savings groups, emergency support systems, safe spaces, and linkage to friendly health and protection services. Such approaches are important because they position sex workers not only as beneficiaries of services, but also as leaders in designing and implementing HIV prevention responses.

In conclusion, HIV prevalence among female refugee sex workers in Greater Kampala was high. Although lower than the 33% previously reported among female sex workers in Kampala, it remained much higher than in Uganda's general adult population. HIV prevalence was associated with inconsistent condom use, exposure to violence, alcohol use before sex, drug use before sex, high client volume, police harassment, older age, and lack of formal education. The interaction between violence and condom use showed that women who experienced violence and did not consistently use condoms had the highest HIV burden. These findings show that HIV prevention cannot succeed by focusing on individual behavior alone. Effective prevention must also reduce violence, protect rights, improve safety, address alcohol and drug use, reduce stigma, and ensure refugee-sensitive access to HIV services.

Strengths and Limitations

This study has several strengths. First, it focuses on female refugee sex workers, a highly vulnerable and often under-researched population within the HIV response. By examining HIV prevalence among refugee sex workers in Kampala, the study provides important evidence for a group that may be missed by both general refugee health programs and key population HIV programs.

Second, the study had a relatively large sample of 686 participants, which strengthens the reliability of the findings and enables meaningful analysis of demographic, behavioral, and structural factors associated with HIV infection. The inclusion of several

important variables, such as condom use, alcohol use before sex, drug use before sex, work-related violence, police harassment, and number of clients, provides a broad understanding of HIV vulnerability in this population.

Despite these strengths, the study also has limitations. First, the cross-sectional design limits the ability to establish causal relationships between the identified factors and HIV infection. The study can show that factors such as inconsistent condom use, exposure to violence, alcohol use, drug use, and police harassment are associated with HIV infection, but it cannot confirm that these factors directly caused HIV infection.

Second, some variables were self-reported, including condom use, alcohol use before sex, drug use before sex, exposure to violence, and police harassment. Because these are sensitive issues, participants may have underreported or overreported some experiences due to fear, stigma, recall difficulties, or social desirability bias. This may have affected the Overall, despite these limitations, the study provides valuable evidence on HIV prevalence among female refugee sex workers in Kampala. The findings inform targeted, rights-based, refugee-sensitive, and combination HIV prevention interventions.

Recommendations

1. Based on this study's findings, HIV prevention programs for female refugee sex workers in Kampala should adopt a comprehensive, rights-based, and refugee-sensitive approach. The high HIV prevalence observed in this population indicates that routine HIV services alone may be insufficient. Interventions should address both individual risk behaviors and the broader social and structural conditions that increase vulnerability to HIV infection.
2. HIV prevention services should expand access to condoms and lubricants. Because inconsistent condom use was strongly associated with HIV infection and had the highest population attributable fraction, programs should ensure a continuous supply of free condoms and lubricants at hotspots, drop-in centers, refugee-serving organizations, health facilities, and through peer educators. Condom promotion should also include practical counseling on condom negotiation, especially in situations where clients offer more money for condomless sex.
3. HIV programs should integrate violence prevention and response services. The study found that exposure to violence was associated with higher HIV prevalence and strengthened the link between inconsistent condom use and HIV infection. Therefore, services for female refugee sex workers should include routine screening for violence, post-violence care, post-exposure prophylaxis, psychosocial support, legal aid, and safe referral pathways. Health workers and peer educators should be trained to identify and support survivors of violence in a confidential, nonjudgmental manner.
4. Pre-exposure prophylaxis should be expanded among female refugee sex workers, especially those reporting inconsistent condom use, exposure to violence, alcohol or drug use before sex, high client volume, or police harassment. PrEP can provide additional protection for women who may not always be able to negotiate condom use. However, PrEP should be offered as part of combination prevention and should not replace condom use, STI screening, contraception, or regular HIV testing.
5. HIV services should address alcohol and drug use in a supportive, non-stigmatizing manner. Because alcohol and drug use before sex are associated with HIV infection, programs should include brief risk-reduction counseling, mental health support, harm-reduction messages, and

referrals to substance-use services as needed. Interventions should recognize that some women may use alcohol or drugs as a coping mechanism for stress, trauma, stigma, or difficult working conditions.

6. Peer-led and community-based interventions should be strengthened. Female refugee sex workers may be more willing to receive services from trusted peers who understand their lived realities. Peer educators can support HIV testing, condom and lubricant distribution, PrEP referral, ART adherence, STI screening, violence reporting, and psychosocial support. Programmes should also build the leadership capacity of refugee sex workers so that they participate meaningfully in designing, implementing, and monitoring HIV interventions.
7. Health services should be made more refugee-sensitive and more friendly to key populations. Health workers should be trained in stigma reduction, confidentiality, trauma-informed care, and respectful service delivery for sex workers and refugees. Services should be offered in accessible locations and, where possible, in languages understood by refugee communities. Mobile clinics, outreach services, flexible clinic hours, and drop-in centers may help reduce barriers to accessing services.
8. Programs should address police harassment and other human rights violations. Because police harassment is linked to HIV infection, there is a need to sensitize law enforcement officers on HIV prevention, human rights, gender-based violence, and the public health impact of punitive policing. Stronger collaboration is needed among health programs, legal aid providers, sex worker-led organizations, refugee-led organizations, and protection actors to ensure that female refugee sex workers can access services and report violence without fear.

9. HIV interventions should include economic strengthening and social protection support. Some refugee sex workers may accept unsafe sex or multiple clients because of financial pressure. Programmes should therefore explore linkages to livelihood training, savings groups, emergency support, food assistance, childcare support, and other social protection services. Although economic support alone may not eliminate HIV risk, it can reduce vulnerability and increase women's ability to make safer choices.

Conflict of Interest

The authors declare that they have no competing interests.

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Ethical Approval

To conduct the survey, ethical approval was obtained from the Kabale University Institutional Review Board and the survey was registered with the Uganda National Council of Science and Technology (UNCST). Additionally, permission was secured from the Most at Risk Population Initiative (MARPI). Participation in the survey was voluntary, and participants were fully informed about the study procedures, including the use of the ODK tool for quantitative data and audio recorders for qualitative data. Written informed consent was obtained from all participants using consent forms before any data collection interviews.

Measures were taken to safeguard personal identifiers and survey data involving human subjects. Participants' names were not linked to their responses, and all data files were stored on password-protected devices accessible only to

authorized members of the survey team. All staff involved in the study completed training and certification through the Collaborative Institutional Training Initiative (CITI), specifically the Information Privacy & Security (IPS) module and other relevant modules, such as Good Clinical Practice (GCP). Survey assistants without prior GCP training were required to complete it before participating in data collection training to ensure compliance with ethical standards throughout the survey.

Survey assistants also received training in interviewing techniques tailored for key and priority populations, with a focus on creating a supportive environment for interviews. All collected data will be securely stored and destroyed five years after the completion of survey activities.

Authors' Contributions

Pande Gerald conceptualized the study, prepared data collection instruments, collected data, and entered and analyzed it. Gerald also conceptualized the manuscript idea and took the lead in writing the manuscript.

Isunju John Bosco, Atulomah Nnodimele Onuigh, Kadama Herbert, Kyambadde Peter, Matsiko Livingstone, provided technical support during the protocol writing, data collection, entry and analysis. Isunju John Bosco, Mudiope Peter, Hudson Baliadawa

participated in manuscript writing and reviewed the manuscript for intellectual content and scientific integrity. All authors read and approved the final manuscript.

Consent for Publication

The participants gave consent for direct quotes from their interviews to be published in the manuscript.

Data Availability

The datasets used and analyzed during this study are under the custody of the Principal Investigator, who is also the corresponding author. The data are not publicly available due to confidentiality and ethical considerations. However, anonymized data may be made available from the corresponding author upon reasonable request and subject to relevant ethical and institutional approvals.

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References

- [1]. Uganda Ministry of Health. Uganda Population-based HIV Impact Assessment 2020–2021: final report. Kampala: Ministry of Health; 2022. Available from: <https://phia.icap.columbia.edu/uganda-final-report-2020-2021/>
- [2]. Uganda Ministry of Health. Crane survey report: HIV and STI bio-behavioural survey among key populations in Uganda. Kampala: Ministry of Health; 2022.
- [3]. Shannon K, Strathdee SA, Goldenberg SM, Duff P, Mwangi P, Rusakova M, et al. Global

- epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet*. 2015;385(9962):55-71. Available from: [https://doi.org/10.1016/S0140-6736\(14\)60931-4](https://doi.org/10.1016/S0140-6736(14)60931-4)
- [4]. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Infect Dis*. 2012;12(7):538-49. Available from: [https://doi.org/10.1016/S1473-3099\(12\)70066-X](https://doi.org/10.1016/S1473-3099(12)70066-X)
 - [5]. Joint United Nations Programme on HIV/AIDS. The urgency of now: AIDS at a crossroads. Geneva: UNAIDS; 2024. Available from:

<https://www.unaids.org/en/resources/documents/2024/global-aids-update-2024>

[6]. World Health Organization. Consolidated guidelines on HIV, viral hepatitis and STI prevention, diagnosis, treatment and care for key populations. Geneva: World Health Organization; 2022. Available from: <https://www.who.int/publications/i/item/9789240052390>

[7]. United Nations High Commissioner for Refugees. Global trends: forced displacement in 2023. Geneva: UNHCR; 2024. Available from: <https://www.unhcr.org/global-trends>

[8]. Logie CH, Okumu M, Mwima S, Hakiza R, Irungi KP, Kyambadde P, et al. The role of context in shaping HIV testing and prevention engagement among urban refugee and displaced youth in Kampala, Uganda. *BMC Public Health*. 2021;21:1241. Available from: <https://doi.org/10.1186/s12889-021-11214-7>

[9]. Scorgie F, Chersich MF, Ntaganira I, Gerbase A, Lule F, Lo YR. Socio-demographic characteristics and behavioral risk factors of female sex workers in sub-Saharan Africa: a systematic review. *AIDS Behav*. 2012;16(4):920-33. Available from: <https://doi.org/10.1007/s10461-011-9985-z>

[10]. Kerrigan DL, Kennedy CE, Morgan-Thomas R, Reza-Paul S, Mwangi P, Win KT, et al. Community empowerment among female sex workers is an effective HIV prevention intervention: a systematic review of the peer-reviewed evidence from low- and middle-income countries. *AIDS Behav*. 2013;17(6):1926-40. Available from: <https://doi.org/10.1007/s10461-013-0458-4>

[11]. Weller SC, Davis-Beaty K. Condom effectiveness in reducing heterosexual HIV transmission. *Cochrane Database Syst Rev*. 2002;(1). Available from: <https://doi.org/10.1002/14651858.CD003255>

[12]. Decker MR, Crago AL, Chu SKH, Sherman SG, Seshu MS, Buthelezi K, et al. Human rights violations against sex workers: burden and effect on HIV. *Lancet*. 2015;385(9963):186-99. Available from: [https://doi.org/10.1016/S0140-6736\(14\)60800-X](https://doi.org/10.1016/S0140-6736(14)60800-X)

[13]. Deering KN, Amin A, Shoveller J, Nesbitt A, Garcia-Moreno C, Duff P, et al. A systematic review of the correlates of violence against sex workers. *Am J Public Health*. 2014;104(5). Available from: <https://doi.org/10.2105/AJPH.2014.301909>

[14]. Li Q, Li X, Stanton B. Alcohol use among female sex workers and male clients: an integrative review of global literature. *Alcohol Alcohol*. 2010;45(2):188-99. Available from: <https://doi.org/10.1093/alcalc/agg095>

[15]. Chersich MF, Bosire W, King'ola N, Temmerman M, Luchters S. Effects of hazardous and harmful alcohol use on HIV incidence and sexual behaviour: a cohort study of Kenyan female sex workers. *Global Health*. 2014;10:22. Available from: <https://doi.org/10.1186/1744-8603-10-22>

[16]. Strathdee SA, Stockman JK. Epidemiology of HIV among injecting and non-injecting drug users: current trends and implications for interventions. *Curr HIV/AIDS Rep*. 2010;7(2):99-106. Available from: <https://doi.org/10.1007/s11904-010-0043-7>

[17]. Vandepitte J, Lierla R, Dallabetta G, Crabbé F, Alary M, Buvé A. Estimates of the number of female sex workers in different regions of the world. *Sex Transm Infect*. 2006;82 Suppl 3. Available from: <https://doi.org/10.1136/sti.2006.020081>

[18]. Hargreaves JR, Boler T. Girl power: the impact of girls' education on HIV and sexual behaviour. London: ActionAid International; 2006. Available from: <https://healtheducationresources.unesco.org/library/documents/girl-power-impact-girls-education-hiv-and-sexual-behaviour>

[19]. Witte SS, Batsukh A, Chang M. Sexual risk behaviors, alcohol abuse, and intimate partner violence among sex workers in Mongolia: implications for HIV prevention intervention development. *J Prev Interv Community*. 2010;38(2):89-103. Available from: <https://doi.org/10.1080/10852351003640776>

[20]. Platt L, Grenfell P, Meiksin R, Elmes J, Sherman SG, Sanders T, et al. Associations between sex work laws and sex workers' health: a systematic review and meta-analysis of quantitative and qualitative studies. *PLoS Med*. 2018;15(12).

Available from:
<https://doi.org/10.1371/journal.pmed.1002680>

[21]. Lyons CE, Schwartz SR, Murray SM, Shannon K, Diouf D, Mothopeng T, et al. The role of sex work laws and stigmas in increasing HIV risks among sex workers. *Nat Commun.* 2020;11:773. Available from: <https://doi.org/10.1038/s41467-020-14593-6>

[22]. Joint United Nations Programme on HIV/AIDS. Global AIDS strategy 2021–2026: end inequalities, end AIDS. Geneva: UNAIDS; 2021. Available from: <https://www.unaids.org/en/Global-AIDS-Strategy-2021-2026>

[23]. World Health Organization. Pre-exposure prophylaxis. Geneva: World Health Organization; 2024. Available from:

<https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/hiv/prevention/pre-exposure-prophylaxis>

[24]. Laga M, Alary M, Nzila N, Manoka AT, Tuliza M, Behets F, et al. Condom promotion, sexually transmitted diseases treatment, and declining incidence of HIV-1 infection in female Zairian sex workers. *Lancet.* 1994;344(8917):246-8. Available from: [https://doi.org/10.1016/S0140-6736\(94\)93005-8](https://doi.org/10.1016/S0140-6736(94)93005-8)