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Factors associated with HIV pre-exposure prophylaxis uptake among female sex workers in Karongi District, Rwanda: a retrospective cross-sectional study

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Research Article

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Abstract

Background

Oral pre-exposure prophylaxis (PrEP) is highly effective in preventing HIV acquisition, yet its uptake among key populations in sub-Saharan Africa remains suboptimal, and evidence on PrEP uptake among female sex workers (FSWs) in Rwanda outside Kigali is limited. This study aimed to determine the proportion of PrEP uptake and the factors associated with it among FSWs in Karongi District, Rwanda.

Methods

We conducted a retrospective cross-sectional study using routine data on eligible HIV-negative FSWs aged 17 years or older screened for PrEP between March and December 2021 at the 10 PrEP-providing health facilities in Karongi District. PrEP uptake was defined as initiation between first eligible screening and 31 December 2021. Factors associated with uptake were identified using multivariable logistic regression and modified Poisson regression, reported as adjusted prevalence ratios (APR) with 95% confidence intervals (CI), and robustness was assessed in sensitivity analyses.

Results

Of 800 eligible FSWs, 265 (33.1%) initiated PrEP. Uptake was associated with recruitment by community volunteers (APR 3.4, 95% CI 1.7–7.2), being single (APR 1.7, 95% CI 1.3–2.3), being a farmer (APR 1.6, 95% CI 1.3–2.1), HIV testing in the previous 3 months (APR 1.7, 95% CI 1.3–2.1), having 3–4 sexual partners in the previous 7 days (APR 1.4, 95% CI 1.1–1.7) and prior awareness of PrEP (APR 2.1, 95% CI 1.5–2.9); these associations were consistent in direction across sensitivity analyses. Uptake also varied markedly by sector of residence, and the association with health insurance differed by sector, being positive in Rubengera and negative in Bwishyura; the final model, which assumed a single insurance effect across sectors, was therefore misspecified for insurance, and its pooled insurance estimate is not interpreted.

Conclusions

Only one in three eligible FSWs in Karongi District initiated PrEP early in PrEP implementation. Volunteer-led demand creation and offering PrEP at HIV testing warrant evaluation as strategies to improve uptake as PrEP services, including long-acting PrEP, are scaled up. The role of health insurance, which differed by sector, warrants further investigation.

Background

Daily oral pre-exposure prophylaxis (PrEP) with tenofovir disoproxil fumarate/emtricitabine (TDF/FTC) is a highly effective biomedical intervention for preventing HIV acquisition among people at substantial risk of infection. Since evidence of its efficacy was established, global PrEP use has grown steadily as an additional prevention option [1], [2]. In 2020, approximately 845,000 people in 54 countries received PrEP at least once during the year (an annual count of PrEP users), an increase of 43% since 2019 and 182% since 2018[3].

Nevertheless, global PrEP scale-up has fallen short of targets: by the end of 2020, a cumulative 928,750 people had initiated oral PrEP worldwide since 2016 (a count of everyone who had ever started PrEP, including those who later stopped, and therefore different from the annual number of users above), less than one-third of the UNAIDS target of three million, and initiations remained concentrated in a few countries, with only ten countries recording more than 25,000 initiations. Sub-Saharan Africa accounted for 56% of global initiations since 2016, led by South Africa (101,007), Kenya (82,886) and Zambia (72,309), so South Africa and Kenya alone accounted for more than one-third of initiations in the region, while the United States, despite more than 200,000 cumulative initiations, showed comparatively modest growth[4]. Rwanda prioritized PrEP

in its 2020 National HIV Guidelines, focusing on the populations most vulnerable to HIV infection to ensure that no one is left behind[5], [6]. National data show that 189 health facilities offer PrEP and 5,966 people have initiated it including 293 in Karongi District between 2019 and December 2021[7].

In Rwanda, published evidence on PrEP among key populations comes mainly from Kigali City, where high retention has been reported among those who initiated PrEP [8]. Female sex workers (FSWs) are a key population prioritized for HIV prevention services, including oral pre-exposure prophylaxis (PrEP) [9]. However, many FSWs cannot use existing prevention methods consistently, often because clients refuse to use condoms, and misconceptions about antiretroviral use by HIV-negative people may further limit PrEP uptake.

Studies from sub-Saharan Africa show that PrEP use among FSWs is shaped by factors at several levels. At the individual level, awareness of PrEP, self-perceived HIV risk, recent HIV testing and a positive attitude toward PrEP have been associated with use [10], [11], [12]. At the interpersonal and community level, peer support and peer-led outreach, and having an income source besides sex work, facilitate use, whereas fear of being identified as a sex worker or as living with HIV discourages it [13], [14]. At the health-system and structural level, stigma and discrimination in health services, the cost of accessing care, mobility and the legal environment for sex work limit access to PrEP [15], [16], [17]. Most of this evidence comes from urban settings and from research or demonstration programmes rather than routine services.

Evidence on PrEP uptake among FSWs in Rwanda, particularly outside Kigali, remains scarce. Karongi District is of particular interest because it is a predominantly rural district on the shore of Lake Kivu[18]. Fishing, trade, tourism and population mobility around the lake may contribute to sex work in the district, and FSWs are likely to be more dispersed and to live further from health facilities than those in Kigali. Data from the early rollout period are informative because they show where FSWs are lost between eligibility and initiation when services are first introduced, a gap that is likely to recur as PrEP is extended to new facilities and as long-acting options are introduced. We used an adapted socio-ecological model [17] to guide the selection of study variables, grouping them into individual factors (e.g., age, marital status, occupation, sexual behavior, HIV testing history, awareness of and willingness to take PrEP), interpersonal and community factors (mode of recruitment, including by community volunteers) and health-system and structural factors (health insurance coverage, sector of residence and health facility). This study therefore aimed to determine the proportion of eligible FSWs who initiated PrEP and to identify factors associated with PrEP uptake among FSWs in Karongi District.

Methods

Study design and setting

We conducted a retrospective cross-sectional study using routine program data from the 10 health facilities offering PrEP services in Karongi District between March and December 2021. Of the district's 26 health facilities, 10 offered PrEP during the study period. Karongi is one of the 30 districts of Rwanda, located in the Western Province, with a population of 373,869[18]

Study population

The study population comprised all HIV-negative FSWs aged 17 years or older who were registered at PrEP service delivery points in Karongi District during the study period. Although Rwandan national guidelines recommend PrEP for people aged 18 years or older [19], routine PrEP registers included adolescents aged 17 years who self-identified as FSWs and had been screened for PrEP at the facilities. These four FSWs were retained to reflect the population reached by PrEP services and because adolescent sex workers are at particularly high risk of HIV infection.

FSWs were excluded if they were younger than 17 years, tested HIV-positive, had signs or symptoms of acute HIV infection, had initiated HIV post-exposure prophylaxis, or reported consistent condom use[20]. In line with the national PrEP eligibility

criteria, FSWs who reported consistent condom use were considered not to be at substantial risk of HIV infection, because correct and consistent condom use provides effective barrier protection against HIV and other sexually transmitted infections [20].

A person at substantial risk of HIV infection was defined as a sexually active person in a high HIV prevalence population, a person who injects drugs, or a person in a relationship with a partner known to be living with HIV[21], [22]; this study focused on FSWs.

Sample size and sampling

No sample size calculation was performed; all eligible FSWs registered at the 10 PrEP sites during the study period were included. Of 1,264 people screened for PrEP, 800 FSWs met the eligibility criteria and were included in the analysis (Fig. 1).

Study variables and definitions

The outcome variable was PrEP uptake, defined as the initiation of oral PrEP by an eligible FSW (i.e., a first PrEP prescription dispensed) at any time between her first eligible PrEP screening and the end of the study period (31 December 2021), as recorded in the PrEP register. Eligible FSWs with no record of PrEP initiation during this period were classified as non-initiators. Where an FSW was screened more than once during the study period, only her first eligible screening visit was retained, identified by her unique client identifier. PrEP uptake was coded as a binary variable (yes/no). The sociodemographic, recruitment, clinical and behavioral variables described below were treated as independent variables and as potential confounders of one another; all candidate variables, except self-perceived risk of HIV and willingness to take PrEP (for which odds ratios could not be estimated), were entered simultaneously into the initial multivariable model.

Sociodemographic variables included age (17–26, 27–36 and ≥ 37 years), marital status (single, married/cohabiting, divorced/separated), sector of residence (Bwishyura, Gashari, Rubengera), education level (no formal education, primary, secondary), occupation (farmer, self-employed) and Ubudehe social category.

Mode of recruitment was classified as facility-based (recruited by healthcare providers at health facility entry points) or community-based (recruited by peer educators or community volunteers).

Ubudehe is Rwanda's national system of household socioeconomic stratification based on income and living conditions; the classification in use during the study period comprised four categories based on monthly household income and land ownership [23], [24]. Category 1 included households earning less than RWF 45,000 per month, such as casual workers, or owning less than 0.5 hectare in rural areas (less than 100 m² in urban areas), as well as people unable to work because of age, major disability or incurable illness who have no other assets or source of livelihood; Category 2, households earning RWF 45,000–65,000 per month or owning 0.5–1 hectare in rural areas (100–300 m² in urban areas); Category 3, households earning RWF 65,000–600,000 per month or owning 1–10 hectares in rural areas (300 m² to 1 hectare in urban areas); and Category 4, households earning more than RWF 600,000 per month or owning more than 10 hectares of land in rural areas (more than 1 hectare in urban areas). No participants were recorded in Category 4, the highest-income category. FSWs from Category 4 households were not expected to be found in the study area, because PrEP services for FSWs in this rural district were delivered mainly at sex work hotspots frequented by lower-income FSWs.

Clinical and behavioral variables included self-perceived risk of HIV infection (“Do you think you are at risk of HIV?”; yes/no), number of sexual partners in the past 7 days (1–2, 3–4, ≥ 5), HIV testing in the past 3 months (yes/no), health insurance coverage (yes/no), willingness to take PrEP (yes/no) and prior awareness of PrEP (“Have you heard of PrEP before?”; yes/no). These clinical and behavioral variables, including self-perceived risk, willingness to take PrEP and prior awareness of PrEP, were self-reported by clients and recorded by healthcare providers during the PrEP screening and eligibility assessment, using the standardized national Register for Oral Pre-Exposure Prophylaxis and the client file. The HIV risk exposure criterion

recorded in the PrEP register at screening (multiple sexual partners, inconsistent or no condom use, or sexually transmitted infection [STI] in the past 6 months) was analysed as a categorical variable. The register records one main risk exposure criterion per client, selected by the screening provider, and this recorded criterion was used, so each participant was assigned to a single category. Because FSWs who reported consistent condom use were excluded, no participant used condoms consistently; the inconsistent or no condom use category (n = 26) therefore comprises FSWs for whom this was the criterion recorded, rather than all FSWs who did not use condoms consistently, and comparisons with this reference category should be interpreted accordingly.

Data collection and management

Trained nurses working in PrEP services, in collaboration with health center data managers, abstracted data from PrEP registers and client files at each health facility using a Microsoft Excel data abstraction sheet. Data were cleaned in Excel and exported to Stata version 14.2 (StataCorp, College Station, TX, USA) for analysis. Data abstraction was conducted in May 2022. To minimize information bias, data abstractors were trained on the study variables and definitions and used a standardized abstraction tool, and the principal investigator checked the abstracted data against the source registers for completeness and consistency; discrepancies were resolved by consulting the original client files. Selection bias was minimized by including all eligible FSWs registered at all PrEP-providing facilities in the district during the study period rather than a sample. All 800 eligible records had complete information on the outcome and all study variables, because missing entries were resolved against the original client files during data verification; therefore, no records were excluded for missing data.

Statistical analysis

Descriptive analysis: Frequencies and percentages were used to summarize categorical variables, and, because age was not normally distributed, the median with interquartile range (IQR) was used for age, overall and by PrEP uptake status, with groups compared using the Wilcoxon rank-sum test. The proportion of PrEP uptake was calculated as the number of FSWs who initiated PrEP divided by the total number of eligible FSWs.

Bivariable analysis: Simple (bivariable) logistic regression was used to assess the association between each independent variable and PrEP uptake, and crude odds ratios (COR) with 95% confidence intervals (CI) were estimated.

Multivariable analysis: All candidate variables were entered into an initial multivariable logistic regression model to control for confounding, except self-perceived risk of HIV and willingness to take PrEP, for which odds ratios could not be estimated, and the final model was built by manual backward elimination, removing at each step the variable with the highest p-value until each remaining variable had at least one category with $p < 0.05$. Adjusted odds ratios (AOR) with 95% CI were reported for variables retained in the final model, which was prespecified as the primary analysis. Because model diagnostics showed that this model did not adequately capture the association between health insurance and uptake, health insurance effects are reported by sector of residence from the interaction model (S6), and the pooled insurance estimate from the final model is not interpreted. The final model, rather than S6, was retained as the primary model because it was prespecified, because a sector-specific insurance effect could not be estimated in Gashari, where no FSW was insured, and because the extreme sector-specific insurance estimates were considered more likely to reflect facility-level recording practices than a true effect of insurance. Because FSWs who reported consistent condom use were excluded as ineligible, a sensitivity analysis recalculated the proportion of PrEP uptake with these FSWs added to the denominator. A p-value < 0.05 was considered statistically significant. This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies and the reporting of studies Conducted using Observational Routinely collected health Data (RECORD) extension; the completed checklists are provided in Additional file 1.

Sensitivity analyses and model diagnostics: To assess the robustness of the final model, eight alternative specifications were fitted: (S1) modified Poisson regression with robust standard errors to estimate adjusted prevalence ratios (APR), because

PrEP uptake was common and odds ratios overstate relative risks for common outcomes; (S2) number of sexual partners entered as a continuous variable; (S3) the final model with age (continuous) and education level added; (S4) a mixed-effects logistic regression model with a random intercept for sector of residence instead of a fixed effect, with the intraclass correlation coefficient (ICC) reported; (S5) the final model without sector of residence; (S6) the final model with an interaction between sector of residence and health insurance coverage, with the effect of health insurance estimated separately for each sector; (S7) the final model with bootstrapped 95% CIs (1,000 replications); and (S8) the final model with the largest HIV risk exposure group (multiple sexual partners, n = 701) as the reference category instead of inconsistent or no condom use (n = 26). Model fit was compared using the Akaike and Bayesian information criteria (AIC and BIC; lower values indicating better fit), the area under the receiver operating characteristic curve (AUC), the Hosmer–Lemeshow goodness-of-fit test (10 groups) and the link test. Multicollinearity was assessed using variance inflation factors (VIF), with values below 10 considered acceptable.

Results

Of 1,264 people screened for PrEP between March and December 2021, 1,081 (85.5%) were FSWs, 157 (12.4%) were adolescent girls and young women (AGYW) and 26 (2.1%) were members of serodiscordant couples. After excluding 273 FSWs who reported consistent condom use and 8 who tested HIV-positive, 800 eligible FSWs were included in the analysis (Fig. 1).

Characteristics of participants and PrEP uptake

Of the 1,081 FSWs seeking PrEP services, 800 (74.0%) were eligible. Of these, 265 (33.1%; 95% CI 29.9–36.4) initiated PrEP. In a sensitivity analysis that also included the 273 FSWs who reported consistent condom use, none of whom initiated PrEP, uptake was 24.7% (265/1,073; 95% CI 22.1–27.3). Most participants were recruited by healthcare providers at health facility entry points (592, 74.0%), followed by peer educators (130, 16.3%) and community volunteers (78, 9.8%). More than half resided in Rubengera sector (433, 54.1%), followed by Bwishyura (289, 36.1%) and Gashari (78, 9.8%). Of the 78 FSWs recruited by community volunteers, 63 (80.8%) resided in Gashari, and 63 of the 78 Gashari residents (80.8%) were recruited by community volunteers; recruitment mode by sector and by health facility is shown in Additional file [X]. Most participants were aged 17–26 years (438, 54.8%); the median age was 26 years (IQR 22–30) overall, 25 years (IQR 22–28) among FSWs who initiated PrEP and 27 years (IQR 23–31) among those who did not (rank-sum $p < 0.001$). Overall, 342 (42.8%) were single and 333 (41.6%) were married or cohabiting; among those who initiated PrEP, 147 (55.5%) were single. Most had primary education (576, 72.0%), and 186 (23.3%) had secondary education. More than half belonged to Ubudehe Category 2 (442, 55.3%) and were farmers (507, 63.4%). Nearly all participants perceived themselves to be at risk of HIV (794, 99.3%), 762 (95.3%) were willing to take PrEP and 609 (76.1%) had heard of PrEP before. Fewer than half had been tested for HIV in the previous 3 months (364, 45.5%) or had health insurance (340, 42.5%). Participant characteristics by PrEP uptake status are shown in Table 1.

Table 1
Sociodemographic, behavioral and clinical characteristics of eligible female sex workers, by PrEP uptake status.

Characteristic		**PrEP uptake outcome**	
	Total N = 800 (%)	***PrEP uptake n = 265 (%)***	***No PrEP uptake n = 535 (%)***
Mode of recruitment			
Healthcare provider	592 (74%)	136 (51%)	456 (85%)
Peer educator	130 (16%)	65 (25%)	65 (12%)
Community volunteer	78 (10%)	64 (24%)	14 (3%)
Sector of residence			
Bwishyura	289 (36%)	33 (12%)	256 (48%)
Gashari	78 (10%)	64 (24%)	14 (3%)
Rubengera	433 (54%)	168 (63%)	265 (50%)
Age (years), median (IQR)	26 (22–30)	25 (22–28)	27 (23–31)
Age group (years)			
17–26	438 (55%)	177 (67%)	261 (49%)
27–36	331 (41%)	84 (32%)	247 (46%)
37+	31 (4%)	4 (2%)	27 (5%)
Marital status			
Divorced/separated	125 (16%)	25 (9%)	100 (19%)
Married/cohabiting	333 (42%)	93 (35%)	240 (45%)
Single	342 (43%)	147 (55%)	195 (36%)
Education level			
No formal education	38 (5%)	17 (6%)	21 (4%)
Primary	576 (72%)	207 (78%)	369 (69%)
Secondary	186 (23%)	41 (15%)	145 (27%)
Social category			
Category 1	148 (19%)	35 (13%)	113 (21%)
Category 2	442 (55%)	169 (64%)	273 (51%)
Category 3	210 (26%)	61 (23%)	149 (28%)
Occupation			
Farmer	507 (63%)	211 (80%)	296 (55%)
Self-employed	293 (37%)	54 (20%)	239 (45%)
Self-perceived risk of HIV			
No	6 (1%)	0 (0%)	6 (1%)

Characteristic		PrEP uptake outcome	
	Total N = 800 (%)	*PrEP uptake n = 265 (%)*	*No PrEP uptake n = 535 (%)*
Yes	794 (99%)	265 (100%)	529 (99%)
HIV risk exposure category			
Inconsistent or no condom use	26 (3%)	6 (2%)	20 (4%)
Multiple sexual partners	701 (88%)	240 (91%)	461 (86%)
STI in the past 6 months	73 (9%)	19 (7%)	54 (10%)
HIV testing in past 3 months			
No	436 (54%)	121 (46%)	315 (59%)
Yes	364 (46%)	144 (54%)	220 (41%)
Sexual partners in past 7 days			
1–2	361 (45%)	82 (31%)	279 (52%)
3–4	217 (27%)	100 (38%)	117 (22%)
5+	222 (28%)	83 (31%)	139 (26%)
Health insurance			
No	460 (58%)	115 (43%)	345 (64%)
Yes	340 (42%)	150 (57%)	190 (36%)
Willingness to take PrEP			
No	38 (5%)	0 (0%)	38 (7%)
Yes	762 (95%)	265 (100%)	497 (93%)
Have you heard of PrEP before (PrEP awareness)			
No	191 (24%)	23 (9%)	168 (31%)
Yes	609 (76%)	242 (91%)	367 (69%)

Data are n (%). There were no missing data. PrEP: pre-exposure prophylaxis; STI: sexually transmitted infection.

Factors associated with PrEP uptake in bivariable analysis

In bivariable analysis, PrEP uptake was associated with recruitment by peer educators (COR 3.4, 95% CI 2.3–5.0) and community volunteers (COR 15.3, 95% CI 8.3–28.2) compared with healthcare providers, and with residence in Gashari (COR 35.5, 95% CI 17.9–70.2) and Rubengera (COR 4.9, 95% CI 3.3–7.4) compared with Bwishyura. FSWs aged 17–26 years had higher odds of uptake than those aged ≥ 37 years (COR 4.6, 95% CI 1.6–13.3). Uptake was also associated with being single compared with divorced/separated (COR 3.0, 95% CI 1.8–4.9), having no formal education (COR 2.9, 95% CI 1.4–5.9) or primary education (COR 2.0, 95% CI 1.4–2.9) compared with secondary education, belonging to Ubudehe Category 2 compared with Category 3 (COR 1.5, 95% CI 1.1–2.2), being a farmer compared with being self-employed (COR 3.2, 95% CI 2.2–4.5) and HIV testing in the previous 3 months (COR 1.7, 95% CI 1.3–2.3). Having 3–4 (COR 2.9, 95% CI 2.0–4.2) or ≥ 5 (COR 2.0, 95% CI 1.4–2.9) sexual partners in the previous 7 days compared with 1–2, having health insurance (COR 2.4, 95% CI 1.8–3.2) and prior awareness of PrEP (COR 4.8, 95% CI 3.0–7.7) were also associated with uptake (Table 2).

Factors independently associated with PrEP uptake

In multivariable analysis, nine variables were retained in the final model: mode of recruitment, sector of residence, marital status, occupation, HIV risk exposure category, HIV testing in the previous 3 months, number of sexual partners in the previous 7 days, health insurance coverage and prior awareness of PrEP. Age, education level and Ubudehe category, although associated with uptake in bivariable analysis, were removed during backward elimination ($p \geq 0.05$) and are therefore not shown with AORs. Compared with FSWs residing in Bwishyura, those in Gashari (AOR 65.7, 95% CI 22.7–190.2) and Rubengera (AOR 46.2, 95% CI 23.6–90.5) had higher odds of uptake, as did those recruited by community volunteers rather than healthcare providers (AOR 35.0, 95% CI 12.1–101.6). Being single (AOR 4.1, 95% CI 1.9–9.0), being a farmer (AOR 3.5, 95% CI 2.1–6.0), recent HIV testing (AOR 3.2, 95% CI 1.9–5.7), having 3–4 sexual partners in the previous 7 days (AOR 2.3, 95% CI 1.3–4.1), having health insurance (AOR 10.5, 95% CI 5.5–20.1) and prior awareness of PrEP (AOR 4.9, 95% CI 2.5–9.5) were also associated with higher odds of uptake (Table 2). FSWs with an STI in the past 6 months had higher odds of uptake than those with inconsistent or no condom use (AOR 6.5, 95% CI 1.2–35.3), but this comparison was based on a small reference group (n = 26) and was not robust in sensitivity analyses (Table 3).

Table 2
Bivariable and multivariable logistic regression of factors associated with PrEP uptake among female sex workers

Characteristic	PrEP uptake outcome		Bivariable		Multivariable	
	PrEP uptake (n = 265), n (row %)	No uptake (n = 535), n (row %)	COR (95% CI)	p-value	AOR (95% CI)	p-value
Mode of recruitment						
Healthcare provider	136 (23%)	456 (77%)	1 (Ref)		1 (Ref)	
Peer educator	65 (50%)	65 (50%)	3.4 (2.3–5.0)	< 0.001	1.9 (0.9–3.7)	0.076
Community volunteer	64 (82%)	14 (18%)	15.3 (8.3–28.2)	< 0.001	35.0 (12.1–101.6)	< 0.001
Sector of residence						
Bwishyura	33 (11%)	256 (89%)	1 (Ref)		1 (Ref)	
Gashari	64 (82%)	14 (18%)	35.5 (17.9–70.2)	< 0.001	65.7 (22.7–190.2)	< 0.001
Rubengera	168 (39%)	265 (61%)	4.9 (3.3–7.4)	< 0.001	46.2 (23.6–90.5)	< 0.001
Age group (years)						
17–26	177 (40%)	261 (60%)	4.6 (1.6–13.3)	0.005	–	–
27–36	84 (25%)	247 (75%)	2.3 (0.8–6.8)	0.131	–	–
37+	4 (13%)	27 (87%)	1 (Ref)		–	–
Marital status						
Divorced/separated	25 (20%)	100 (80%)	1 (Ref)		1 (Ref)	
Married/cohabiting	93 (28%)	240 (72%)	1.5 (0.9–2.5)	0.085	2.1 (1.0–4.4)	0.062
Single	147 (43%)	195 (57%)	3.0 (1.8–4.9)	< 0.001	4.1 (1.9–9.0)	< 0.001
Education level						
No formal education	17 (45%)	21 (55%)	2.9 (1.4–5.9)	0.005	–	–
Primary	207 (36%)	369 (64%)	2.0 (1.4–2.9)	< 0.001	–	–
Secondary	41 (22%)	145 (78%)	1 (Ref)		–	–
Social category						

Odds ratios for self-perceived risk of HIV and willingness to take PrEP could not be estimated (NE) because no FSW in the reference category initiated PrEP. Variables entered into the initial multivariable model were mode of recruitment, sector of residence, age group, marital status, education level, Ubudehe social category, occupation, HIV risk exposure category, HIV testing in the past 3 months, number of sexual partners in the past 7 days, health insurance and PrEP awareness; age group, education level and Ubudehe category were removed during backward elimination. PrEP: pre-exposure prophylaxis; COR: crude odds ratio; CI: confidence interval; Ref: reference category; AOR: adjusted odds ratio; NE: not estimable; –: not entered into or not retained in the final multivariable model. Percentages in the PrEP uptake and no uptake columns are row percentages (proportion of FSWs in each category who did or did not initiate PrEP)

Characteristic	PrEP uptake outcome		Bivariable		Multivariable	
	PrEP uptake (n = 265), n (row %)	No uptake (n = 535), n (row %)	COR (95% CI)	p-value	AOR (95% CI)	p-value
Category 1	35 (24%)	113 (76%)	0.8 (0.5–1.2)	0.257	–	–
Category 2	169 (38%)	273 (62%)	1.5 (1.1–2.2)	0.022	–	–
Category 3	61 (29%)	149 (71%)	1 (Ref)		–	–
Occupation						
Farmer	211 (42%)	296 (58%)	3.2 (2.2–4.5)	< 0.001	3.5 (2.1–6.0)	< 0.001
Self-employed	54 (18%)	239 (82%)	1 (Ref)		1 (Ref)	
Self-perceived risk of HIV						
No	0 (0%)	6 (100%)	1 (Ref)		–	–
Yes	265 (33%)	529 (67%)	NE	–	–	–
HIV risk exposure category						
Inconsistent or no condom use	6 (23%)	20 (77%)	1 (Ref)		1 (Ref)	
Multiple sexual partners	240 (34%)	461 (66%)	1.7 (0.7–4.4)	0.243	4.5 (0.9–20.9)	0.059
STI in the past 6 months	19 (26%)	54 (74%)	1.2 (0.4–3.4)	0.766	6.5 (1.2–35.3)	0.030
HIV testing in past 3 months						
No	121 (28%)	315 (72%)	1 (Ref)		1 (Ref)	
Yes	144 (40%)	220 (60%)	1.7 (1.3–2.3)	< 0.001	3.2 (1.9–5.7)	< 0.001
Sexual partners in past 7 days						
1–2	82 (23%)	279 (77%)	1 (Ref)		1 (Ref)	
3–4	100 (46%)	117 (54%)	2.9 (2.0–4.2)	< 0.001	2.3 (1.3–4.1)	0.003
5+	83 (37%)	139 (63%)	2.0 (1.4–2.9)	< 0.001	1.4 (0.8–2.6)	0.244
Health insurance						
No	115 (25%)	345 (75%)	1 (Ref)		1 (Ref)	

Odds ratios for self-perceived risk of HIV and willingness to take PrEP could not be estimated (NE) because no FSW in the reference category initiated PrEP. Variables entered into the initial multivariable model were mode of recruitment, sector of residence, age group, marital status, education level, Ubudehe social category, occupation, HIV risk exposure category, HIV testing in the past 3 months, number of sexual partners in the past 7 days, health insurance and PrEP awareness; age group, education level and Ubudehe category were removed during backward elimination. PrEP: pre-exposure prophylaxis; COR: crude odds ratio; CI: confidence interval; Ref: reference category; AOR: adjusted odds ratio; NE: not estimable; –: not entered into or not retained in the final multivariable model. Percentages in the PrEP uptake and no uptake columns are row percentages (proportion of FSWs in each category who did or did not initiate PrEP)

Characteristic	PrEP uptake outcome		Bivariable		Multivariable	
	PrEP uptake (n = 265), n (row %)	No uptake (n = 535), n (row %)	COR (95% CI)	p-value	AOR (95% CI)	p-value
Yes	150 (44%)	190 (56%)	2.4 (1.8–3.2)	< 0.001	10.5 (5.5–20.1)	< 0.001
Willingness to take PrEP						
No	0 (0%)	38 (100%)	1 (Ref)		–	–
Yes	265 (35%)	497 (65%)	NE	–	–	–
Heard of PrEP before (PrEP awareness)						
No	23 (12%)	168 (88%)	1 (Ref)		1 (Ref)	
Yes	242 (40%)	367 (60%)	4.8 (3.0–7.7)	< 0.001	4.9 (2.5–9.5)	< 0.001

Odds ratios for self-perceived risk of HIV and willingness to take PrEP could not be estimated (NE) because no FSW in the reference category initiated PrEP. Variables entered into the initial multivariable model were mode of recruitment, sector of residence, age group, marital status, education level, Ubudehe social category, occupation, HIV risk exposure category, HIV testing in the past 3 months, number of sexual partners in the past 7 days, health insurance and PrEP awareness; age group, education level and Ubudehe category were removed during backward elimination. PrEP: pre-exposure prophylaxis; COR: crude odds ratio; CI: confidence interval; Ref: reference category; AOR: adjusted odds ratio; NE: not estimable; –: not entered into or not retained in the final multivariable model. Percentages in the PrEP uptake and no uptake columns are row percentages (proportion of FSWs in each category who did or did not initiate PrEP)

Sensitivity analyses

In sensitivity analyses, the associations of recruitment by community volunteers, occupation, recent HIV testing and prior awareness of PrEP with uptake were consistent in direction and statistically significant in all alternative specifications, and being single remained significant in all models except S3 (AOR 2.4, 95% CI 1.0–5.8), in which age, which is correlated with marital status, was added (Table 3). Having 3–4 sexual partners in the past 7 days was associated with uptake in all models in which it was included. In contrast, the magnitude of the associations for volunteer recruitment and sector of residence was unstable: bootstrapped CIs were very wide (community volunteer AOR 35.0, 95% CI 5.0–246; Gashari AOR 65.7, 95% CI 10.8–401), and the corresponding adjusted prevalence ratios were much smaller (community volunteer APR 3.4, 95% CI 1.7–7.2; Gashari APR 7.0, 95% CI 2.8–17.7; Rubengera APR 5.2, 95% CI 3.6–7.5). Prevalence ratios were also smaller than odds ratios for health insurance (APR 2.8 vs AOR 10.5), prior awareness of PrEP (APR 2.1 vs AOR 4.9) and recent HIV testing (APR 1.7 vs AOR 3.2). The association with an STI in the past 6 months was not robust: it was not statistically significant in S5 and S6, and when multiple sexual partners was used as the reference category (S8), neither STI (AOR 1.5, 95% CI 0.7–3.2) nor inconsistent or no condom use (AOR 0.2, 95% CI 0.05–1.1) differed significantly from the reference. The association between health insurance and uptake differed by sector of residence (Table 4): insured FSWs were more likely than uninsured FSWs to initiate PrEP in Rubengera (96.4% vs 11.3%; AOR 109, 95% CI 37.1–322) but less likely in Bwishyura (7.5% vs 20.2%; AOR 0.05, 95% CI 0.02–0.15), and no FSW in Gashari had health insurance. Because the screening facility was not recorded in the analysis dataset, we could not assess whether insured initiators in Rubengera were concentrated at particular facilities. Health insurance status had no missing values in the analysis dataset (800/800), so the pattern cannot be explained by differential completeness of insurance data between initiators and non-initiators. The pooled AOR for health insurance in the final model therefore combines opposite effects and should not be interpreted as a single effect. The model including this interaction (S6) fitted the data better than the final model (AIC 425.1 vs 547.0; BIC 500.1 vs 617.2; AUC 0.954 vs 0.922) and was adequately calibrated (Hosmer–Lemeshow $p = 0.105$ vs $p < 0.001$; link test $p = 0.479$ vs 0.035). The final model was therefore misspecified with respect to health insurance. For all other statistically significant associations, estimates from S6 were in the same direction as those from the final model, although recruitment by peer educators (AOR 5.2, 95% CI 2.0–13.5) and being married or cohabiting (AOR 3.3, 95% CI 1.2–8.9) became statistically significant in S6 (Table 3); the final model was retained as the primary model because it was prespecified and because the interaction could not be estimated in

Gashari, where no FSW was insured. Modelling sector of residence as a random intercept rather than a fixed effect (S4) had little effect on the estimates (intraclass correlation 0.52; Table 3), and all associations that were statistically significant in the final model remained significant. Because the screening facility was not recorded in the analysis dataset and there were only three sectors, clustering by health facility could not be modelled, and cluster-robust or wild cluster bootstrap inference was not feasible. There was no important multicollinearity in the final model (maximum VIF 3.65).

Table 3
Sensitivity analyses: adjusted estimates (95% CI) for factors associated with PrEP uptake across alternative model specifications

Variable	S0 Final model	S1 Modified Poisson (APR)	S2 Partners continuous	S3 + Age and education	S4 Sector random intercept	S5 Without sector	S6 Sector × insurance	S7 Bootstrap CI
Mode of recruitment (ref: healthcare provider)								
Peer educator	1.9 (0.9–3.7)	1.2 (0.9–1.4)	1.6 (0.8–3.2)	1.8 (0.9–3.6)	1.9 (0.9–3.7)	1.3 (0.7–2.2)	5.2 (2.0–13.5)*	1.9 (0.9–3.7)
Community volunteer	35.0 (12.1–102)*	3.4 (1.7–7.2)*	34.3 (11.9–99.4)*	38.8 (13.3–113)*	36.9 (12.8–106)*	19.7 (9.7–40.2)*	10.0 (4.0–25.1)*	35.0 (5.0–246)*
Sector of residence (ref: Bwishyura)								
Gashari	65.7 (22.7–190)*	7.0 (2.8–17.7)*	73.6 (25.5–212)*	58.9 (20.3–171)*	–	–	–	65.7 (10.8–401)*
Rubengera	46.2 (23.6–90.5)*	5.2 (3.6–7.5)*	45.3 (23.1–89.1)*	38.0 (19.2–75.2)*	–	–	–	46.2 (18.1–118)*
Marital status (ref: divorced/separated)								
Married/cohabiting	2.1 (1.0–4.4)	1.4 (1.1–1.8)*	2.1 (1.0–4.5)*	1.8 (0.8–3.9)	2.1 (1.0–4.4)	1.6 (0.9–3.0)	3.3 (1.2–8.9)*	2.1 (1.1–4.0)*
Single	4.1 (1.9–9.0)*	1.7 (1.3–2.3)*	4.1 (1.9–9.0)*	2.4 (1.0–5.8)	4.1 (1.9–9.0)*	2.9 (1.6–5.5)*	7.1 (2.6–19.7)*	4.1 (2.0–8.4)*
Occupation (ref: self-employed)								
Farmer	3.5 (2.1–6.0)*	1.6 (1.3–2.1)*	3.6 (2.1–6.1)*	3.7 (2.1–6.7)*	3.6 (2.1–6.1)*	5.5 (3.6–8.5)*	3.3 (1.7–6.3)*	3.5 (2.1–5.9)*
HIV testing in past 3 months (ref: no)								
Yes	3.2 (1.9–5.7)*	1.7 (1.3–2.1)*	3.5 (2.0–6.0)*	3.3 (1.9–5.9)*	3.2 (1.8–5.6)*	2.1 (1.4–3.4)*	5.4 (2.7–10.6)*	3.2 (1.9–5.7)*
HIV risk exposure category (ref: inconsistent or no condom use)								

Variable	S0 Final model	S1 Modified Poisson (APR)	S2 Partners continuous	S3 + Age and education	S4 Sector random intercept	S5 Without sector	S6 Sector × insurance	S7 Bootstrap CI
Mode of recruitment (ref: healthcare provider)								
Multiple sexual partners	4.5 (0.9–20.9)	1.5 (0.9–2.4)	4.0 (0.9–18.9)	4.7 (1.0–22.7)	4.4 (0.9–20.5)	2.3 (0.6–8.8)	2.1 (0.4–10.0)	4.5 (0.8–23.5)
STI in the past 6 months	6.5 (1.2–35.3)*	1.8 (1.1–3.0)*	6.0 (1.1–32.2)*	6.9 (1.2–38.9)*	6.3 (1.2–34.1)*	2.4 (0.6–10.1)	4.7 (0.8–26.8)	6.5 (1.2–35.4)*
Sexual partners in past 7 days (ref: 1–2)								
3–4	2.3 (1.3–4.1)*	1.4 (1.1–1.7)*	–	2.3 (1.3–4.0)*	2.4 (1.3–4.2)*	1.9 (1.2–3.0)*	2.3 (1.2–4.5)*	2.3 (1.2–4.5)*
≥ 5	1.4 (0.8–2.6)	1.1 (0.9–1.4)	–	1.4 (0.8–2.6)	1.4 (0.8–2.6)	1.3 (0.8–2.1)	0.9 (0.5–1.9)	1.4 (0.7–2.8)
Per additional partner	–	–	1.06 (0.97–1.14)	–	–	–	–	–
Health insurance (ref: no)								
Yes, all sectors	10.5 (5.5–20.1)*	2.8 (2.0–4.0)*	12.3 (6.5–23.3)*	11.4 (5.9–22.2)*	10.2 (5.3–19.6)*	2.6 (1.6–4.4)*	–	10.5 (4.8–22.9)*
Yes, Bwishyura	–	–	–	–	–	–	0.05 (0.02–0.15)*	–
Yes, Rubengera	–	–	–	–	–	–	109 (37.1–322)*	–
Prior awareness of PrEP (ref: no)								
Yes	4.9 (2.5–9.5)*	2.1 (1.5–2.9)*	4.9 (2.6–9.5)*	4.8 (2.5–9.4)*	4.9 (2.5–9.5)*	3.9 (2.2–6.8)*	5.9 (2.7–13.0)*	4.9 (2.5–9.6)*
Additional covariates in S3								
Age, per year	–	–	–	0.92	–	–	–	–

Variable	S0 Final model	S1 Modified Poisson (APR)	S2 Partners continuous	S3 + Age and education	S4 Sector random intercept	S5 Without sector	S6 Sector × insurance	S7 Bootstrap CI
Mode of recruitment (ref: healthcare provider)								
				(0.87–0.98)*				
No formal education (ref: secondary)	–	–	–	1.6 (0.5–4.7)	–	–	–	–
Primary education (ref: secondary)	–	–	–	1.2 (0.7–2.3)	–	–	–	–

*Values are adjusted odds ratios (AOR) with 95% confidence intervals (CI), except S1, which shows adjusted prevalence ratios (APR). *p < 0.05. –: term not included in the model. S0: final multivariable logistic regression model (*Table 2*); S1: modified Poisson regression with robust standard errors; S2: number of sexual partners entered as a continuous variable; S3: S0 plus age (continuous) and education level; S4: mixed-effects logistic regression with a random intercept for sector of residence (sector removed as a fixed effect); S5: S0 without sector of residence; S6: S0 with a sector of residence × health insurance interaction, with the effect of health insurance shown separately by sector (no FSW in Gashari had health insurance); S7: S0 with bootstrapped 95% CI (1,000 replications). S8 (multiple sexual partners as the reference category for HIV risk exposure) is reported in the text. PrEP: pre-exposure prophylaxis; ref: reference category.*

Table 4
PrEP uptake by health insurance coverage within sector of residence

Sector of residence	Health insurance	n	Initiated PrEP, n (row %)	AOR (95% CI)□	p-value
Bwishyura	No	89	18 (20.2%)	1 (Ref)	
	Yes	200	15 (7.5%)	0.05 (0.02–0.15)	< 0.001
Gashari	No	78	64 (82.1%)	1 (Ref)	
	Yes	0	–	NE	
Rubengera	No	293	33 (11.3%)	1 (Ref)	
	Yes	140	135 (96.4%)	109 (37.1–322)	< 0.001

□ *Effect of health insurance within each sector of residence, estimated from model S6 (*Table 3*) and adjusted for all other variables in the final model. NE: not estimable, because no FSW in Gashari had health insurance. AOR: adjusted odds ratio; CI: confidence interval; Ref: reference category; PrEP: pre-exposure prophylaxis.*

Discussion

This study found that one in three eligible FSWs (33.1%) in Karongi District initiated PrEP between March and December 2021, early in PrEP implementation in the district. Sex workers are among the populations at highest risk of HIV, and HIV prevention among key populations is a priority of the Rwanda Ministry of Health; HIV prevention among sex workers also benefits their sexual partners and the wider community [20]. In many societies, sex workers face barriers to health and social services because of stigma and discrimination[25]. Uptake among FSWs in Karongi District (33.1%) was lower than that reported in Benin (47%) [26], South Africa (98%)[27] and Senegal (82.2%) [28]. However, these studies were largely demonstration projects or research studies that provided intensive support, such as dedicated study staff, peer navigation

and close follow-up, whereas our data reflect routine service delivery in public health facilities; higher uptake in those settings is therefore expected. Our finding is more comparable with that of a study among FSWs in Zimbabwe, where the monthly PrEP initiation rate in a peer-led, community-based programme rose during 2020 to a peak of 51% in September 2020 [29] and with a study at sex worker and men who have sex with men (MSM) facilities in South Africa, where 44% of eligible FSWs and 33% of eligible MSM initiated PrEP [30]. The Zimbabwe study, like ours, was conducted during the COVID-19 pandemic; there, uptake increased after PrEP delivery shifted from clinics to peer-led, community-based services, which is consistent with the higher uptake we observed among FSWs recruited by community volunteers. Low uptake in our setting is unlikely to be explained by unwillingness alone, most FSWs had heard of PrEP (76.1%) and were willing to take it (95.3%). The gap between willingness and initiation suggests that structural and health-system barriers also play a role. Nonetheless, prior awareness of PrEP was strongly associated with uptake, consistent with evidence that awareness increases the acceptability of and willingness to use PrEP [31]. Awareness and education campaigns delivered by nurses, midwives, physicians, peer educators and community volunteers, together with mass media and mobile outreach, could therefore strengthen PrEP demand creation among FSWs.

Access to PrEP information may also be limited because FSWs are not always seen by the same healthcare provider and may not disclose their occupation[32]. The strong association between community volunteer recruitment and uptake suggests that community-based outreach may reach FSWs who are ready to initiate PrEP, or may provide counseling and follow-up that facilitate initiation. However, the very large odds ratios for recruitment mode and sector of residence, with wide confidence intervals, should be interpreted with caution; the identical distributions of volunteer-recruited FSWs and Gashari residents in Table 1 suggest that these variables may overlap. Recent HIV testing was also associated with uptake, highlighting HIV testing services as a key entry point for PrEP. Age was associated with uptake in bivariable analysis but not after adjustment. Single FSWs may face fewer partner-related barriers to PrEP use, such as the need to conceal medication from a regular partner. The higher uptake among FSWs recorded as farmers should be interpreted cautiously, because this category may include women with other informal livelihoods. This finding, and the higher uptake among those reporting 3–4 but not ≥ 5 partners in the previous week, warrants further investigation. Health insurance coverage showed one of the strongest associations with uptake. However, this association differed markedly by sector of residence: insured FSWs were more likely to initiate PrEP in Rubengera but less likely in Bwishyura, and no FSW in Gashari was insured (Table 4). The pooled estimate may therefore reflect sector- or facility-level differences rather than an effect of insurance itself and should be interpreted with caution. Model diagnostics also showed that the final model, which assumed a single effect of insurance across sectors, was poorly calibrated, whereas the model allowing sector-specific insurance effects fitted the data well; the pooled odds ratio of 10.5 should therefore not be interpreted as the effect of insurance. The final model was thus misspecified with respect to health insurance. We retained it as the primary model because it was prespecified, the insurance interaction could not be estimated in Gashari and its other estimates were consistent in direction with those from S6, but conclusions about insurance are based only on the sector-specific estimates. The magnitude of the sector-specific estimates (96.4% vs 11.3% uptake in Rubengera, with the opposite pattern in Bwishyura) is also more consistent with differences in how insurance was recorded at individual facilities than with a behavioural effect. Because PrEP is provided free of charge in Rwanda[9], [20], this association is unlikely to reflect the cost of PrEP itself. Where insurance is associated with uptake, it may lower out-of-pocket costs for the screening and treatment of sexually transmitted infections, which are common among FSWs who do not use condoms consistently, and may encourage regular contact with health services where PrEP is offered.

The legal and social context of sex work may also shape PrEP uptake. Law Nº68/2018 determining offences and penalties in general removed criminal penalties for sex work in Rwanda [33], but FSWs continue to report stigma, discrimination and administrative detention in transit centers [34], [35], which may discourage them from disclosing their occupation or attending health facilities (18). Studies from neighboring East African countries show a similar gap between awareness and use: awareness of PrEP among FSWs is often high, yet reported use has ranged from about one in ten to nearly two-thirds, with stigma, discomfort with health services and mobility cited as barriers [10], [36], [37]. Use was higher among FSWs with an income source besides sex work [13] and among those with a positive attitude toward PrEP [12]. As in our study, these findings show that high awareness and willingness do not guarantee initiation, and that peer support and community-based delivery may facilitate PrEP use among FSWs[14] .

Strengths and limitations

This study used data from all PrEP-providing facilities in Karongi District and reflects routine service delivery. However, it has several limitations. First, routine records were sometimes incomplete or inadequately documented. Although missing entries were resolved against the original client files and no records were excluded, the client files may themselves contain recording errors, so some misclassification of study variables cannot be ruled out. Second, the study was conducted in a single district, which limits the generalizability of the findings to all FSWs in Rwanda. Third, the cross-sectional design does not allow causal inference. Fourth, the study was conducted in the early phase of PrEP implementation in Karongi District, and we could not assess PrEP continuation or discontinuation. Fifth, willingness to take PrEP, self-perceived risk and PrEP awareness were recorded at screening and may partly reflect the uptake decision itself. Sixth, consistent condom use was self-reported and may have been overestimated, so some excluded FSWs may still have been at substantial risk of HIV infection. Seventh, occupation may have been misclassified: in the Rwandan context, people who are not salaried professionals or business owners commonly report farming as their occupation, so the 'farmer' category may include FSWs with other informal livelihoods, and the association between occupation and PrEP uptake should be interpreted with caution. Eighth, observations were clustered within health facilities, and sector of residence may partly reflect facility-level differences in service delivery; because the screening facility was not recorded in the analysis dataset, clustering by health facility could not be modelled; sector of residence was modelled as a random intercept in a sensitivity analysis, but with only three sectors the between-sector variance is estimated imprecisely, and sector and facility effects cannot be separated. Ninth, the study period coincided with the COVID-19 pandemic, which may have disrupted PrEP service delivery and demand creation. Tenth, the primary model was misspecified with respect to health insurance and poorly calibrated (Hosmer–Lemeshow $p < 0.001$; link test $p = 0.035$), mainly because it assumed a single effect of health insurance across sectors; insurance effects are therefore reported by sector. In addition, the extreme and opposite insurance associations in Rubengera and Bwishyura may reflect facility-level recording practices rather than a behavioural effect: insurance status may have been recorded more completely for FSWs who initiated PrEP, or enrolment in health insurance may have followed rather than preceded PrEP initiation (reverse ordering), and these possibilities could not be excluded with routine data. Finally, the wide confidence intervals for some estimates indicate limited precision.

Implications for programmes, policy and research

Although our data come from the early phase of PrEP implementation (March–December 2021), the gap we observed between eligibility, willingness and initiation remains relevant as Rwanda expands PrEP for key populations. Our findings suggest several programme priorities. First, PrEP delivery for FSWs could be differentiated and brought closer to where they live and work, for example through peer educators, community volunteers and outreach or hotspot-based services, rather than relying mainly on facility entry points. Second, PrEP should be offered systematically during HIV testing, so that every FSW who tests HIV-negative is screened and, if eligible, offered PrEP at the same contact. Third, provider training to reduce stigma and support disclosure of sex work could help FSWs access PrEP information and services. Fourth, as long-acting options such as injectable cabotegravir and lenacapavir become available, they may help FSWs for whom daily pills, concealment from partners or mobility are barriers, and they could be delivered through the same community-based and HIV testing platforms.

Future research should follow FSWs prospectively from screening to initiation and continuation to identify where they drop out of the PrEP cascade, and should use multilevel designs that include facility-level characteristics. Qualitative studies with FSWs, peer educators and providers could explain why willingness does not translate into initiation and why uptake differs by recruitment mode and place of residence. Implementation studies should evaluate community-based and differentiated delivery models and the acceptability and uptake of long-acting PrEP among FSWs in Rwanda, ideally across several districts.

Conclusions

PrEP uptake among eligible FSWs in Karongi District was low, with only one in three initiating PrEP between March and December 2021. Recruitment by community volunteers, being single, working as a farmer, recent HIV testing and prior awareness of PrEP were associated with uptake, and these associations were consistent in direction across sensitivity analyses. Uptake also varied markedly by sector of residence, but the size of the recruitment and sector effects was unstable, and the association with health insurance differed by sector and may reflect differences in recording between facilities.

Strengthening community-based and volunteer-led demand creation, integrating PrEP offers into HIV testing services, and improving PrEP awareness among FSWs could increase uptake as PrEP services expand to other sites. Longitudinal studies are needed to assess PrEP continuation and adherence among FSWs in Karongi District and nationally.

Abbreviations

AGYW
Adolescent girls and young women
AOR
Adjusted odds ratio
CI
Confidence interval
COR
Crude odds ratio
FSW
Female sex worker
MSM
Men who have sex with men
PrEP
Pre-exposure prophylaxis
STI
Sexually transmitted infection
TDF/FTC
Tenofovir disoproxil fumarate/emtricitabine

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of the College of Medicine and Health Sciences, University of Rwanda (Ref: 290/CMHS/IRB/2022; approved on 26 April 2022), before data abstraction began in May 2022, and permission to conduct the study was obtained from Kibuye Referral Hospital. The requirement for individual informed consent was waived by the Institutional Review Board because the study was a retrospective review of de-identified routine program data, including the records of four FSWs aged 17 years. All methods were carried out in accordance with relevant guidelines and regulations, including the Declaration of Helsinki. No personal identifiers were collected.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

GT conceived the study, collected and analyzed the data, and drafted the manuscript. EN supervised the study and critically revised the manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are not publicly available because they were abstracted from routine PrEP program records owned by the Rwanda Ministry of Health through the Rwanda Biomedical Centre (RBC) and, because of small numbers at some facilities, could allow indirect identification of members of a highly stigmatized key population. De-identified data are available from the corresponding author on reasonable request and with permission from the Rwanda Biomedical Centre.

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Figures

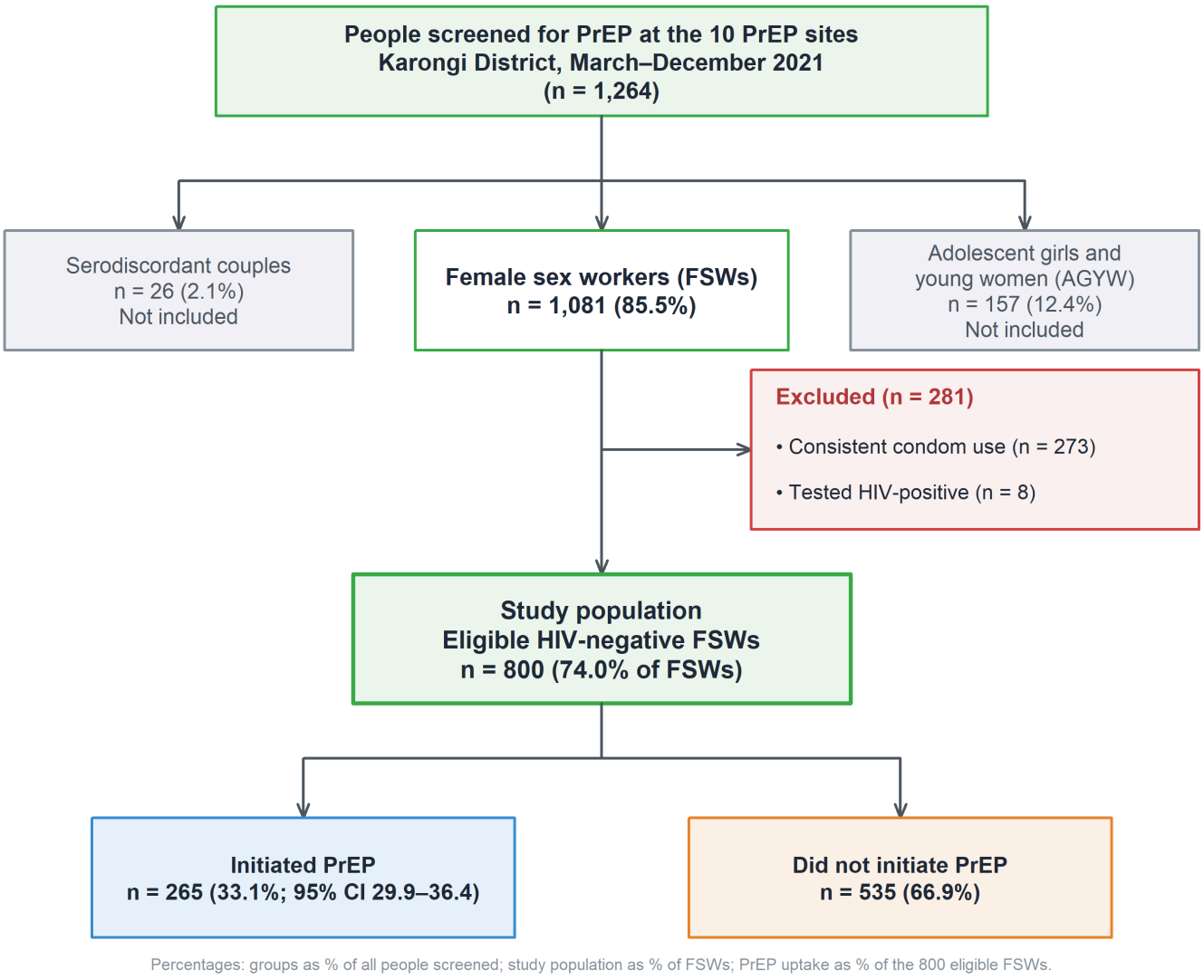


Figure 1

Flow chart of participant selection.

Abbreviations: AGYW, adolescent girls and young women; FSW, female sex worker; PrEP, pre-exposure prophylaxis.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- PrePChart1.docx
- PrEPSTROBECHECKLIST.docx