




# BMJ Open HIV pre-exposure prophylaxis uptake, retention and adherence among female sex workers in sub-Saharan Africa: a systematic review

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## ABSTRACT

**Objective** To evaluate oral pre-exposure prophylaxis (PrEP) uptake, retention and adherence among female sex workers (FSWs) receiving care through community and facility delivery models in sub-Saharan Africa (SSA).

**Design** Systematic review and meta-analysis.

**Data sources** We searched online databases (PubMed, MEDLINE, SCOPUS, EMBASE, Google Scholar, Cochrane Database of Systematic Reviews and Web of Science) between January 2012 and 3 April 2022.

**Eligibility criteria for studies** Randomised controlled trials, cohort studies, cross-sectional studies and quasi-experimental studies with PrEP uptake, adherence and retention outcomes among FSWs in SSA.

**Data extraction and synthesis** Seven coders extracted data. The framework of the Cochrane Consumers and Communication Review Group guided data synthesis. The Risk of Bias In Non-Randomized Studies of Interventions tool was used to evaluate the risk of bias. Meta-analysis was conducted using a random-effects model. A narrative synthesis was performed to analyse the primary outcomes of PrEP uptake, adherence and retention.

**Results** Of 8538 records evaluated, 23 studies with 40 669 FSWs were included in this analysis. The pooled proportion of FSWs initiating PrEP was 70% (95% CI: 56% to 85%) in studies that reported on facility-based models and 49% (95% CI: 10% to 87%) in community-based models. At 6 months, the pooled proportion of FSWs retained was 66% (95% CI: 15% to 100%) for facility-based models and 83% (95% CI: 75% to 91%) for community-based models. Factors associated with increased PrEP uptake were visiting a sex worker programme (adjusted OR (aOR) 2.92; 95% CI: 1.91 to 4.46), having ≥10 clients per day (aOR 1.71; 95% CI: 1.06 to 2.76) and lack of access to free healthcare in government-run health clinics (relative risk: 1.16; 95% CI: 1.06 to 1.26).

**Conclusions** A hybrid approach incorporating both facility-based strategies for increasing uptake and community-based strategies for improving retention and adherence may effectively improve PrEP coverage among FSWs.

**PROSPERO registration number** CRD42020219363.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This systematic review provides meta-analyses of pre-exposure prophylaxis (PrEP) uptake, retention and adherence among female sex workers (FSWs) in sub-Saharan Africa who accessed PrEP through community and facility delivery models.
- ⇒ Our review was limited because we included non-randomised controlled trial study designs to evaluate the effect of PrEP delivery models on our outcomes.
- ⇒ Some of the studies included in this review focused on key populations in general and had small samples of FSWs.
- ⇒ This review was limited to evaluating oral PrEP uptake, retention and adherence for cisgender FSWs accessing community or facility PrEP delivery models.

## INTRODUCTION

Female sex workers (FSWs) have a 30 times greater risk of acquiring HIV than other women aged 15–49 years in the general population.<sup>1</sup> In sub-Saharan Africa (SSA), sex workers and sex partners of key populations account for 15% and 26% of new HIV infections, respectively.<sup>1</sup> The Joint United Nations Programme on HIV/AIDS (UNAIDS) global target is for 95% of people at risk of HIV to use person-centred and effective combination prevention methods by 2025.<sup>2</sup> HIV pre-exposure prophylaxis (PrEP) is the use of antiretroviral drugs by people without HIV to prevent HIV acquisition.<sup>3</sup> The WHO recommends multiple PrEP options (daily pill, monthly dapivirine vaginal ring or 2-month injectable cabotegravir) as part of combination prevention approaches for people at substantial risk of HIV infection.<sup>4</sup> However, FSWs in SSA have

suboptimal PrEP uptake, adherence and retention<sup>5–8</sup> despite significant HIV risk.

The WHO also recommends decentralised, simplified and differentiated service delivery to support PrEP uptake, continuation and effective use.<sup>9</sup> The WHO building blocks of differentiated PrEP service delivery are (1) where to deliver PrEP (service location: health facility or community); (2) who to deliver PrEP (service provider: physician, clinical officer, nurse, pharmacist, community health worker or peer); (3) when to deliver PrEP (service frequency: monthly, quarterly, every 6 months); and (4) what to deliver (service package: HIV testing, PrEP refills, condoms, lubricant, contraception).<sup>10</sup> Diversifying PrEP delivery increases choice of service location, provider and PrEP formulation and overcomes barriers to PrEP access.<sup>5</sup>

FSWs face a range of barriers when accessing PrEP through healthcare facilities; thus, diversifying where PrEP is delivered could increase PrEP access for this stigmatised population.<sup>9</sup> Whereas differentiated PrEP service delivery is effective for men who have sex with other men, adolescent girls and young women,<sup>11 12</sup> evidence of the effect of service location on PrEP-related outcomes (uptake, retention, adherence) for FSWs in SSA is needed. We conducted a systematic review to compare PrEP uptake, retention and adherence among African FSWs receiving PrEP delivered through community or facility-based models.

## METHODS

This systematic review was developed and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols 2020 statement.<sup>13</sup> The protocol was registered with PROSPERO (<https://www.crd.york.ac.uk/prospero/>; registration number: CRD42020219363).

### Eligibility criteria

#### Types of studies

This review included randomised controlled trials, cohort studies, cross-sectional studies and quasi-experimental studies in original research articles published in peer-reviewed journals and the grey literature, with PrEP uptake, adherence and retention outcomes among FSWs in SSA and India. We excluded qualitative studies (4676), publications from resource-rich settings (1037), studies of populations other than FSWs (527) and non-English articles (102).

#### Types of participants

Participants were FSWs aged 14 years and older, HIV negative and taking PrEP.

#### Types of intervention

The interventions included PrEP facility and community delivery models. A control group was not included because this study aimed to compare PrEP uptake, retention and adherence between different delivery models.

### Types of outcome measures

#### Primary outcomes

Primary outcomes were PrEP uptake, retention and adherence among FSWs by delivery model. Uptake was defined as PrEP initiation during the review period. Retention was defined as remaining in PrEP care for at least 6 months. Adherence was defined as taking PrEP as prescribed during the study period through various delivery strategies.

#### Secondary outcomes

Secondary outcomes were demographic and clinical factors associated with PrEP uptake, retention and adherence among FSWs.

### Search strategy

An experienced information scientist performed a thorough literature search on the following bibliographical databases: PubMed (biomedical, 1946–present, <https://www.ncbi.nlm.nih.gov/pubmed/>), Google Scholar (multidisciplinary, <https://scholar.google.com/>), SciVerse SCOPUS (multidisciplinary, 1823–present, <https://www.scopus.com/>) and EMBASE-OVID (biomedical, 1947–present, <https://www.embase.com>). Additional grey literature searches were manually performed on the UNAIDS database (<https://www.unaids.org/en>), WHO (<https://www.who.int/>) and the National Institutes of Health (NIH) websites (<https://www.nih.gov>). Furthermore, a citation search was conducted using references and citations from the included studies and similar systematic reviews.

The search strategy was developed and piloted for sensitivity and specificity to ensure the comprehensiveness and inclusivity of all relevant literature. PubMed served as the primary database for this process. The search was limited to original primary research articles published in peer-reviewed journals and unpublished studies from institutional websites and repositories from 2012 to 3 April 2022, following the Population, Intervention, Control, Outcomes, Study design and Time frame format.<sup>14</sup> The following key search terms—HIV/AIDS, female sex workers, pre-exposure prophylaxis, delivery models, PrEP uptake, adherence and retention—were combined using Boolean operators (AND, OR, NOT) during the information search. The search was restricted to articles written in English or had an accompanying English translation.

### Data collection process

#### Eligibility criteria

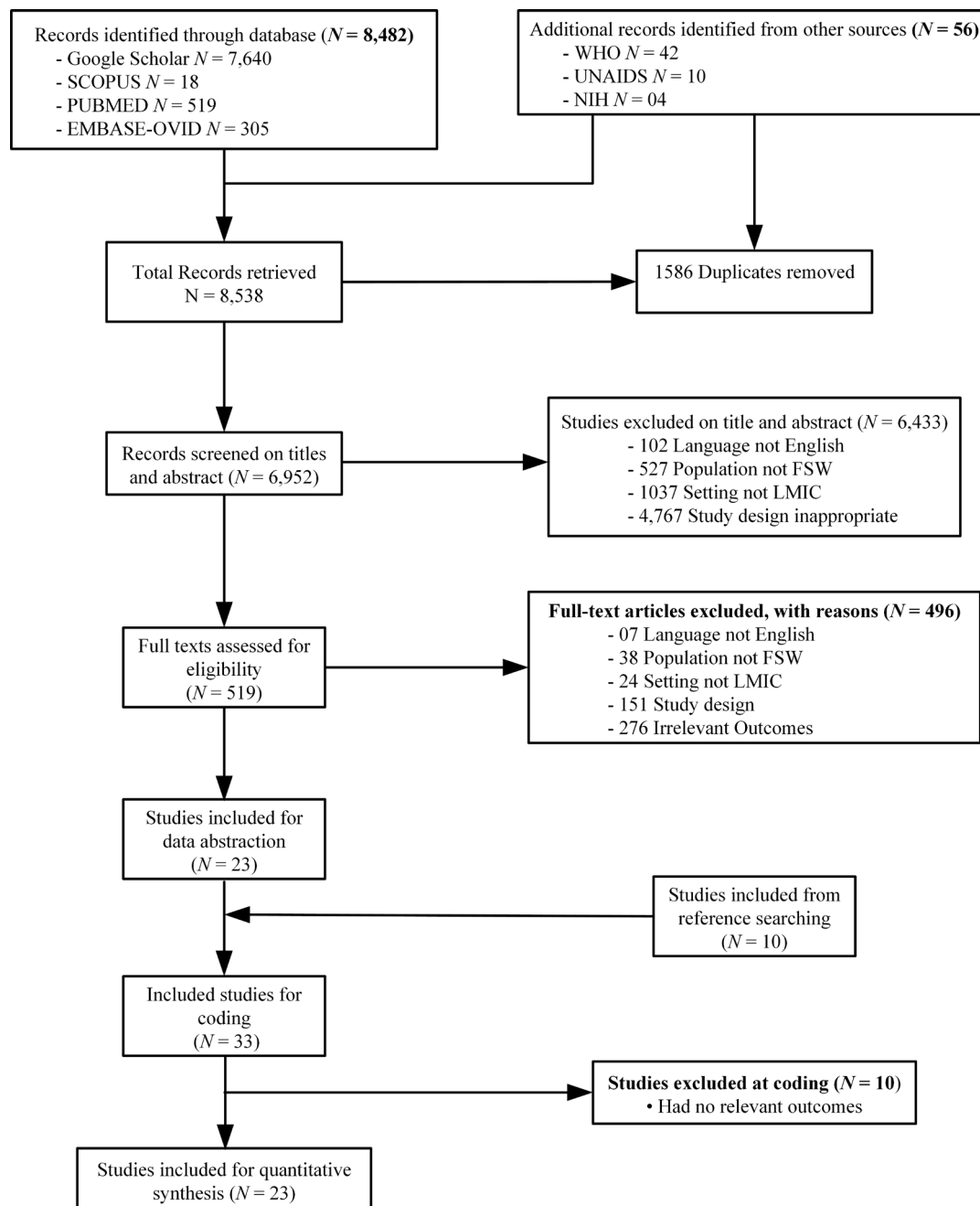
Our search was limited to original articles from primary studies published in peer-reviewed journals and unpublished studies found on institutional websites and repositories. This search covered the period between 1 January 2012 and 3 April 2022. The criteria for inclusion in this review required all articles to be written in English or have an English translation. This ensured that only relevant studies were retrieved and considered for this review. The retrieved studies were imported into EndNote

V.X9.3.3 (Clarivate Analytics, Philadelphia, USA) using the program's duplicate management features to eliminate duplicate entries and create a comprehensive and organised citation database. This database was exported to Microsoft Excel V.2016 (Microsoft Corporation, Redmond, Washington, USA) for title and abstract screening.

The screening tool was created and tested using a subset of 10% of the collected studies to encompass all elements of the eligibility criteria. Articles were screened based on their title and abstract; subsequently, those that met the eligibility criteria were subjected to full-text screening.

### Study selection process/screening

Pairs of research assistants conducted the screening process. Any discrepancies were resolved and subsequently verified by author RM to ensure accuracy. Rescreening and retraining were performed if the level of agreement between RM, IS and KOO was <80%. Decisions and justifications for the exclusion of studies were duly recorded. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart was used to summarise the selection process (figure 1).



**Figure 1** Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart. FSW, female sex worker; LMIC, low/middle-income country; NIH, National Institutes of Health; UNAIDS, Joint United Nations Programme on HIV/AIDS.

### Data abstraction process/coding

The coding tool was developed and pilot-tested to guarantee the inclusion of all necessary data elements for this review, using Microsoft Excel V.2016 (Microsoft Corp, Redmond, Washington, USA) for abstraction purposes. The coding process was carried out by pairs of individuals on the review team, and any discrepancies were resolved through discussion after reconciling their respective results. An independent senior reviewer validated the results for quality control and assurance.

### Data items

The primary outcomes for this systematic review were FSW uptake, retention and adherence to PrEP in both community and facility delivery models. Secondary outcomes were barriers and enablers of FSW PrEP uptake, adherence and retention in community and facility PrEP delivery models. We also collected administrative details such as author name, year of publication and author's affiliation, along with data on study design and delivery model components (online supplemental table 1).

### Assessment of risk of bias in the included studies

The risk of bias in each included study was evaluated by two independent reviewers (IS and KOO) using the Risk of Bias In Non-Randomized Studies of Interventions tool. The risk of bias assessment covered several domains, including bias due to confounding, bias in selection of participants into the study, bias in the classification of interventions, bias due to deviations from intended observations, bias due to missing data and bias in the selection of reported studies. Differences between reviewers were discussed until a consensus was reached.

### Measure of PrEP delivery model effect

We reported pooled proportions of PrEP uptake (online supplemental figure 1) and retention (online supplemental figure 2) as reported by the study authors. Due to the lack of homogeneity among the included studies ( $p=0.31$ ), conducting a meta-analysis to generate more accurate point estimates for the facility and community PrEP delivery models was not feasible.

### Missing data

The included studies did not report any missing data. The author was contacted via email if further clarification regarding the provided data was necessary.

### Assessment of publication bias

The Doi plot and Luis Furuya-Kanamori asymmetry index (LFK index) were used to evaluate the presence of publication bias. If there is symmetry, no publication bias exists, whereas a lack of symmetry may suggest the presence of publication bias. An LFK index of  $\pm 1$  indicates no asymmetry, an LFK index between  $\pm 1$  and  $\pm 2$  represents minor asymmetry, and an LFK index greater than  $\pm 2$  signifies major asymmetry. The Doi plot for publication bias showed no signs of symmetry, confirming the presence of bias (online supplemental figures 3 and 4).

### Heterogeneity

A random-effects model was used for the meta-analysis, with heterogeneity among studies evaluated visually through a forest plot and quantitatively using the  $I^2$  index. The heterogeneity threshold was set at  $I^2 \geq 50\%$ . Overall, there was significant variability in PrEP uptake ( $I^2=99.9\%$ ) across studies, as reflected by the random-effects pooled proportion estimate of 63% (95% CI: 48% to 79%). Regarding retention in care, the findings indicate significant heterogeneity among studies ( $I^2=99.9\%$ ), with an overall pooled retention rate of 76% (95% CI: 55% to 97%). Our meta-analysis revealed significant heterogeneity among studies regarding PrEP uptake and retention rates. However, the small number of studies prevented us from conducting in-depth analysis using meta-regression.

### Data synthesis

The data synthesis process adhered to the structure prescribed by the Cochrane Consumers and Communication Review Group.<sup>15</sup> We described the included articles, categorised them by study design and intervention type, systematically organised and tabulated findings to discern trends, and standardised the results into a unified descriptive format. The data were integrated into the summary of findings tables, which informed the syntheses used for dissemination. A narrative synthesis was performed to analyse the primary outcomes of PrEP uptake, adherence and retention among FSWs in community and facility delivery models.

### Statistical analysis

The data were analysed using a restricted maximum likelihood model. The primary features of the included studies were consolidated by calculating pooled proportions to estimate overall PrEP uptake, retention and adherence for both community and facility PrEP delivery models. Pooled proportions with exact binomial 95% CIs were calculated and presented in forest plots (online supplemental figures 1 and 2). The homogeneity of results was calculated using the  $X^2$  test, while the  $I^2$  statistic was used to describe the percentage variation across included studies. All analyses were performed using STATA V.16.0 (StataCorp, Stata Statistical Software: College Station, Texas, USA).

### Patient and public involvement

The PrEP technical team at the School of Medicine, Makerere University, Uganda provided feedback on the review protocol and analysis. FSWs were involved in a qualitative study, and the Ugandan Ministry of Health may ultimately consider their stated preferences while developing PrEP delivery guidelines.



## RESULTS

### Identification and selection of studies

A total of 8538 citations were retrieved after searching bibliographical databases (Google Scholar, EMBASE-OVID, PubMed, SCOPUS) and institutional websites (WHO, UNAIDS and NIH). After the removal of duplicates, 6952 citations remained. Of these, 6433 articles were excluded after title and abstract screening. The remaining 519 full-text articles were screened for eligibility, of which 23 articles were included for data abstraction. An additional 10 articles were included from reference searching, yielding a total of 33 articles for coding (figure 1).

### Characteristics of excluded studies

Out of the 8538 records identified, 1582 duplicates were removed. Of the remaining 6956 records, 6433 studies were excluded at title and abstract screening because they had an inappropriate study design (4767), were not in low/middle-income countries (LMICs) (1037), not among FSWs (527) and were not written in English (102). The remaining 523 articles were assessed for eligibility using full text, of which 496 were excluded because they lacked relevant outcomes (278), had inappropriate study design (151), were not among FSWs (38), were from high-income countries (24) or were not written in English (7) (figure 1).

### Characteristics of included studies

Of the 23 articles included in the data abstraction, 21 were from SSA (Benin, Democratic Republic of Congo, Eswatini, Ghana, Ivory Coast, Kenya, Senegal, South Africa, Uganda and Zimbabwe) and 2 were from South Asia (India) (table 1). Five studies were conducted in South Africa. All studies were published in peer-reviewed journals between 2016 and 2022. Reviewed studies included 40 699 participants (median: 647, IQR: 1928) and ranged in size from 126 (smallest study) to 19 407 (largest study) participants. 16 studies were cohort studies, demonstration projects, randomised trials or mixed-methods studies, and 7 were cross-sectional. 14 articles described facility-based delivery models, 8 studies used community models and 1 study did not report the delivery model.

### Risk of bias in studies

Risk of bias assessment for the non-randomised studies<sup>16</sup> included in the systematic review shows that the studies scored strongly across the six components considered in the evaluation. Among the included articles, only 8% reported withdrawals and dropouts from the study during the analysis. Some studies (21%) did not report the study design. Data collection methods and confounding were commonly mentioned in 100% of the studies (online supplemental figure 6). Funnel plots were not used to assess publication bias because they are not recommended for proportional meta-analyses.<sup>17</sup> The Doi plot and LFK index were used to evaluate potential publication bias.<sup>18</sup> An LFK index of  $\pm 1$  indicates no asymmetry, an LFK index between  $\pm 1$  and  $\pm 2$  represents minor asymmetry, and an LFK index greater than

$\pm 2$  signifies major asymmetry. The Doi plot for publication bias showed no signs of symmetry, confirming the presence of bias (online supplemental figures 3 and 4).

### Sensitivity analysis

Sensitivity analysis excluded studies with significantly small or large effect sizes and a limited sample size. The LFK's test results did not change substantially; therefore, the conclusions remained unchanged.

### PrEP uptake

14 studies reported PrEP uptake,<sup>19–32</sup> with varying definitions used among the studies (table 2). Nine (64%) defined uptake as the proportion of clients enrolled in PrEP care,<sup>20 21 24–27 30 32</sup> two (14%) defined it as the proportion of clients who had ever used PrEP,<sup>19 22</sup> and two (14%) defined uptake as currently using PrEP or having knowledge of PrEP. Overall, the pooled proportion of PrEP uptake was 63% (95% CI: 48% to 79%); 70% (95% CI: 56% to 85%) in facility-based models<sup>19 28</sup> and 49% (95% CI: 10% to 87%) in community models<sup>29 31</sup> (online supplemental figure 1). Factors associated with increased PrEP uptake included visiting a sex worker programme (adjusted OR (aOR) 2.92; 95% CI: 1.91 to 4.46), having  $\geq 10$  clients per day (aOR 1.71; 95% CI: 1.06 to 2.76)<sup>19</sup> and lack of access to free public sector healthcare (relative risk 1.16; 95% CI: 1.06 to 1.26).<sup>25</sup> Factors associated with decreased PrEP uptake included duration of sex work  $\geq 2$  years (aOR 0.51; 95% CI: 0.32 to 0.83) and experiencing emotional violence (aOR 0.23; 95% CI: 0.07 to 0.71).<sup>22</sup> Reasons for initiating PrEP included sexual activity, perceived risk of HIV and having multiple sexual partners.<sup>23</sup> PrEP decliners were concerned about daily intake of PrEP,<sup>21 23</sup> side effects<sup>23 24 27 31</sup> or stigma.<sup>23 31</sup>

### PrEP retention

Eight studies reported PrEP retention at 1 month and quarterly intervals according to refill schedules at health facilities<sup>21 24 25 27 28 30 32 33</sup> (online supplemental table 2). Five studies<sup>21 24 25 27 28</sup> reported facility model retention and three reported community model retention.<sup>30 32 33</sup> Overall, the pooled proportion of month 6 retention was 76% (95% CI: 55% to 97%); 83% (95% CI: 73% to 91%) for facility models<sup>25 28</sup> and 66% (95% CI: 15% to 100%)<sup>30 32</sup> for community models (online supplemental figure 2). PrEP retention at 1 month was generally  $>80\%$  except for three studies,<sup>21 28 30</sup> and gradually decreased over time. However, three studies reported an initial increase and maintained high retention levels.<sup>21 24 32</sup> Compared with younger FSWs (18–25 years), older FSWs were less likely to discontinue PrEP (HR 0.5; 95% CI: 0.2 to 0.9 for 26–35 years, HR 0.3; 95% CI: 0.2 to 0.7 for 36–45 years and HR 0.2; 95% CI: 0.1 to 0.5 for  $>45$  years)<sup>25</sup> (online supplemental table 2A). Reasons for PrEP discontinuation included moving out of town,<sup>7 25</sup> returning to the country of origin,<sup>27</sup> pregnancy,<sup>25 27</sup> no longer doing sex work,<sup>7 24</sup> not taking a daily pill,<sup>7 24</sup> breast feeding,

**Table 1** Study characteristics

Study ID	Country	Study design	Sample size	Delivery model	Unique model components
Rao (2022)	South Africa	Retrospective cohort	2776	Facility based	NR
Witte <i>et al</i> <sup>31</sup>	Uganda	Cross-sectional	542	Community based	Hotspots
Hensen <i>et al</i> <sup>19</sup>	Zimbabwe	Mixed methods	963	Facility based	Static clinics, community mobilisation and referrals (DREAMS Initiative)
Jana <i>et al</i> <sup>24</sup>	India	Demonstration trial	678	Home delivery & facility based	Weekly pick-ups and home delivery
Little <i>et al</i> <sup>33</sup>	South Africa	Mixed methods	600	Facility based	Training of staff and peers
Leis <i>et al</i> <sup>22</sup>	Kenya	Cross-sectional	220	Facility based	Availability of free PrEP
Franks <i>et al</i> <sup>21</sup>	DRC	Demonstration project	469	Facility based	Leveraged existing facility staff and was supported by the PrEP coordinator
Chimbindi (2021)	South Africa	Mixed methods	2184	Community based	Hotspots
Nalukwago (2021)	Uganda	Cross-sectional	126	Facility based	Drug pick-ups
Matambanadzo <i>et al</i> <sup>30</sup>	Zimbabwe	Follow-up study	19 407	Community based	Peer led, used virtual appointment platforms, had multimonth refills, post-initiation support, unique alphanumeric identifier
Kagaayi <i>et al</i> <sup>26</sup>	Uganda	Retrospective cohort	1332	Facility based	Health facilities and community outreach
Diantha (2020)	South Africa	Cross-sectional	299	Facility based	Implementers of oral PrEP
Sarr <i>et al</i> <sup>25</sup>	Senegal	Demonstration trial	267	Facility based	Clinic drug refills
Geldsetzer (2020)	Eswatini	Stepped-wedge RCT and qualitative survey	2232	Facility based	PrEP promotion using videos and T-shirts, flip charts and booklets
Becquet (2020)	Ivory Coast	Mixed methods	1000	Community based	Use of community-based organisations
Guure (2020)	Ghana	Cross-sectional	998	Community based	Venue, day and time scheduling at different FSW venues
Sushena (2020)	India	Demonstration trial	647	Community based	Intense community preparedness using peers and leaders
Mudzviti (2020)	Zimbabwe	Cross-sectional	131	NR	NR
Chimbindi (2019)	South Africa	Cohort	2184	Community based	Targeted rollout (demand for, access to and community members' attitude toward PrEP)
Mboup <i>et al</i> <sup>27</sup>	Benin	Prospective cohort	256	Facility based	Drug refills at the facility and in the community, integration of ART with PrEP
Cowan <i>et al</i> <sup>20</sup>	Zimbabwe	Cluster randomised trial	2883	Facility based	Community mobilisation, legal advice, trained peers, drop-in centres and telephone reminders (Sister's Programme)
Eakle <i>et al</i> <sup>28</sup>	South Africa	Retrospective cohort	219	Facility based	Clinic pick-ups
Alary (2016)	Benin	NR	256	Community based	NR

ART, antiretroviral treatment; DRC, Democratic Republic of Congo; FSW, female sex worker; NR, not reported; PrEP, pre-exposure prophylaxis; RCT, randomised controlled trial.

HIV seroconversion, desire to marry, partner's request,<sup>27</sup> serious injury or death,<sup>25</sup> and being in police custody.<sup>24</sup>

### PrEP adherence

Five studies reported PrEP adherence<sup>24 25 27 28 32</sup> (online supplemental table 3), of which four studies reported facility models.<sup>24 25 27 28</sup> The most common adherence measure was self-report.<sup>24 27 28 32</sup> Other adherence measures were plasma tenofovir disoproxil fumarate levels<sup>24 25 32</sup> and Medical Event Management System.<sup>25</sup> Adherence after 7 days was mostly self-reported and increased from 71% in the 1st month to 75% by the 15th month. Non-condom use at the last sex act with a paying customer (aOR 0.07; 95% CI: 0.01 to 0.42) was associated with poor PrEP adherence. Other reasons associated with

poor adherence included simply forgetting (20%), being too busy (14%) and running out of study pills (14%),<sup>25</sup> as well as the duration of sex work, high intention to adhere to treatment,<sup>27</sup> not interested in daily medication or no longer felt at risk<sup>21</sup> (online supplemental table 3A).

### DISCUSSION

This systematic review summarised the pooled proportions of FSWs who initiated PrEP, remained engaged in care, and adhered to PrEP in SSA and other LMIC settings during the past decade, irrespective of whether PrEP was delivered through facility or community models. None of the included studies directly evaluated the impact

**Table 2** PrEP uptake

Study ID	Uptake	Definition of uptake	Factors associated with (or reasons for) PrEP uptake
Facility-based models			
Hensen <i>et al</i> <sup>19</sup>	33.6%	Ever used/total	FSWs with a high number (10+) of clients (aOR 1.71; 95% CI: 1.06 to 2.76), duration of sex work (<2 years, aOR 0.51; 95% CI: 0.32 to 0.83), having visited a sex worker programme in 12 months (aOR 2.92; 95% CI: 1.91 to 4.46) and ever been offered PrEP were more likely to initiate PrEP.
Cowan <i>et al</i> <sup>20</sup>	38.4%	Enrolled/eligible	NR
Franks (2021)	NR	Enrolled/eligible	Decliners were not interested in daily medication and did not believe they needed PrEP*.
Leis <i>et al</i> <sup>22</sup>	60.9%	Current or past user/total	Current PrEP users who experienced emotional violence (aOR 0.23; 95% CI: 0.07 to 0.71) had a decline in PrEP use, while those who experienced physical violence (aOR 3.01; 95% CI: 1.16 to 7.81) increased their PrEP use.
Pillay <i>et al</i> <sup>23</sup>	66.3%	Current or past users/those who have heard of PrEP	Reasons for accepting PrEP included being sexually active (34.5%), perceived risk of HIV (25.7%) and had multiple sex partners (23.9%), whereas for decliners failed side effects (41.9%), stigma (12.9%) and daily adherence (12.9%).
Jana <i>et al</i> <sup>24</sup>	80.4%	Enrolled/eligible	Decliners found daily PrEP inconvenient (14%) and feared side effects (43%), while others gave no reason (14%) or did not identify as FSW (29%).
Sarr <i>et al</i> <sup>25</sup>	82.4%	Enrolled/eligible	Unregistered FSWs (RR 1.16; 95% CI: 1.06 to 1.26) more likely to initiate.
Kagaayi <i>et al</i> <sup>26</sup>	82.8%	Enrolled/eligible	NR
Mboup <i>et al</i> <sup>27</sup>	88.3%	Enrolled/eligible	Decliners did not want to take daily pills (4/34), wanted to think more about PrEP (4/34), do not perceive self as at risk (9/34), were afraid of side effects (9/34) and were going out of town (8/34).
Eakle <i>et al</i> <sup>28</sup>	97.8%	NR	NR
Community-based models			
Guure <i>et al</i> <sup>29</sup>	6.4%	Ever used/those who have heard of PrEP	FSWs who were willing to use PrEP had higher odds of ever taking compared with FSWs not willing to take PrEP (OR 43; CI: 2.93 to 150); FSWs who had screened for STIs had higher odds of taking PrEP than those who had never screened (OR 5.2; CI: 1.68 to 11.36).
Matambanadzo <i>et al</i> <sup>30</sup>	33.7%	Enrolled/eligible	NR
Witte <i>et al</i> <sup>31</sup>	55.2%	Enrolled/eligible, not on PrEP already	FSWs with greater social support (aOR 0.81; 95% CI: 0.05 to 0.66) were less likely to initiate, while those with high family stigma related to sex work (aOR 2.2; 95% CI: 1.15 to 4.22) were more likely to initiate PrEP. Decliners expressed inability to adhere to daily medication (16.4%), concerns about side effects (5%) and fear of stigma associated with HIV-positive status (3.8%).
Reza-Paul <i>et al</i> <sup>32</sup>	99.2%	Enrolled/eligible	NR
*Results not disaggregated for FSWs. aOR, adjusted OR; FSWs, female sex workers; NR, not reported; PrEP, pre-exposure prophylaxis; RR, relative risk; STIs, sexually transmitted infections.			

of facility or community-based delivery models on FSW PrEP uptake, retention and adherence. This review corroborates evidence from earlier studies suggesting that current PrEP delivery methods in SSA may not fully address FSWs' unique challenges, such as high mobility, intimate partner violence and stigma.<sup>10 34–36</sup> These factors have a significant impact on PrEP adherence and retention. A review of PrEP studies found that PrEP uptake, retention and adherence were low in real-world settings, suggesting that oral PrEP adherence involves more than receiving a pill. Therefore, PrEP programmes should address context and population-specific adherence facilitators and barriers for FSWs.<sup>34</sup>

The heterogeneous composition of these models made it difficult to draw direct comparisons between facility-based and community-based PrEP delivery models. Thus,

it was impossible to objectively evaluate which delivery platform best optimises PrEP initiation and continuation for FSWs in this setting. Several variations of infrastructural settings, providers and delivery channels were used for both community and facility-based delivery models in SSA and India, as there are currently no universally accepted guidelines for what should define a facility or community delivery model. Effective HIV prevention packages for FSWs should include combinations of biomedical, behavioural and structural interventions tailored to local contexts.<sup>37 38</sup> In contrast, demonstration projects and clinical trial studies demonstrated high PrEP uptake, retention and adherence.<sup>39–45</sup> The comparatively lower uptake, retention and adherence observed in real-world settings than reported by clinical trials and demonstration projects may be due to inconvenient clinic hours,



extended wait times at clinics, stigmatisation of sex work and discrimination in healthcare settings.<sup>5</sup>

Our systematic review is the first to evaluate PrEP uptake, retention and adherence among FSWs in SSA within community and facility delivery models. The main limitation of this review was the inability to compare facility and community delivery models directly. Some of the included studies focused on key populations in general and had very small sample sizes of FSWs. Furthermore, this review was limited to evaluating oral PrEP uptake, retention and adherence for FSWs who used either community or facility PrEP delivery models. No study in our review compared outcomes across facility versus community models. Finally, the included studies did not address long-term PrEP continuation, HIV drug resistance or sexual behaviours.

The findings of this systematic review suggest that a tailored PrEP delivery model for FSWs could improve PrEP uptake, adherence and retention by addressing FSW-specific barriers. Therefore, further research is necessary to conduct a needs assessment to determine the preferred PrEP delivery model for FSWs. Differentiated delivery models that address the needs of FSWs, such as tailored clinic hours that accommodate their mobility, multimonth drug refills, appointment spacing, peer delivery of PrEP refills and HIV/syphilis self-tests, peer support for adherence and retention in care, and sexual and reproductive health services, may enhance linkage and retention in PrEP care and decrease HIV incidence.<sup>30 46</sup>

Implementing strategies that address gender-based violence and offer mental health support can effectively promote PrEP continuation, alleviate the burden on health systems and enhance FSW participation in PrEP care.<sup>37 38 44 47</sup> The WHO recommends the implementation of the following interventions for sex workers: (a) HIV prevention methods (condoms, PrEP), (b) harm reduction services (needle and syringe programmes, opioid substitution therapy, naloxone administration), (c) behavioural interventions, (d) testing for HIV and other sexually transmitted infections, (e) HIV treatment and care, and (f) prevention and management of tuberculosis, hepatitis and mental health.<sup>9</sup> An effective PrEP delivery model must prioritise addressing barriers to accessing care, such as HIV stigma resulting from the misidentification of PrEP as antiretroviral treatment, lack of awareness about its effectiveness, potential side effects, geographical distance from clinics and ensuring appropriate monitoring for PrEP adherence as well as HIV self-tests.<sup>10 34 35 38</sup> Future studies should focus on determining if providing choice of delivery models increases PrEP uptake and retention for FSWs.

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