

HIV Self-testing in Africa: adoption, barriers, and health outcomes: a systematic review and Meta-Analysis

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ABSTRACT

Background: HIV testing is an essential pathway to HIV prevention and management services. However, HIV testing has remained low in resource-constrained settings in Africa owing to certain barriers such as stigma and confidentiality issues. HIV self-testing (HIVST) is an alternative preventive measure for HIV that can address these constraints. This study examined HIVST adoption/ uptake, health outcomes and barriers among adults in Africa.

Methods: This was a systematic review and meta-analysis that surveyed published literature from January 2018 to August 2024 using five electronic databases (PsycINFO, MEDLINE in PubMed, Web of Science, CINAHL, and EMBASE) and bibliographic search. Studies were included if they were peer-reviewed, published in the English language, and examined HIVST uptake, barriers and health outcomes following HIVST uptake within Africa. The Joanna Briggs Institute Critical Appraisal Checklist was used for critical appraisal of the quantitative articles while the qualitative articles were appraised using the Critical Appraisal Skills Program. Narrative synthesis and effect size computations were used to analyze findings. The review was registered with PROSPERO under registration number 600021.

Results: Twenty-two articles related to HIVST were included in the final synthesis. Of the included articles, 13 measured HIVST adoption/ uptake/ acceptability, 6 reported the outcomes of HIVST, and 18 reported barriers to HIVST. The meta-analysis revealed a pooled HIVST uptake estimate of 67% among adults in Africa. Early diagnosis and linkage to care were the most commonly reported health outcomes following HIVST by adults within Africa. The barriers to HIVST uptake were participants' lack of expertise in interpreting results, cost of the kits, social stigma and discrimination, lack of professional help, not having enough time to test or get a self-test kit, and differing spousal opinions regarding self-testing were significant barriers to the use of HIVST.

Conclusion: Continued health education, promotion, and healthcare provider-assisted services should be encouraged to foster uptake rates within Africa. Also, HIVST should be made available, free of charge particularly in resource-limited settings to ensure cost is not a barrier to access. Nevertheless, caution should still be taken when generalizing these results since high heterogeneity was observed within this analysis

Key-words: Adoption, uptake, HIVST, barriers, health outcomes, Africa

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INTRODUCTION

Human Immunodeficiency Virus (HIV) is a serious public health problem in Africa, particularly affecting the sub-Saharan region. Over 75% of People living with HIV (PLHIV) reside in Africa, and nearly half (45.7%) of newly identified cases of the disease among adults are among Africans (Njau et al., 2019). Efforts to achieve the 95-95-95 global target by 2030 require increased utilization of HIV testing as an entry point to the HIV cascade (Joint United Nations Programme on HIV/AIDS, 2018a). Several African nations have scaled up HIV testing services (HTS), in addition to facilitating the wider availability of antiretroviral therapy (ART) (Joint United Nations Programme on HIV/AIDS, 2018b). According to the Joint United Nations Programme on HIV/AIDS (2018a), over 25% of adults in Africa do not know their HIV status, irrespective of the availability of a broad provision of HTS, making access to ART less successful. HIV Self-Testing (HIVST) is an innovative method that has been presented as a means of accessing hard-to-reach and high-risk populations, particularly youth who are HIV-positive (Njau et al., 2019). HIVST allows potential users to know their serostatus but does not offer a definite diagnosis (World Health Organization, 2016). According to national testing algorithms, those with reactive self-test findings require additional confirmatory HIV testing at a medical facility (Johnson et al., 2017).

HIVST can currently be diagnosed quickly using two different methods: the finger prick test and the oraQuick test (oral test) (World Health Organization). The components of the finger prick self-test prototype include a bag containing a test cassette, a vial of diluent, a disinfection wipe, a compression swab, a lancet, a sampler stick, dressing, and usage instructions from the manufacturer (Peck et al., 2014). Precisely, after waiting for ten minutes, a drop of blood drawn with a sampler stick is inserted into the test cassette, and two drops of diluent are added before the results are read (Tonen-Wolyec et al., 2018). Particularly in the age of "universal test and treatment," complete

coverage of HIV testing is essential for preventing new infections and putting an end to the AIDS epidemic (Nguyen et al., 2021). HIV testing is essential for early diagnosis, for treating and supporting those who have been diagnosed with the virus, and ultimately for preventing new infections and deaths from AIDS. Nevertheless, despite the advantages of HIV testing, a large number of people have never had an HIV test, and some newly diagnosed patients have advanced disease (Ajayi et al., 2021; Staveteig et al., 2017). Undiagnosed people make up 38% of new infections and are more likely to spread the virus to others. Eight out of ten new infections are caused by undiagnosed individuals and those with diagnoses who are not receiving treatment (Barral et al., 2014; Control & Prevention, 2019; Fauci et al., 2019).

Globally, there is significant evidence to support the potential of HIVST to penetrate underserved and hard-to-reach populations, but the levels of acceptance of this innovation vary between developed and less developed nations (Krause et al., 2013; Kurth et al., 2016). While global HIVST research efforts are introducing groundbreaking research towards specific populations such as key populations that reside in hard-to-reach areas, such penetrations are also much desired in sub-Saharan Africa (SSA), where the general population should also be considered in terms of reach. However, there is a dearth of published evidence for the use of HIVST that currently exists in SSA, and the adoption of this innovation may still be far-fetched. On the other hand, in the global context, there is increasing evidence on the facilitators and barriers for HIVST published literature (Johnson et al., 2017; Krause et al., 2013; Pant Pai et al., 2013; Suthar et al., 2013). Key motivators include things like convenience, quick testing and waiting times, privacy, autonomy and a sense of empowerment, using oral fluid rather than blood samples, and feeling in charge of one's health decisions (Johnson et al., 2017; Krause et al., 2013; Pant Pai et al., 2013; Suthar et al., 2013). Preference for oral fluid HIV testing is

influenced by the simple methods for obtaining the sample and the 20-minute wait period for results (Krause et al., 2013; Suthar et al., 2013). The literature contains reports on a variety of HIVST-related difficulties from investigations carried out worldwide. These obstacles include a lack of HIVST regulations, stigma and discrimination, lack of awareness, false beliefs about the calibre of self-test kits, and the notion that self-testing for HIV has negative consequences (Bos & Onya, 2008; Johnson et al., 2017; Mabuto et al., 2019; Njau et al., 2019; Wood et al., 2014).

While these general barriers are frequently mentioned in existing literature, there is a significant gap in detailed, region-specific studies. The unique cultural, socioeconomic, and logistical factors that influence the adoption of HIV self-testing in the African region necessitate this study. Another gap that this research fills is the limited data on the impact of HIV self-testing on health outcomes compared to traditional testing methods. Current pooled literature has not thoroughly examined how HIV self-testing affects key health outcomes, such as linkage to care, reduction in late diagnoses, and overall HIV transmission rates. Additionally, there is a notable gap in research concerning user satisfaction as an outcome, with HIV self-testing kits. Most studies tend to focus on the clinical and epidemiological aspects of HIV self-testing, often overlooking the importance of user perspectives in the African context. Understanding user satisfaction is crucial for improving the design and distribution of HIV self-testing kits within Africa. Therefore, this current study aimed to synthesize the evidence base on the adoption of HIVST using a systematic review and meta-analysis, to profile Africa's acceptability rates of HIVST. The study further mapped out current literature that pointed out the barriers to adoption of HIVST, and the health outcomes among adults in Africa.

METHODS

Research design

Using a predetermined process, this systematic review was carried out in compliance with the

Preferred Reporting Items for Systematic Reviews and the Meta-analyses (PRISMA) statement. PROSPERO was searched systematically without language, geography, publication date or any other restrictions to identify if such studies existed. To find unpublished research and continuing investigations, experts in the subject were contacted, and bibliographies of pertinent studies were examined. The meta-analysis was used to pool HIVST adoption/ uptake estimates among adults living in Africa.

Search strategy

We searched five electronic databases that index literature from a broad range of disciplines including PsycINFO, MEDLINE in PubMed, Web of Science, CINAHL, and EMBASE. Relevant articles in these electronic databases were selected due to their significantly high scientific relevance and evidence base. To find studies that may answer the study questions, we employed a multi-tiered search method. The databases used shortened terms and Medical Subject Headings (MeSH), and operators were built to connect the terms and set limits. Combining terms carefully prevented the review's quality from declining. Search terms included were: "adults", "HIVST", "HIV Self-testing", "adoption", "uptake", "acceptability", "acceptance", "barriers", "challenges", "health outcomes", "Africa", and "sub-Saharan Africa". When applicable, asterisks (*) and Boolean operators like "OR" and "AND" were used as descriptors to increase the search's sensitivity. The Patient/Population; Intervention; Comparison/Control/Comparator; Outcome (PICO) framework was modified to include duration (time frame) and study types while excluding the comparator. Table 1 below outlines the selection criteria for the articles for this review. The following requirements were satisfied by the included articles in this review: (1) the study was carried out in Africa; (2) the research presented results on HIV testing among individuals who were 18 years of age or older; and (3) the research was peer-reviewed and published in English. Articles that were not

published between January 2018 and August 2024, contained research that had not been published, or was written in a language other than English were removed. Articles published before this period were excluded from this review since they were deemed to be "current literature" if they were released within the last

ten years. The publications that were included concentrated on African-living individuals who were thought to be at risk for HIV infection. To find pertinent papers for the current analysis, reference lists of selected studies and reviews were manually searched.

Table 1: Eligibility Criteria

	Inclusion Criteria	Exclusion Criteria
Participants	Adults in Africa at risk of or affected by HIV	Studies focusing solely on populations outside Africa or those without risk of HIV exposure
Intervention	Studies examining HIVST using any approach	Studies that do not specifically address HIVST or focus on unrelated interventions
Outcomes	Studies reporting on Adoption(uptake rates and acceptability of HIVST); barriers to HIVST; and Health outcomes	Studies not reporting on adoption, barriers or health outcomes related to HIVST.
Duration	Studies conducted and published between January 2018 and August 2024	Studies conducted or published outside the specified date range
Study types	Quantitative (e.g. Randomized Control trials, cohort, cross-sectional studies), qualitative (e.g. ethnography, phenomenology) and mixed studies published in the English language	Non-empirical studies such as reviews, editorials
	Full-text peer-reviewed empirical studies employing both quantitative and qualitative approaches.	Narrative reviews, expert opinions, Editorials, Meta-analyses, Integrative reviews, conference proceedings, and letters

Data Extraction

Endnotes X20 software was used to find relevant research, classify them into various electronic databases, de-duplicate them, and

finally include relevant publications after abstracts were found using electronic searches and manual searches of reference lists in scientific databases. The initial paperwork,

database search organization, and online information monitoring were all done using Microsoft Excel. The search results were separately examined by two members of the study team. After removing duplicate articles, the team members initially evaluated the titles and abstracts of every article to determine the relevancy of each one. The articles were classified as either "Does Not Meet Inclusion Criteria" or "Selected for Full-Text Review." After that, information was taken out of the publications that had been chosen for full-text inspection. To determine if the chosen papers satisfied all inclusion requirements, the two research participants provided a summary of the publications based on their methodology and conclusions.

To verify that the included papers were suitable for inclusion in the final sample of included articles, the research members additionally independently examined the included publications in their entirety and provided a summary of their methodology, design, and findings. A third member of the research team resolved any disagreements or misunderstandings over the included articles for which the two research members were unable to agree.

Quality assessment

To reduce the risk of bias and ensure that quality papers were included, critical appraisal of quantitative studies for this review was carried out by two independent reviewers based on the set requirements by the modified Joanna Briggs Institute (JBI) Critical Appraisal Checklist (Appendix 2) (JBI, n.d). The JBI tool consists of nine questions with scores of either 0 or 1 for responses of "No/Unclear" and "Yes" respectively. In essence, the score ranges from 0 to 9. The qualitative articles were assessed using the Critical Appraisal Skills Programme (CASP) tool (Appendix 3) (Critical Appraisal Skills Programme, 2018). There were 10 criteria used in this instrument, providing a total of 10 points. 'Yes' was allocated a score of 1 while 'No' and 'unclear' were allocated a score of 0. Though the instrument has no standard cut-off, any article

that scored seven and above was considered to be of high quality. The review was registered with PROSPERO under registration number 600021.

Data analysis and Synthesis

Effect size computation

Review Manager (RevMan) 5.4.1 software was used to analyze and identify the pooled prevalence estimates of HIVST adoption/uptake in Africa within the last 7 years. For the pooled prevalence, the proportion of uptake (outcome), the sample size, and the Standard Error of the Mean (SEM) in all included studies were extracted or calculated independently and entered manually into RevMan (Research Gate, 2015). In cases where the SEM was to be calculated, we used the following formula: $\sqrt{p \times (1-p)/n}$ where p is the proportion of the sample with the outcome of interest and n is the sample size. The overall findings were documented, along with tests for heterogeneity (I^2 statistic). We employed random-effects models because the investigations were different from one another. The reviewers expected that the random effects framework would likely be used to determine the data synthesis of the prevalence for this study, allowing for the inference of effect sizes to the study's population of adult adopters of HIVST.

Narrative synthesis

A narrative synthesis was used to present the results of the barriers and health outcomes. We chose to employ narrative synthesis as the best tool for pooling the relationships of our variables in this investigation, despite the wide variety of diverse papers that were included in this systematic review. Each item was arranged according to themes, like HIVST uptake barriers and health outcomes in Africa. Every article's findings were matched to the relevant theme; some, however, were included in more than one theme.

Results

The results of the database searches yielded 7,003 articles; following the removal of duplicate articles, 5,802 articles were retained. Articles (n= 5,709) were then excluded for several reasons,

such as not discussing HIVST, not being carried out within SSA, and the ineligible study designs. Ninety-three articles were selected for full-text review. Seventy-one articles were excluded because they did not meet the primary inclusion criteria of including adults ($n = 51$), did not discuss uptake, barriers or health outcomes (n

$= 19$), or were retracted by the publishers ($n = 1$). A total of twenty-two articles were chosen for an extensive evaluation and were used in the synthesis. The recommendations given by the PRISMA were deemed appropriate and adhered to in this review as shown in Figure 1 below (Moher et al., 2010).

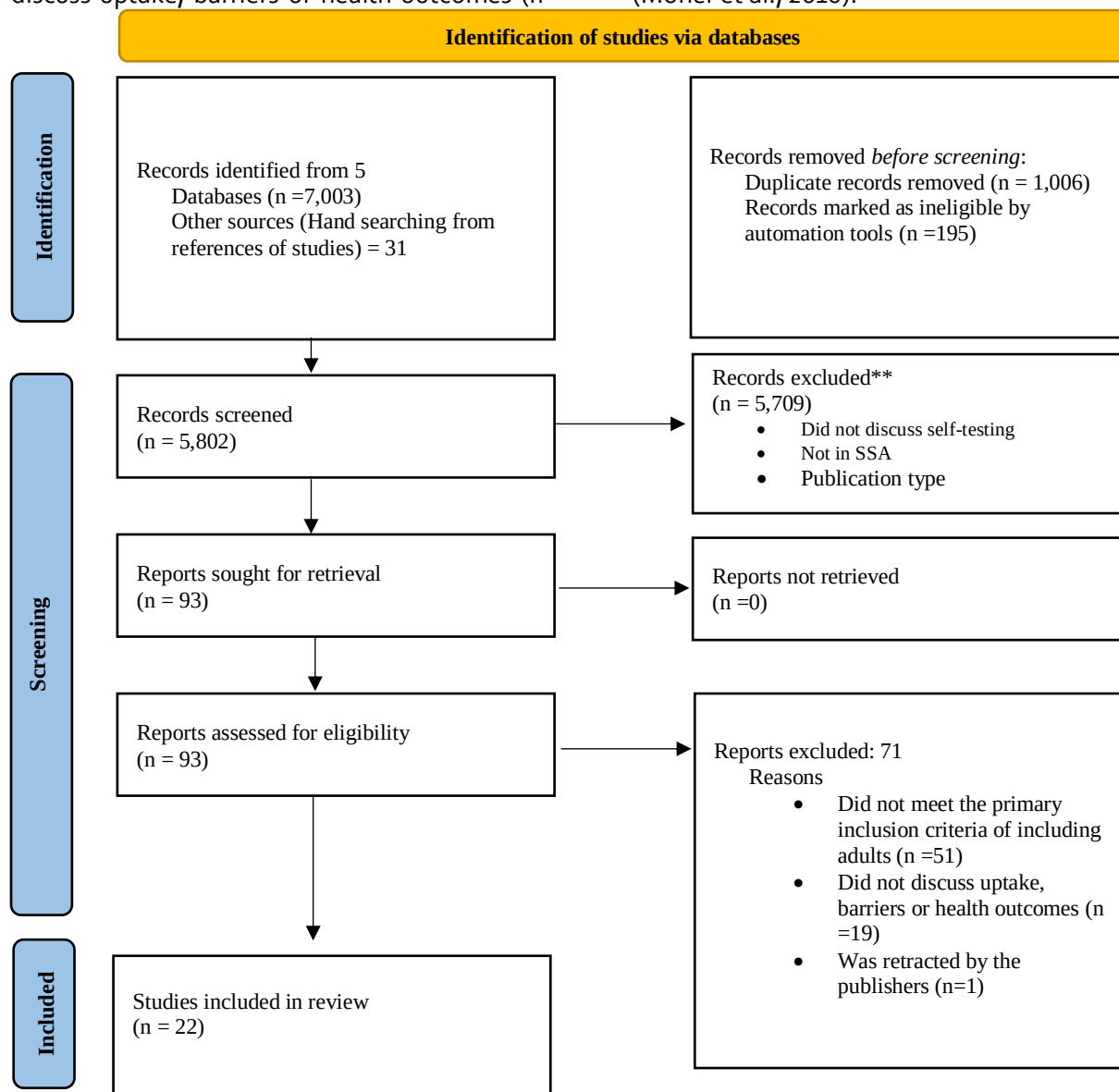


Figure 1: PRISMA flowchart showing the identification, screening, and inclusion of relevant studies for the review

Characteristics of included studies

Eleven sub-Saharan African countries were represented in the included studies (Table 2). The frequencies of the represented countries in

the included articles were as follows: Kenya ($n = 6$), Uganda ($n = 5$), South Africa ($n = 2$), Nigeria ($n = 2$), Zimbabwe ($n = 1$), Malawi ($n = 1$), Rwanda

(n=1), Senegal (n=1), Tanzania (n=1), and Eswatini (n=1). The study approaches of the included articles were either quantitative (n=17) or qualitative (n=5). Of the included articles, 13

measured HIVST adoption/ uptake/ acceptability, 6 reported the outcomes of HIVST, and 18 reported barriers to HIVST.

Table 2: Characteristics of included studies

SN	Reference	Objective	Methods	Sample	Main findings
1.	Aizobu et al. (2023) Nigeria	To identify enablers and barriers to the uptake of HIVST among sexually active youth	Qualitative (Exploratory)	80 youths aged 18 to 25 years	Fear of discrimination, large packing, high cost, lack of confidence due to user error, and fear of status disclosure were the main obstacles.
2.	Chang et al. (2019) Zimbabwe	To assess the demand for HIV self-testing among adults and priority population sub-groups under alternative pricing and distribution strategies	Quantitative (Randomized Clinical trial)	3,996 adult men and women	Self-testing demand was very price sensitive: 55 participants (6.9%) who were offered self-tests for US \$0.50 (odds ratio [OR], 0.14; 95%CI, 0.10-0.19) redeemed their vouchers, a decrease in demand of more than 25 percentage points, compared to 260 participants (32.5%) who were offered free self-tests.
3.	Choko et al. (2018) Uganda	To measure the occurrence of adverse events, and evaluate the potential yield of peer-delivered HIVST	Quantitative (Single-arm pilot trial)	116 adult men	Nineteen Seeds presented 116 men with an HIV test kit; 95 (81.9%) of them accepted the offer.
4.	Christian et al. (2020) Kenya	To explore views about self-testing	Qualitative (In-depth interview)	24 truckers participating in a randomized controlled trial	Perceived hurdles and facilitators were found at several levels, even though the majority of participants stated

					they would utilize an HIV self-test. A common obstacle mentioned by many participants (intrapersonal) was not having enough time to test or get a self-test kit. Participants' opinions regarding self-testing with a partner (interpersonal) differed. Participants recommended policies and programs, stating that they favoured having access to self-test kits in places where training was available.
5.	Dovel et al. (2020) Malawi	To evaluate the cost, acceptability, and effectiveness of facility-based HIV self-testing among Malawian outpatients in comparison to optimal provider-initiated testing and counselling.	Quantitative (Cluster Randomized trial)	5,885 outpatients	With a low risk of unfavourable outcomes, facility-based HIV self-testing improved HIV testing among outpatients in Malawi. When scaling up HIV testing in areas where there is a large unmet need, facility-based HIV self-testing should be taken into consideration.
6.	Drake et al. (2020) Kenya	To evaluate the effectiveness of SMS in capturing at-home clinical outcomes and spot any biases in reporting when compared to in-person interviewing.	Quantitative (Cohort study)	2123 women	486 (23.89%) of the 2123 women who were offered HIVSTs and mSurvey enrollment did accept them.

7.	Dzinamarira et al. (2020) Rwanda	To assess the level of awareness and acceptability of HIVST among male clinic attendees in Kigali, Rwanda.	Quantitative (Cross-sectional)	579 adult men	Just 21% of the 579 men surveyed knew about HIV/ST, and 74% thought it was appropriate. The following variables were shown to be substantially ($p < 0.05$) linked with HIVST awareness utilizing logistic regression analysis: having paid or received money for sex in the previous month, health-seeking behaviour, knowledge of HIVST, attitude toward HIVST, and perception of HIV risk. The following are factors linked to HIVST acceptability: condom use following drug and alcohol use, understanding of HIVST, attitude toward HIVST, and health-seeking behaviour.
8.	Gichangi et al. (2018) Kenya	To evaluate the impact of using oral HIV self-testing on HIV couples testing among ANC clients in Kenya and their male partners	Quantitative (Three-arm randomized controlled trial)	1133 couple pairs	79.1% (334/422) of the women in the self-testing study arm 3 stated that their spouse had tested positive for HIV as a couple, compared to 27% (110/406) and 35.1% (136/387) in study arms 1 and 2, respectively. When using the oral HIV self-test kits, over 90% of male partners said that taking a

					sample and reading the results was simple.
9.	Harichund et al. (2019) South Africa	In addition to examining the variables that drove and impacted their acceptability, this study evaluated whether men or women in KwaZulu-Natal showed a greater acceptance of HIVST.	Qualitative (FGD and In-depth interview)	63 adults (23 attended FGD while 40 completed in-depth interviews)	The majority of participants found HIVST to be acceptable, with women more likely to do so. Men favoured HIVST because it was practical and effective, while women favoured it because it may lead to empowerment and autonomy. Deterrents to HIV testing included a lack of HIV counselling, handling a positive HIV test result, and being connected to care.
10.	Hensen et al. (2020) Zambia	To measure levels of and factors associated with acceptance and use of secondary distribution of HIVST kits	Quantitative (Cross-sectional)	9105 individuals aged 18 years and older	9.1% (n = 825) of the 9105 people who gave their consent to PopART who were 18 years of age or older accepted an HIVST kit for secondary distribution. Of those who reported using the kit, 55.8% said they had. HIVST kits distributed through secondary distribution were more likely to be used by men and accepted by women. Those who were over thirty and had not taken part in a prior PopART round were more likely to use the kits. 6.8% of the samples

					yielded reactive results.
11.	Kelvin et al. (2018) Kenya	To assess the predictors of choosing self-administered oral HIV testing in the clinic with supervision versus the standard provider-administered blood test	Quantitative (Cross-sectional)	149 Kenyan truck drivers	Overall, 56.38% of participants chose the self-test as against 23.49% of those who chose a provider-administered test, and 20.13% of those who refused to test.
12.	Korte et al. (2020) Uganda	To investigate the impact of the HIVST model on male partner testing rates	Quantitative (Cluster Randomized controlled trial)	1514 couple pairs (777 intervention and 737 control)	Male partners who tested positive for HIV were more likely to be in the intervention group (576/746/77.2%) than in the control group (264/709 (37.2%); $P < 0.01$). Of the 34 HIV-positive men in the intervention group, 10 were in the control group, and 6/26 (23%) and 4/6 (67%), respectively, reported linking to care.
13.	Lyons et al. (2019) Senegal	To determine the use and acceptability of HIVST among first-time testers at risk for HIV in Senegal	Experimental design	1,959 participants	Most participants (74.5%) were comfortable using HIVST, 86.1% considered the instructions straightforward to follow, and 94.4% believed their family and friends would use it.
14.	Muwanguzi et al. (2022) Uganda	To explore the motivators for and barriers to linkage to HIV care and	Qualitative (Cross-sectional)	12 men aged 18 to 60 years	Obstacles to receiving HIV care were (i) rigid work schedules and (ii) long travel times

		treatment among men who returned positive results following HIVST			to obtain ART. (iii) the COVID-19 pandemic's disruptive effects, (iv) required job moves, (v) Denying HIV-positive outcomes and (vi) being afraid of social stigma
15.	Napierala et al. (2020) Kenya	To examine male partner and couples testing outcomes and sexual decision-making associated with HIVST	Quantitative (Cluster randomized trial)	921 adults 18 years and above	To their sexual partners, participants gave a median of three self-tests. 94% of those who had a primary partner also provided them with a self-test. 97% of them agreed to take the test. Ninety-one per cent of participants reported having couples testing when it was approved. Sixty-four per cent of the 1954 transactional sex encounters had an offer to self-test. 93% of partners took the given self-tests, and 84% of those who accepted also completed couples testing. When men had a reactive result (56.3% vs. 89.7%, $p < 0.01$), were not offered a self-test (56.3% vs. 62.0%, $p = 0.02$), or declined to self-test (56.3% vs. 78.3, $p < 0.01$), condom use was higher than for partners with an HIV-negative result.
16.	Nnko et al. (2020) Tanzania	To explore the acceptability of FSWs towards the	Qualitative (Participatory group	227 Female sex workers	The study showed that FSWs have a positive attitude

		introduction of HIVST in Tanzania	discussions and in-depth interviews)		toward HIV testing. There were issues raised by participants regarding their capacity to understand and rely on the test results. Participants also voiced fear that HIV testing could result in negative personal effects, such as extreme distress and self-harm for those who test positive for the virus. It's quite likely that study participants' worries regarding HIVST side effects stemmed from their general impression that the test would only be available without assistance.
17.	Okoboi et al. (2020) Uganda	To evaluate the yield of peer-distributed HIVST kits compared with standard-of-care testing approaches in identifying undiagnosed HIV infection	Experimental study	297 adults	Three-quarters of the 143 MSM who completed HIVST (95%) had never tested for the virus. Twelve individuals in all received a new HIV infection diagnosis: eight were in the peer HIVST group and four were in the SOC group [5.6% vs 2.7%, respectively; $P = 0.02$]. Participants who had recently acquired an HIV diagnosis had confirmatory testing and started antiretroviral medication.
18.	Ortblad et	To evaluate HIV self-	Quantitative	104 adult	Misinterpretation of

	al. (2018) Uganda	testing performance and results interpretation among FSWs	(Cross-sectional)	participants	HIVST results was a common barrier to accurate results and further testing.
19.	Pasipamire et al. (2020) Eswatini	To describe the strategies used during the phase-in of HIVST under routine conditions	Quantitative (Cross-sectional)	1895 adult participants	Of the 938 individuals with known HIVST findings, 34 (3.9%) had reactive results. It was known that twenty-one (62%) individuals had undergone confirmatory blood-based HTS; of these, twenty (95%) had concordant reactive findings, and nineteen (95%) had been connected to HIV treatment at a clinic.
20.	Shapiro et al. (2020) South Africa	To implement a men-focused HIVST distribution programme to evaluate components contributing to participation and retention	Quantitative	4496 adult men	Of the participants, 42% selected oral-swab kits and 58% selected blood-based HIV testing. For 11% of men, this was their first time testing. 314 (8%) of the 3902 (83%) testers who submitted their test results to the research team tested positive for HIV. Of 274 males whose HIVST findings were reactive, 68% had an ART linkage.
21.	Tun et al. (2018) Nigeria	To distribute oral HIVST kits to men who have sex with men through key opinion leaders	Cohort study	257 participants	14 (5.6%) of the 257 individuals who finished the three-month follow-up interview self-reported having an HIV-positive result, and 97.7% of them reported using the HIVST kit. Within a week after receiving

					the kit, 49.4% of the participants tested, whereas a quarter (22.7%) tested on the same day. By the end of the three-month survey, all 14 of the individuals who tested positive had sought follow-up testing and started HIV treatment.
22.	Wanga et al. (2020) Kenya	To evaluate optional facility-based HIVST	Experimental study	172 Young women using Pre-exposure prophylaxis	HIVST was accepted at 34.7% (70/202) of visits

The pooled adoption/ uptake estimates of HIVST in Africa

Thirteen of the included articles reporting the adoption/ uptake of HIVST were included in the meta-analysis. From the forest plot in Figure 2 below, the pooled adoption proportion of HIVST is 0.67 (95% CI: 0.53, 0.82; $I^2 = 100\%$; $p < 0.00001$). By implication, the current uptake rate of HIVST in Africa amounts to 67%. We found a high degree of heterogeneity in this meta-analysis,

with an I^2 score of 100%. This suggests that there is a significant amount of diversity among the included research, more than one could anticipate from pure chance. We did not conduct sub-group or sensitivity analyses because it can be inferred that the effect sizes, methodology, or populations used in the studies vary considerably, hence a limitation of this study.

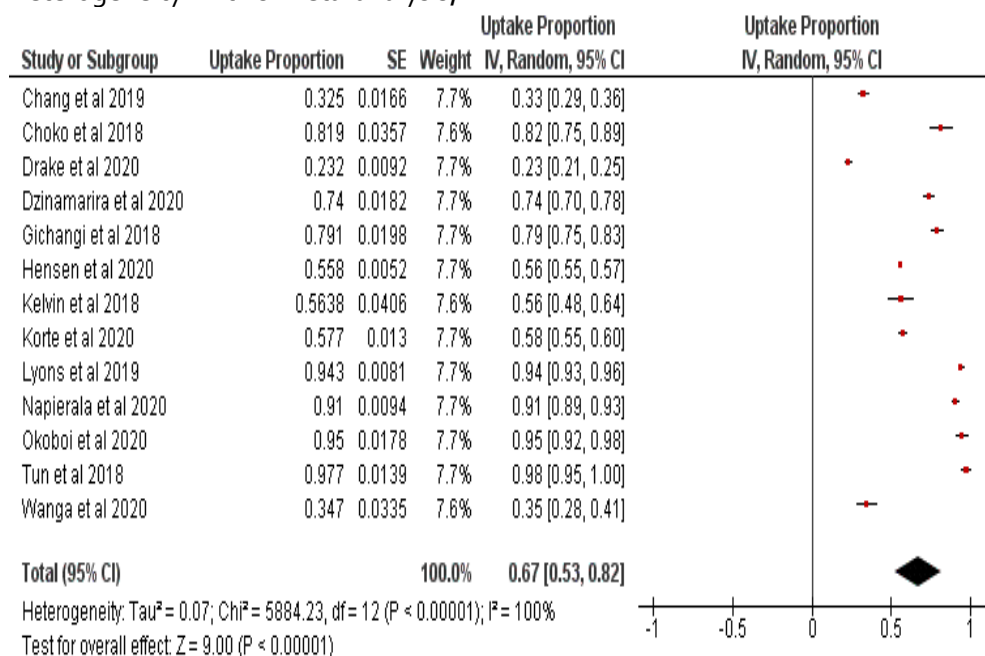


Figure 2: Random effect model forest plot of the overall HIVST adoption/ uptake estimates in Africa

Health outcomes of HIVST in Africa

Six of the included studies reported some health outcomes after HIVST uptake. There were two prominent themes namely: early diagnosis of HIV and linkage to care. In Uganda, linkage to antiretroviral therapy care and support was widely reported by Korte et al. (2020), who found that 34 HIV-positive men in the intervention versus 10 in the control group were linked to standard HIV care and support. Okoboi et al. (2020) also reported that the HIVST among MSM in Uganda led to early diagnoses and prompt linkage to care and support, as all (100%) participants of the study newly diagnosed with HIV received confirmatory HIV tests and ART initiated. Participants who tested positive for HIV were also linked to care in Eswatini (Pasipamire et al., 2020) likewise those in Nigeria (Tun et al., 2018), South Africa (Shapiro et al., 2020), and Malawi (Dovel et al., 2020).

HIVST Barriers in Africa

Participants in most of our included studies reported perceived barriers such as inability to correctly interpret results stemming from lack of awareness (Choko et al., 2018; Dzinamarira et al., 2020; Nnko et al., 2020; Ortblad et al., 2018); and absence of professional support/ counselling and delayed linkage to care (Harichund et al., 2019; Kelvin et al., 2018; Korte et al., 2020; Muwanguzi et al., 2022; Tun et al., 2018). Findings revealed that social stigma, not having enough time to test or get a self-test kit, and differing spousal opinions regarding self-testing were significant barriers to the use of HIVST (Aizobu et al., 2023; Christian et al., 2020; Gichangi et al., 2018; Muwanguzi et al., 2022). Chang et al. (2019), Christian et al. (2020) and Aizobu et al. (2023) reported that the demand for HIVST is significantly price-sensitive in low-income settings; by implication, high prices of these kits may also deter uptake. Also a summary table is presented in Table 3.

Table 3: Barriers by study

Barrier Category	Specific Barrier	Studies Reporting
Knowledge/Awareness	Inability to correctly interpret results due to lack of awareness	Choko et al. (2018); Dzinamarira et al. (2020); Nnko et al. (2020); Ortblad et al. (2018)
Health System Factors	Absence of professional support/counselling and delayed linkage to care	Harichund et al. (2019); Kelvin et al. (2018); Korte et al. (2020); Muwanguzi et al. (2022); Tun et al. (2018)
Social Factors	Social stigma	Aizobu et al. (2023); Christian et al. (2020); Gichangi et al. (2018); Muwanguzi et al. (2022)
Accessibility Constraints	Lack of time to test or obtain self-test kits	Aizobu et al. (2023); Christian et al. (2020); Gichangi et al. (2018); Muwanguzi et al. (2022)
Interpersonal Factors	Differing spousal opinions regarding self-testing	Aizobu et al. (2023); Christian et al. (2020); Gichangi et al. (2018); Muwanguzi et al. (2022)
Economic Factors	Price sensitivity/high cost of HIV self-test kits	Chang et al. (2019); Christian et al. (2020); Aizobu et al. (2023)

DISCUSSION

We completed a systematic review and meta-

analysis to assess the adoption/ uptake of

HIVST, the health outcomes following uptake, and barriers to its uptake in Africa. Though significant attention has been paid to HIVST in the current dispensation, there are deterrents to uptake in most low-income settings in Africa. The estimate of HIVST adoption obtained from this meta-analysis, which was identified as 67%, shows a similar improvement in uptake that has been found through a global study (Eshun-Wilson et al., 2021). The higher rates of adoption reported in Africa could be attributed to combined efforts made by both governments and non-governmental organizations towards promoting self-testing for HIV as part of the broader strategies aimed at prevention and treatment, like those outlined in the UNAIDS' '95-95-95' target. Nevertheless, caution should still be taken when generalizing these results since high heterogeneity was observed within this analysis. Diverging levels of acceptance may demonstrate differences in terms of cultural attitudes or accessibilities regarding socioeconomic status and health infrastructure systems. For instance, Hamilton et al. (2021) suggest that the varying prevalence is a result of the distribution techniques employed. Higher approval ratings were received using the door-to-door distribution approach compared to facility-based methods used.

The barriers to HIVST that were identified in this review, such as difficulties in result interpretation, lack of professional assistance and social stigma are consistent with those found by previous studies conducted across Africa and beyond. The difficulty faced by users when interpreting their test results accurately will often lead them to express doubts about the accuracy of their tests or will leave them pondering on the next steps that should be taken following a positive outcome. For example, Cambiano et al. (2019) emphasized how individuals who administered themselves HIVST had trouble deciphering accurate results causing confusion and anxiety over one's status within SSA. This report echoes findings from our research wherein several sources (Choko et al., 2018; Dzinamarira et al., 2020) highlighted an

urgent need for instructional materials/support systems supporting users through navigating these hurdles throughout the self-testing process.

The review identified the absence of pre-and post-test counseling as a crucial obstacle to the uptake of HIVST. Counseling is an integral part of traditional testing, helping individuals prepare for results, offering emotional support, and guiding them on their next steps. Without this guidance, anxiety can build up among those who test positive through HIVST; they may delay confirmatory testing or treatment. Studies from South Africa and Kenya indicated that professional assistance remained highly desired even when using self-testing kits (Harichund et al., 2019; Kelvin et al., 2018). Aside from creating more fear over one's condition, stigmatization associated with being diagnosed with HIV exacerbates concerns about receiving feedback without enough psychological preparation. A study by Mahlalela et al. (2024) found that stigma was a significant factor in the low uptake of HIVST, as individuals feared being judged by their community. This underscores the need for community-level interventions that normalize HIV testing and reduce the stigma associated with it.

In low-income settings, the cost of HIV self-testing (HIVST) kits is a major barrier to uptake. This particularly affects individuals living in rural areas or with limited disposable incomes in Africa. Numerous studies have demonstrated that kit pricing significantly impacts adoption rates, consistent with findings from other resource-limited regions. For example, the Muchedzi et al. (2021) study conducted in Zimbabwe revealed high price sensitivity for demand toward HIVST; free or subsidized distribution resulted in significant increases in use among populations. Also, two studies in low-resource settings in India found that cost was a deterrent to HIVST uptake especially among key populations (Balakrishnan et al., 2023; Woodford et al., 2016). The health outcomes associated with HIVST, particularly early diagnosis and linkage to care,



were crucial indicators of the success of HIV self-testing initiatives in Africa. This review found that linkage to care was generally high among individuals who tested positive through HIVST, with several studies (Korte et al., 2020; Okoboi et al., 2020) reporting that nearly all individuals diagnosed with HIV through self-testing were linked to confirmatory testing and ART initiation. This is consistent with the findings of an SSA study by Hlongwa et al. (2023), which reported that HIVST significantly improved early diagnosis rates and facilitated faster linkage to care, particularly in settings with robust healthcare infrastructure and follow-up systems. This finding also corroborates the report of Chen et al. (2024) who indicated that the innovative approaches of the HIVST are key to retaining HIV-positive clients to care. However, some studies present a more nuanced picture of the challenges associated with linkage to care following HIVST. A study by Nnko et al. (2020) found that while HIVST increased the likelihood of early diagnosis, a significant proportion of individuals who tested positive did not follow up with confirmatory testing or ART initiation. This finding aligns with the concern that without proper integration into health systems, HIVST may not fully achieve its potential to improve long-term health outcomes. However, several studies have demonstrated that community-based follow-up and peer support can significantly enhance linkage to care, suggesting that pairing HIVST with strong support mechanisms is essential for maximizing its benefits (Abubakari et al., 2021; Chipungu et al., 2017; Neuman et al., 2021). While early diagnosis and linkage to care are critical, less is known about the impact of HIVST on long-term health outcomes, such as viral suppression and retention in care. This is a limitation of both this review and the wider literature, as few studies have tracked individuals who used HIVST beyond the initial stages of care. This highlights the need for further research on how HIVST fits into the broader HIV care cascade and whether it can improve not only early diagnosis and linkage to

care but also long-term health outcomes.

Strengths and limitations

The study provides a critical review of the uptake of HIVST, its health outcomes and the barriers to uptake among adults in resource-limited settings in Africa. The study provided a mix of quantitative and qualitative evidence to further analyze these key points and provide valuable lessons that can be learned to indicate areas of improvement. Utilizing a blend of approaches strengthens the generalizability of findings across various settings within Africa and widens the applicability of the results to a wide range of settings. However, the study is not without limitations. In the meta-analysis, there was a high level of heterogeneity indicating that the variability among the included studies was substantial. The pooled effect size derived from these studies may not be representative of a single underlying effect, hence these findings should be interpreted with caution. Future research should aim to provide more precise estimates and enhance the understanding of the effect being studied. Also, the included studies are disproportionately concentrated in East Africa, particularly in Kenya and Uganda, which together account for approximately half of the total studies reviewed. Specifically, the overrepresentation of evidence from these settings may reflect contextual, health system, socio-cultural, and economic characteristics that are not fully representative of other regions such as West, Central, and parts of Southern Africa. Consequently, the findings of this review should be interpreted with caution when extrapolating to countries with differing healthcare infrastructures, levels of HIV awareness, policy environments, and socio-cultural dynamics influencing HIV self-testing uptake. Despite the inclusion of 13 studies in the meta-analysis, an assessment of publication bias, although feasible was not conducted. This omission is acknowledged as a limitation, as it may affect the robustness and interpretability of the findings.

Conclusion

There is a reasonable uptake level of HIVST



among adults in Africa. Also, early diagnosis and linkage to care were the most commonly reported health outcomes following HIVST by adults within Africa. The barriers to HIVST uptake were participants' lack of expertise in interpreting results, cost of the kits, social stigma and discrimination, lack of professional help, not having enough time to test or get a self-test kit, and differing spousal opinions regarding self-testing were significant barriers to the use of HIVST. Continued health

education, promotion, and healthcare provider-assisted services should be encouraged to foster uptake rates within Africa. Also, HIVST should be made available, free of charge particularly in resource-limited settings to ensure cost is not a barrier to access. Government and other key actors should explore innovative distribution models such as mobile testing units and community pharmacies as well as online platforms to improve access, especially in hard-to-reach areas.

REFERENCES

1. Abubakari, G. M., Turner, D., Ni, Z., Conserve, D. F., Dada, D., Otchere, A., Amanfoh, Y., Boakye, F., Torpey, K., & Nelson, L. E. (2021). Community-Based Interventions as Opportunities to Increase HIV Self-Testing and Linkage to Care Among Men Who Have Sex With Men - Lessons From Ghana, West Africa. *Front Public Health*, 9, 660256. <https://doi.org/10.3389/fpubh.2021.660256>
2. Aizobu, D., Wada, Y. H., Anyanti, J., Omoregie, G., Adesina, B., Malaba, S., Kabeer, M., Oyegunle, S., Ikpeazu, A., & Idogho, O. (2023). Enablers and barriers to effective HIV self-testing in the private sector among sexually active youths in Nigeria: A qualitative study using journey map methodology. *PLoS One*, 18(4), e0285003. <https://doi.org/10.1371/journal.pone.0285003>
3. Ajayi, A., Awopegba, O., Owolabi, E., & Ajala, A. (2021). Coverage of HIV testing among pregnant women in Nigeria: progress, challenges and opportunities. *Journal of Public Health*, 43(1), e77-e84.
4. Balakrishnan, P., Smiline Girija, A., Shanmugam, S., Kannan, I., Vignesh, R., Shankar, E. M., & Sucharitha, S. T. (2023). The implementation of HIV self-testing in resource-limited settings where the HIV disease burden is high. *International Journal of Public Health*, 68, 1605790.
5. Barral, M. F., Oliveira, G. R. d., Lobato, R. C., Mendoza-Sassi, R. A., Martínez, A. M., & Gonçalves, C. V. (2014). Risk factors of HIV-1 vertical transmission (VT) and the influence of antiretroviral therapy (ART) in pregnancy outcome. *Revista do Instituto de Medicina Tropical de São Paulo*, 56(2), 133-138.
6. Bos, A. E. R., & Onya, H. (2008). Fear of stigmatization as barrier to voluntary HIV counselling and testing in South Africa. *East Afr J Public Health*, 5(2), 49.
7. Cambiano, V., Johnson, C. C., Hatzold, K., Terris-Prestholt, F., Maheswaran, H., Thirumurthy, H., Figueroa, C., Cowan, F. M., Sibanda, E. L., Ncube, G., Revill, P., Baggaley, R. C., Corbett, E. L., & Phillips, A. (2019). The impact and cost-effectiveness of community-based HIV self-testing in sub-Saharan Africa: a health economic and modelling analysis. *J Int AIDS Soc*, 22 Suppl 1(Suppl 1), e25243. <https://doi.org/10.1002/jia2.25243>
8. Chang, W., Matambanadzo, P., Takaruzza, A., Hatzold, K., Cowan, F. M., Sibanda, E., & Thirumurthy, H. (2019). Effect of prices, distribution strategies, and marketing on demand for HIV self-testing in Zimbabwe: a randomized clinical trial. *JAMA network open*, 2(8), e199818-e199818.
9. Chen, S., Fang, Y., Chan, P. S.-f., Kawuki, J., Mo, P., & Wang, Z. (2024). Counseling Supporting HIV Self-Testing and Linkage to Care Among Men Who Have Sex With Men: Systematic Review and Meta-Analysis. *JMIR Public Health Surveill*, 10, e45647. <https://doi.org/10.2196/45647>
10. Chipungu, J., Bosomprah, S., Zanolini, A., Thimurthy, H., Chilengi, R., Sharma, A., & Holmes, C. B. (2017). Understanding linkage to care with HIV self-test approach in Lusaka, Zambia - A mixed method approach. *PLoS One*, 12(11), e0187998. <https://doi.org/10.1371/journal.pone.0187998>
11. Choko, A. T., Nanfuka, M., Birungi, J., Taasi, G., Kitembo, P., & HELLERINGER, S. (2018). A pilot trial of the peer-based distribution of HIV self-test kits among fishermen in Bulisa, Uganda. *PLoS One*, 13(11), e0208191.
12. Christian, S. N., Mantell, J. E., Romo, M. L., Grov, C., George, G., Mwai, E., Nyaga, E., Odhiambo, J. O., Govender, K., & Kelvin, E. A. (2020). Applying a social-ecological lens to opinions about HIV self-testing among Kenyan truckers who declined to test: a qualitative study. *African Journal of AIDS Research*, 19(2), 147-155.
13. Control, C. f. D., & Prevention. (2019). Gaps in HIV testing and treatment hinder efforts to stop new infections. In: Critical Appraisal Skills Programme. (2018). *Qualitative Checklist*. <https://casp-uk.net/casp-tools-checklists/>
14. Dovel, K., Shaba, F., Offorjebe, O. A., Balakasi, K., Nyirenda, M., Phiri, K., Gupta, S. K., Wong, V., Tseng, C.-H., & Nichols, B. E. (2020). Effect of facility-based HIV self-testing on uptake of testing among outpatients in Malawi: a cluster-randomised trial. *The Lancet Global Health*, 8(2), e276-e287.
15. Drake, A. L., Begnel, E., Pintye, J., Kinuthia, J., Wagner, A. D., Rothschild, C. W., Otieno, F., Kemunto, V., Baeten, J. M., & John-Stewart, G. (2020). The utility of SMS to report male partner HIV self-testing outcomes among women seeking reproductive health services in Kenya: Cohort study. *JMIR mHealth and uHealth*, 8(3), e15281.
16. Dzinamarira, T., Muvunyi, C. M., Kamanzi, C., & Mashamba-Thompson, T. P. (2020). HIV self-testing in Rwanda: awareness and acceptability among male clinic attendees in Kigali, Rwanda: A cross-sectional survey. *Heliyon*, 6(3).
17. Eshun-Wilson, I., Jamil, M. S., Witzel, T. C., Glidded, D. V., Johnson, C., Le Trouneau, N., Ford, N., McGee, K., Kemp, C., Baral, S., Schwartz, S., & Geng, E. H. (2021). A Systematic

- Review and Network Meta-analyses to Assess the Effectiveness of Human Immunodeficiency Virus (HIV) Self-testing Distribution Strategies. *Clin Infect Dis*, 73(4), e1018-e1028. <https://doi.org/10.1093/cid/ciabo29>
17. Fauci, A. S., Redfield, R. R., Sigounas, G., Weahkee, M. D., & Giroir, B. P. (2019). Ending the HIV epidemic: a plan for the United States. *Jama*, 321(9), 844-845.
 18. Gichangi, A., Wambua, J., Mutwiwa, S., Njogu, R., Bazant, E., Wamicwe, J., Wafula, R., Vrana, C. J., Stevens, D. R., & Mudany, M. (2018). Impact of HIV self-test distribution to male partners of ANC clients: results of a randomized controlled trial in Kenya. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 79(4), 467-473.
 19. Hamilton, A., Thompson, N., Choko, A. T., Hlongwa, M., Jolly, P., Korte, J. E., & Conserve, D. F. (2021). HIV self-testing uptake and intervention strategies among men in sub-Saharan Africa: a systematic review. *Frontiers in Public Health*, 9, 594298.
 20. Harichund, C., Moshabela, M., Kunene, P., & Abdool Karim, Q. (2019). Acceptability of HIV self-testing among men and women in KwaZulu-Natal, South Africa. *AIDS care*, 31(2), 186-192.
 21. Hensen, B., Schaap, A. J., Mulubwa, C., Floyd, S., Shanaube, K., Phiri, M. M., Bond, V., Bwalya, C., Simwinga, M., & Fidler, S. (2020). Who accepts and who uses community-based secondary distribution HIV self-testing (HIVST) kits? Findings from the intervention arm of a cluster-randomized trial of HIVST distribution nested in four HPTN 071 (PopART) communities in Zambia. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 84(4), 355-364.
 22. Hlongwa, M., Moyo, E., & Dzinamarira, T. (2023). Approaches for improving linkage to HIV care among HIV self-testing individuals in sub-Saharan Africa. *BMJ Global Health*, 8(7), e012664.
 23. JBI. (n.d). *Critical Appraisal Tools*. Retrieved November 20th, from <https://jbi.global/critical-appraisal-tools>
 24. Johnson, C. C., Kennedy, C., Fonner, V., Siegfried, N., Figueroa, C., Dalal, S., Sands, A., & Baggaley, R. (2017). Examining the effects of HIV self-testing compared to standard HIV testing services: a systematic review and meta-analysis. *African Journal of Reproduction and Gynaecological Endoscopy*, 20(1).
 25. Joint United Nations Programme on HIV/AIDS. (2018a). Miles to go: closing gaps, breaking barriers, righting injustices. *Geneva: UNAIDS*, 4.
 26. Joint United Nations Programme on HIV/AIDS. (2018b). UNAIDS data 2018.
 27. Kelvin, E. A., George, G., Mwai, E., Nyaga, E. N., Mantell, J. E., Romo, M. L., Odhiambo, J. O., & Govender, K. (2018). Offering self-administered oral HIV testing as a choice to truck drivers in Kenya: predictors of uptake and need for guidance while self-testing. *AIDS and Behavior*, 22, 580-592.
 28. Korte, J. E., Kisa, R., Vrana-Diaz, C. J., Malek, A. M., Buregyeya, E., Matovu, J. K., Kagaayi, J., Musoke, W., Chemusto, H., & Mukama, S. C. (2020). HIV oral self-testing for male partners of women attending antenatal care in central Uganda: uptake of testing and linkage to care in a randomized trial. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 84(3), 271-279.
 29. Krause, J., Subklew-Sehume, F., Kenyon, C., & Colebunders, R. (2013). Acceptability of HIV self-testing: a systematic literature review. *BMC Public Health*, 13, 735. <https://doi.org/10.1186/1471-2458-13-735>
 30. Kurth, A. E., Cleland, C. M., Chhun, N., Sidle, J. E., Were, E., Naanyu, V., Emonyi, W., Macharia, S. M., Sang, E., & Siika, A. M. (2016). Accuracy and acceptability of oral fluid HIV self-testing in a general adult population in Kenya. *AIDS and Behavior*, 20, 870-879.
 31. Lyons, C. E., Coly, K., Bowring, A. L., Liestman, B., Diouf, D., Wong, V. J., Turpin, G., Castor, D., Dieng, P., & Olawore, O. (2019). Use and acceptability of HIV self-testing among first-time testers at risk for HIV in Senegal. *AIDS and Behavior*, 23, 130-141.
 32. Mabuto, T., Hansoti, B., Kerrigan, D., Mshweshwe-Pakela, N., Kubeka, G., Charalambous, S., & Hoffmann, C. (2019). HIV testing services in healthcare facilities in South Africa: a missed opportunity. *African Journal of Reproduction and Gynaecological Endoscopy*, 22(10).
 33. Mahlalela, N. B., Manne-Goehler, J., Ohene-Kwofie, D., B. Adams, L., Montana, L., Kahn, K., Rohr, J. K., Bärnighausen, T., & Gómez-Olivé, F. X. (2024). The Association Between HIV-Related Stigma and the Uptake of HIV Testing and ART Among Older Adults in Rural South Africa: Findings from the HAALSI Cohort Study. *AIDS and Behavior*, 28(3), 1104-1121. <https://doi.org/10.1007/s10461-023-04222-w>
 34. Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2010). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *International journal of surgery*, 8(5), 336-341.
 35. Muchedzi, A., Mpofu, M., Mudzengerere, F. H., Bateganya, M., Mavimba, T., Satti, H., Dhlwayo, R., Zulu, T., Tapera, T., Samushonga, T., Nyagura, T., Ncube, G., & Tafuma, T. A. (2021). High HIV Positivity Rates Following Large-Scale HIV Self-Testing Implementation in Zimbabwe, 2018-2020. *Front Public Health*, 9, 606376. <https://doi.org/10.3389/fpubh.2021.606376>

36. Muwanguzi, P. A., Nelson, L. E., Ngabirano, T. D., Kiwanuka, N., Osingada, C. P., & Sewankambo, N. K. (2022). Linkage to care and treatment among men with reactive HIV self-tests after workplace-based testing in Uganda: a qualitative study. *Frontiers in Public Health*, 10, 650719.
37. Napierala, S., Bair, E. F., Marcus, N., Ochwal, P., Maman, S., Agot, K., & Thirumurthy, H. (2020). Male partner testing and sexual behaviour following provision of multiple HIV self-tests to Kenyan women at higher risk of HIV infection in a cluster randomized trial. *Journal of the International AIDS Society*, 23, e25515.
38. Neuman, M., Fielding, K. L., Ayles, H., Cowan, F. M., Hensen, B., Indravudh, P. P., Johnson, C., Sibanda, E. L., Hatzold, K., & Corbett, E. L. (2021). ART initiations following community-based distribution of HIV self-tests: meta-analysis and meta-regression of STAR Initiative data. *BMJ Glob Health*, 6(Suppl 4). <https://doi.org/10.1136/bmjgh-2021-004986>
39. Nguyen, P. T., Gilmour, S., Le, P. M., Onishi, K., Kato, K., & Nguyen, H. V. (2021). Progress toward HIV elimination goals: trends in and projections of annual HIV testing and condom use in Africa. *Aids*, 35(8), 1253-1262.
40. Njau, B., Covin, C., Lisasi, E., Damian, D., Mushi, D., Boule, A., & Mathews, C. (2019). A systematic review of qualitative evidence on factors enabling and deterring uptake of HIV self-testing in Africa. *BMC Public Health*, 19, 1-16.
41. Nnko, S., Nyato, D., Kuringe, E., Casalini, C., Shao, A., Komba, A., Changalucha, J., & Wambura, M. (2020). Female sex workers perspectives and concerns regarding HIV self-testing: an exploratory study in Tanzania. *BMC Public Health*, 20, 1-9.
42. Okoboi, S., Lazarus, O., Castelnuovo, B., Nanfuka, M., Kambugu, A., Mujugira, A., & King, R. (2020). Peer distribution of HIV self-test kits to men who have sex with men to identify undiagnosed HIV infection in Uganda: a pilot study. *PLoS One*, 15(1), e0227741.
43. Ortblad, K. F., Musoke, D. K., Ngabirano, T., Nakitende, A., Taasi, G., Barresi, L. G., Bärnighausen, T., & Oldenburg, C. E. (2018). HIV self-test performance among female sex workers in Kampala, Uganda: a cross-sectional study. *BMJ Open*, 8(11), e022652.
44. Pant Pai, N., Sharma, J., Shivkumar, S., Pillay, S., Vadnais, C., Joseph, L., Dheda, K., & Peeling, R. W. (2013). Supervised and unsupervised self-testing for HIV in high-and low-risk populations: a systematic review. *PLOS Medicine*, 10(4), e1001414.
45. Pasipamire, L., Nesbitt, R. C., Dube, L., Mabena, E., Nzima, M., Dlamini, M., Rugongo, N., Maphalala, N., Obulutsa, T. A., & Ciglenecki, I. (2020). Implementation of community and facility-based HIV self-testing under routine conditions in southern Eswatini. *Tropical Medicine & International Health*, 25(6), 723-731.
46. Peck, R. B., Lim, J. M., van Rooyen, H., Mukoma, W., Chepuka, L., Bansil, P., Knight, L. C., Muturi, N., Chirwa, E., & Lee, A. M. (2014). What should the ideal HIV self-test look like? A usability study of test prototypes in unsupervised HIV self-testing in Kenya, Malawi, and South Africa. *AIDS and Behavior*, 18, 422-432. Research Gate. (2015). *How to calculate pooled prevalence using RevMan*. <https://www.researchgate.net/post/How-to-calculate-pooled-prevalence-using-RevMan>
47. Shapiro, A. E., van Heerden, A., Krows, M., Sausi, K., Sithole, N., Schaafsma, T. T., Koole, O., van Rooyen, H., Celum, C. L., & Barnabas, R. V. (2020). An implementation study of oral and blood-based HIV self-testing and linkage to care among men in rural and peri-urban KwaZulu-Natal, South Africa. *Journal of the International AIDS Society*, 23, e25514.
48. Staveteig, S., Croft, T. N., Kampa, K. T., & Head, S. K. (2017). Reaching the 'first 90': Gaps in coverage of HIV testing among people living with HIV in 16 African countries. *PLoS One*, 12(10), e0186316.
49. Suthar, A. B., Ford, N., Bachanas, P. J., Wong, V. J., Rajan, J. S., Saltzman, A. K., Ajose, O., Fakoya, A. O., Granich, R. M., & Negussie, E. K. (2013). Towards universal voluntary HIV testing and counselling: a systematic review and meta-analysis of community-based approaches. *PLOS Medicine*, 10(8), e1001496.
50. Tonen-Wolyec, S., Batina-Agasa, S., Muwonga, J., Fwamba N'kulu, F., Mboumba Bouassa, R.-S., & Bélec, L. (2018). Evaluation of the practicability and virological performance of finger-stick whole-blood HIV self-testing in French-speaking sub-Saharan Africa. *PLoS One*, 13(1), e0189475.
51. Tun, W., Vu, L., Dirisu, O., Sekoni, A., Shoyemi, E., Njab, J., Ogunsola, S., & Adebajo, S. (2018). Uptake of HIV self-testing and linkage to treatment among men who have sex with men (MSM) in Nigeria: A pilot programme using key opinion leaders to reach MSM. *Journal of the International AIDS Society*, 21, e25124.
52. Wanga, V., Omollo, V., Bukusi, E. A., Odoyo, J. B., Morton, J. F., Kidoguchi, L., Johnson, R., Hughes, J. P., Celum, C., & Baeten, J. M. (2020). Uptake and impact of facility-based HIV self-testing on PrEP delivery: a pilot study among young women in Kisumu, Kenya. *Journal of the International AIDS Society*, 23(8), e25561.
53. Wood, B. R., Ballenger, C., & Stekler, J. D. (2014). Arguments for and against HIV self-testing. *HIV/AIDS-Research and Palliative Care*, 117-126.

54. Woodford, M. R., Chakrapani, V., Newman, P. A., & Shunmugam, M. (2016). Barriers and facilitators to voluntary HIV testing uptake among communities at high risk of HIV exposure in Chennai, India. *Global Public Health*, 11(3), 363-379.
55. World Health Organization. WHO prequalification: Sample product dossier for an IVD intended for HIV self-testing. SIMU [TM] self-test for HIV 12O working document, December 2015. In.
56. World Health Organization. (2016). *Guidelines on HIV self-testing and partner notification: supplement to consolidated guidelines on HIV testing services*. World Health Organization.