

Advances in HIV self-testing: Systematic review of current developments and the road ahead in high-burden countries of Africa

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Abstract

Objectives: Although HIV self-testing technologies have created new opportunities for achieving national and global HIV testing goals, current developments have not been compiled to inform policy and practice, especially in high HIV burden countries of Africa. We aimed to compile and synthesize the evidence about HIV self-testing technologies, strategies, and uptake in the top-10 high HIV burden countries of Africa.

Methods: We searched CINAHL, PubMed, Web of Science, PsycINFO, Social Science Citation Index, and EMBASE to include eligible articles published in English between January 2012 and November 2022.

Results: In total, 865 articles were retrieved and only 16 studies conducted in five African countries were eligible and included in this review. The two types of HIV self-testing modalities presently being used in Africa are: The first is Home Self-Test which is done entirely at home or in another private location by using oral fluid or blood specimen. The second modality is Mail-In Self-Test (self-sampling), where the user collects their own sample and sends this to a laboratory for testing. Perceived opportunities for the uptake of HIV self-testing were autonomy and self-empowerment, privacy, suitability, creating a chance to test, and simplicity of use. The potential barriers to HIV self-testing included fear and worry of a positive test result, concern of the test results is not reliable, low literacy, and potential psychological and social harms. The oral-fluid self-testing is preferred by most users because it is easy to use, less invasive, and painless. The difficulty of instructions on how to use self-test kits, and the presence of different products of HIV self-testing kits, increase rates of user errors.

Conclusion: Adopting HIV self-testing by overcoming the challenging potential barriers could enable early detection, care, treatment, and prevention of the disease to achieve the 95-95-95 goal by 2030. Further study is necessary to explore the actual practices related to HIV self-testing among different populations in Africa.

Keywords

HIV, AIDS, HIV testing, HIVST, barriers, opportunities, Sub-Saharan Africa

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Introduction

HIV/AIDS remains to be a major global public health issue, since the beginning of the epidemic, about 85.6 million people have been infected, about 40.4 million people have died and about 39.0 million people were living with HIV globally at the end of 2022.^{1,2}

Although the burden of the epidemic continues to vary considerably between countries and regions, the World Health Organization (WHO) African Region remains most severely affected,³ accounting for more than two-thirds

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(25.6 million) of the people living with HIV and two-thirds of the global total of new HIV infections worldwide.^{1,3,4} Among the 12 countries with the highest prevalence of HIV in the world, 11 of them are found in Africa, particularly sub-Saharan Africa, where HIV testing opportunities are scarce.⁵

HIV testing is access to HIV prevention, treatment, and care. The new approaches of escalating HIV testing and effective treatment and the wider availability of self-testing technology have created new opportunities for achieving national and global HIV testing goals.⁵ HIV self-testing (HIVST) is necessary not only for diagnosis of HIV infection but also to provide critical opportunities for behavior change interventions, including risk reduction counseling and condom provision, and linkage to care treatment services for those infected. The evolving benefit of HIV testing in the prevention of risk factors and early initiation of treatment requires the development of a new cost-effective and pragmatic approach to HIV testing service provision.⁶

Scientific advancements and innovative approaches like HIVST are crucial in the process of ending the HIV epidemic. WHO has planned to reduce the number of people acquiring HIV from 1.5 million in 2020 to 335,000 by 2030 and avoid more than 500,000 annual deaths. This would necessitate scientific improvements in HIV treatment and diagnostic technology, as well as novel service delivery techniques.⁷

The United States Centers for Disease Control and Prevention (CDC) recommend that everyone between the ages of 13 and 64 gets tested at least once as part of routine medical care and those people with certain risk factors should be tested once a year.⁸ Anyone involved in high-risk activities (e.g., sharing drug needles, having sex with HIV-positive people without using a condom) should get tested every 3 months.⁴

Currently, it is estimated that only 85% (75%–97%) of all people living with HIV knew their HIV status.⁹ Countries are looking for ways to rapidly increase the uptake of HIV testing services, especially for populations with limited opportunity to be tested and those at higher risk to acquire the infection.¹⁰

HIVST is a procedure in which a person collects his or her specimen (oral fluid or blood), using an HIVST kit and then performs an HIV test and reads the result, often in an isolated location, either alone or with trusted ones.¹¹ HIVST is an innovative solution to the problem of low HIV testing coverage which can be implemented and circulated in several settings within and outside the health facility. HIVST can help in realizing the first “95” of the Joint United Nations Program on HIV/AIDS 95-95-95 goals for 2030 targets in the HIV treatment cascade. This is by enabling individuals who have never tested and are not currently reached by the existing HIV testing and counseling services to conveniently obtain information on their status.¹²

HIVST is a primary test that requires further testing by a trained health worker to provide a definitive HIV-positive diagnosis.^{9,10} An individual uses a kit (usually a rapid diagnostic test) to collect a specimen, perform the test and

interpret the test results for themselves which screens for HIV-1/2 antibodies or the HIV-1 p24 antigen.¹³ HIVST can overcome many barriers to testing, like privacy issues, stigma, long waiting times, and expenses associated with traveling to the health facility.¹³

According to the World Health Organization (WHO) reported in 2018, 59 countries of the world had adopted HIVST and 53 additional countries were developing policies.¹³ However, around two-thirds of these nations have upper, middle, or high-income status, including Australia, Brazil, France, Moldova, the UK, and USA.¹³ HIVST assessment in low to middle-income countries, like those in sub-Saharan Africa, is expected to decrease significantly, but the support for the affordable sale of Oraquick Self-Testing Kits made by Bill and Melinda Gates Foundation might scale up HIV testing in these higher-risk areas.¹⁴

We conducted a systematic review to examine the HIVST literature focusing on currently available HIVST technologies/kits, proposed strategies to self-test, and opportunities and barriers to HIVST in the top 10 high HIV burden countries of Africa: Eswatini (19.58%), Lesotho (18.72%), Botswana (15.75%), South Africa (14.75%), Namibia (8.9%), Zimbabwe (8.7%), Mozambique (8.21%), Zambia (6.9%), Malawi (5.69%), and Equatorial Guinea (5.21%).¹⁵ In this review, we aim to systematically identify relevant articles to address valuable gaps and provide implications for future research.

Methods

Sources of information

This review synthesizes the evidence about HIVST technologies, strategies, and uptake, taking into account the top-10 high HIV burden countries of Africa. Current developments in technologies, strategies, and policies were received from the guidelines of WHO, CDC, Unitaid-WHO HIVST, UNAID Fact sheet, and Global health sector strategy. The HIVST uptake in top-10 high HIV burden countries of Africa was retrieved from recent studies following the guidance provided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). To ensure ample coverage in the search process, the following electronic databases were surveyed: PubMed, Google Scholar CINAHL, Web of Science, and PsycINFO. Both Boolean-paired keywords and controlled vocabulary about HIVST strategies for men and women in the top 10 African countries were used. Search strategies included terms, such as HIV, HIVST, HIV testing, self-testing, adults, willingness, opportunities, barrier(s), Africa, and lists of each top 10 African countries' names.

Inclusion criteria

The included articles fulfilled the following criteria: (1) if the research was conducted in sub-Saharan Africa, (2) if the

reported findings were on HIVST, both genders aged 18 years or older, and (3) if the research was peer-reviewed and published in English. Articles were excluded if the research was unpublished if they were written in languages other than English, or if they were not published between January 2012 and November 2022. Articles were considered to be “recent literature” if they were published within the past 10 years (from 2012 to 2022); therefore, articles published earlier than this time were not included in this review. The included articles focused on both men and women who were deemed as being at risk for HIV infection (those having risky sexual behavior, substance use, etc.) and living in sub-Saharan Africa.

Data extraction

The results of the database search were reviewed in a Mendeley Desktop file. First, we reviewed the titles and abstracts of all articles, after duplicate articles were removed, to assess the relevance of each article. The articles were categorized into either “Selected for Full-Text Review” or “Does Not Meet Inclusion Criteria.” Data were then extracted from the articles categorized as selected for full-text review. Thirty-eight articles were selected to be reviewed in full. Then the selected articles were summarized according to their methods and findings to assess if they met the full inclusion criteria. The included articles were read in their completeness and summarized their methods, design, and results to confirm the appropriateness for being included in the final sample of included articles.

Quality assessment

We used appropriate quality assessment tools to evaluate the methodological and research quality of each article before its inclusion in this review. Each included article was rated using a pre-determined scoring requirement for each assessment. The Critical Appraisal Skills Program (CASP)¹⁴ was used to evaluate qualitative studies; included articles had to meet at least 7 of the 10 listed criteria. Included articles evaluated using the quality assessment tool for observational cohort and cross-sectional studies¹⁵ were required to meet at least 11 of 14 listed criteria. Included articles evaluated using the Cochrane Risk of Bias Tool for randomized trials¹⁶ were required to have a low level of assessed bias in the four domains (selection, performance, attrition, and other). Articles with poor scores on either of the quality assessment tools were excluded from the review.

Data synthesis

A descriptive synthesis approach was used to present the results of this review. Descriptive synthesis allows for the synthesis of the findings of multiple studies in a qualitative manner.¹⁷ We organized each article by themes, such as

HIVST opportunities and barriers to HIVST. The findings of each article were matched with their appropriate theme; however, some articles were included in multiple themes.

Ethical considerations

This study did not undertake any formal data collection involving any humans or animals.

Results

The results of the database searches retrieved 865 articles and finally yielded 16 articles that met the full-inclusion criteria and are presented in this review (see Figure 1). Top 10 high HIV prevalence sub-Saharan countries were searched on the databases, but only five countries are represented in included studies (Table 1). The frequency of represented countries in included articles was as follows: Eswatini (1), Malawi (7), South Africa (5), Uganda (1), Zimbabwe (1), and two countries (1). The designs of the articles included: a randomized controlled trial (2), a qualitative survey (7), implementation project (2), longitudinal study (2), and mixed methods (3). Of the included articles, 10 focused on HIVST implementation, and opportunities, and 6 focused on barriers to HIVST; however, data extracted from each article is presented under its appropriate subsection regardless of study focus.

HIVST implementation science projects

This review identified articles reported on different strategies to implement HIVST services. The study done between April 2018 and December 2019, among antenatal care (ANC) clinic attendees and people or those newly diagnosed with HIV clients across 12 clinics in three cities in South Africa suggested partner-delivered HIVST in real-world implementation was able to affordably reach the target population.²⁹ A three-arm, open-label, pragmatic, cluster-randomized trial done in Malawi during COVID-19-related lockdowns between 8 September 2018 and 2 May 2019 investigated secondary administration of HIVST kits, with an additional financial incentive, improves the proportion of male partners HIV testing acceptability and increased test uptake.³⁰ According to an adaptive multi-arm, two-stage cluster randomized trial conducted in Malawi, the strategy of using conditional fixed financial incentives plus partner-delivered HIVST increased the odds of men’s linkage to care.³¹ Before implementing the HIVST service program awareness and willingness to self-test of the population should be investigated.³²

Opportunities to HIVST

In South Africa, HIV experts, HIV policymakers, and health-care providers considered the availability of HIVST as a

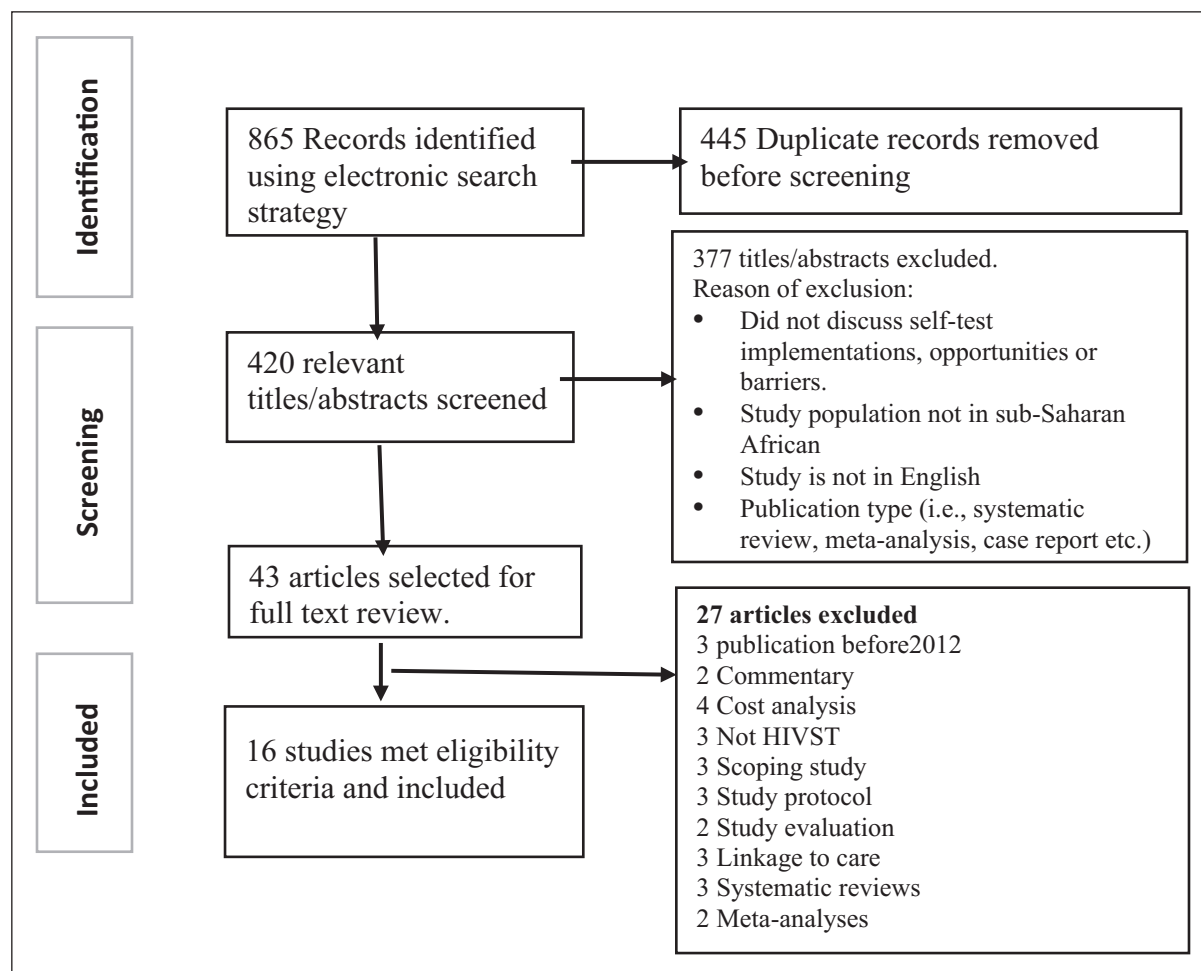


Figure 1. PRISMA flow diagram for article inclusion/exclusion.

factor that would boost the uptake of HIV testing, permit repeat testing, identify first-time testers, and lead to the linkage of care and treatment.³⁴ Furthermore, potential HIVST users in Malawi identified the potential of HIVST to reduce stigma and discrimination associated with HIV testing, which will encourage men to utilize HIVST.²²

Also, most participants in South Africa believed that HIVST gives a chance to test for HIV while avoiding facility-based barriers, resulting in greater use of self-testing. Others have claimed that HIVST testing will reduce facility-related hurdles such as long wait times, queues, and stigma from a healthcare practitioner.^{23,35} HIVST approaches have also increased the confidentiality of HIV test results compared to conventional ones.²³

A potential enabling element for the uptake of HIVST, according to HIV experts, HIV policymakers, healthcare professionals, and potential HIVST users, is the autonomy to select one's own HIV testing method and self-empowerment to accept responsibility for one's life. They believed that a person would take a more active role in managing his or her own health and decision-making process for HIV testing if

they felt autonomous and empowered.^{23,35} HIV policymakers believed that HIVST might provide couples a chance to communicate before performing self-tests. They thought that direct communication could help people disclose their HIV status and lessen gender-based violence associated with HIV-positive outcomes.³⁴

Barriers of HIVST

Despite the large-scale programmatic approach to increasing the HIVST in Africa, barriers including fear of discrimination, big packaging, high price, lack of confidence from user error, and fear of status disclosure were identified in many countries. Pitfalls of HIV testing in healthcare facilities in South Africa include fears over loss of privacy and confidentiality.³² Perceived barriers included a lack of counseling and difficulty in ensuring linkages to care among those with positive results in South Africa.¹⁸ In South Africa, both the oral fluid and finger stick groups made mistakes; nevertheless, the oral fluid test was conducted effectively by the majority of participants, but the finger stick test was less consistent.¹⁸

Table 1. Characteristics of included studies (n = 16).

Author, year	Country	Study aim	Study population	Study design	Sample size	Main findings
Knight et al. ¹⁸	South Africa	To assess the perceived usability and acceptability of HIVST among lay users using several self-tests prototypes	Men and women	Mixed-method design in depth interviews and exit questionnaire	50 adults	Perceived easiness-to-use, privacy, autonomy, ease of access, widespread availability of test kits, and low or free kits, emerged as important factors influencing acceptability and desirability
Kumwenda et al. ¹⁹	Malawi	To describe discordance, disclosure, and gendered unavailability of male partners	Men and women	Qualitative, in-depth interviews	33 adults	Key barriers to couples separate HIVST: Fear of HIV- discordant result, fear of being known to have HIV, and unavailability of the male partner
Muwanguzi et al. ²⁰	Uganda	To explore employers' and employees' perceptions of the drivers and barriers of workplace-based HIVST	Men	Qualitative, focus group discussions	48 adults	Barriers to workplace-based HIVST: prohibitive cost of HIV tests, stigma, lack of testing support, the fear of discrimination and isolation, and concerns around decreased work productivity in the event of a reactive self-test. Drivers of workplace-based HIVST: convenience, autonomy, need for privacy, trustworthiness of the result
Van Rooyen et al. ²¹	Kenya, Malawi, South Africa	To assess the perceptions of HIVST among stakeholders in three sub-Saharan countries	Men and women	Qualitative design-in-depth interview; thematic analysis	54 (HIV policymaker, HIV experts, and healthcare providers)	HIVST is an important complementary approach to existing conventional HIV testing services; contextual and operational evidence needed to contribute to normative WHO guidance
Lippman et al. ²²	South Africa	To explore acceptability, feasibility, utilization, and distribution patterns of HIVST in high prevalence area	Men	A longitudinal HIVST study from June 2015 to May 2017	127 participants	HIVST use and network distribution is acceptable and feasible for men who have sex with men (MSM) (men who have sex with men) in South Africa and can increase testing uptake and frequency, potentially improving early detection among MSM and their networks
Sithole et al. ²³	South Africa	Providing HIVST as an alternative testing strategy to clinic-based testing, investigating HIVST acceptability and feasibility	Men	Community-based services improved HIV testing	2634 adults	Large-scale distribution of HIVST kits targeting men in rural KwaZulu-Natal is feasible and highly effective in reaching men, including those who had not previously tested for HIV
Mphahlele et al. ²⁴	Malawi	To examine adult perceptions of HIVST and understand what components of a facility, HIVST strategies are crucial for the intervention scale-up	Men and women	Qualitative study	57 adults	Facility HIVST was largely acceptable to outpatients in Malawi with novel facilitators that are unique to facility HIVST in OPD waiting spaces
Pasipamire et al. ²⁵	Eswatini	Describe the strategies used during the phase-in of HIVST under routine conditions and discuss challenges and successes	Men and women	Community-based interventional study	1895 adults	Integration of HIVST into existing HIV facility, and community-based testing strategies are found to be feasible, and HIVST has been adopted by national testing bodies in Eswatini
Mukora-Museyeka et al. ²⁶	Zimbabwe	To articulate the development and implementation of a systematic and multifaceted HIVST intervention	Men and women	Exploratory sequential mixed method study	227 university students	Peer-delivered HIVST using trained personnel was acceptable among adolescents and young adults. HIVST could increase the uptake of HIV testing for this population
Makusha et al. ²⁷	South Africa	To explore attitudes, opinions, and experiences among key stakeholders regarding HIVST in South Africa	Men and women	Qualitative design-in-depth interview; constant comparison method	Key HIV stakeholders, (n = 12)	HIVST has the potential to reach hard-to-reach groups, including men
Choko et al. ²⁸	Malawi	To explore views regarding the acceptability of offering HIV-self test kits alone or in combination with linkage intervention to Antenatal care (ANC) attendees aimed at their male partners	Men and women	Qualitative design-in depth interviews and focus group discussions; simple descriptive content analysis	Men (n = 28) and pregnant women (n = 34) aged 18 years and older attending ANC	Perceived high acceptability of woman-delivered HIVST among pregnant women attending ANC and their male partners; HIVST was not likely to lead to adverse events (i.e., intimate partner violence (IPV)); conditional financial incentives may motivate male partners to link into HIV care post-HIVST
Zishiri et al. ²⁹	South Africa	Evaluated programmatic implementation of partner-delivered self-testing through ANC attendees and people newly diagnosed with HIV	Men and women	Survey	10,256 male sexual partners of ANC clients, and 4154 people newly diagnosed with HIV for their partners	Partner-delivered HIVST in real world implementation was able to affordably reach many male partners of ANC attendees and index partners of people newly diagnosed with HIV in South Africa
Hubbard et al. ³⁰	Malawi	Examined the barriers to linkage to care and ART initiation for men using HIVST and their preferences for interventions to improve HIV treatment outcomes following self-testing	Male and female	A qualitative study	16 males and 11 females	Barriers to ART initiation centered on the absence of healthcare workers at the time of diagnosis and included lack of external motivation for linkage to care and lack of counselling before and after testing
Choko et al. ³¹	Malawi	To investigate whether secondary administration of HIVST kits, with or without an additional financial incentive, could improve the proportion of tests or care	Men and women	A three-arm, open-label, pragmatic, cluster-randomized trial	4544 eligible women in the ANC cohort and 708 eligible patients in the index cohort	Although administration of HIVST kits in the ANC cohort, even when offered alongside a financial incentive, did not identify significantly more male partners with HIV than did standard care, out-of-clinic options for HIV testing appear more acceptable to many male partners of women with HIV, increasing test uptake
Choko et al. ³²	Malawi	To identify interventions that could increase male partner testing and subsequent linkage to care or prevention	Men and women	An adaptive multi-arm, multi-stage cluster randomized trial	2349 women and 676 men	The odds of men's linkage to care or prevention increased substantially using conditional fixed financial incentives plus partner-delivered HIVST; combinations were potentially affordable
Johnson et al. ³³	Malawi and Zimbabwe	Assessed early implementation of HIVST questions in population-based surveys, and associations with awareness and use of, and future willingness to, self-test	Men and women	Cross-sectional population-based surveys	14,027 men and 17,358 women	Despite low awareness and minimal HIVST experience, willingness to self-test was high among Zimbabwean men, especially older men with moderate-to-high HIV-related sexual risk

A community-based HIVST study revealed fear of HIV-discordant result, fear of being recognized to have HIV, and male partner unavailability were identified as important barriers to HIVST in Malawi.²⁸ A qualitative study showed that 10% of participants in Malawi needed assistance while using HIVST kits and individuals occasionally needed encouragement.²⁷ Another qualitative study conducted in Malawi concluded male-tailored interventions are desired by men to overcome barriers to ART initiation centered on the absence of healthcare workers at the time of diagnosis and included lack of external motivation for linkage to care among men who used HIVST.²⁹ High costs, stigma, a lack of testing assistance, a supposedly difficult time connecting to care, and fear of the repercussions of reactionary outcomes (discrimination, isolation, decreased productivity at work, potential damage) were among the perceived barriers to HIV testing in Uganda.²⁸ A cross-sectional study from Malawi, Kenya, and South Africa also revealed that participants found it challenging or unclear to follow the HIVST instructions. Less than 25% of candidates successfully passed the exam without making any mistakes. Participants found it challenging to evaluate the results.³⁴

Future innovation to improve self-tests for HIV. The growing pipeline of HIVST products is encouraging. However, there remains potential for further innovation. The evidence suggests that, although most self-testers can perform HIVST correctly,³³ user errors are not uncommon.³⁶ There is potential to further optimize and improve HIV self-test product performance, particularly simplified and painless sample collection, clear instructions, demonstrations, and support tools, fewer steps, and faster and easy-to-read results.¹²

Oral fluid HIVST and future directions. Through many studies and populations, participants prefer oral fluid to blood-based HIVST methods, because the oral fluid method avoids the need to perform a fingerstick,³⁷ though some studies and participants demonstrated and recognized that, blood specimens are more reliable in detecting HIV than oral fluid.³⁷

The improvement of oral fluid specimen tests, and their acceptance demands a more reliable solution. For example, by antibody detection by agglutination-PCR (ADAP) oral fluid assays, or by increasing in acceptability of fingerstick blood self-collection, for example making more full use of blood samples by conducting additional assessments of interest, such as testing for sexually transmitted infections (STIs).³⁸

The low concentration of HIV antibodies in oral fluid makes it difficult in improving the oral fluid test sensitivities; however, some studies have confirmed that with ADAP oral fluid sensitivity for HIV is enhanced up to the standard of other blood-based third-generation tests with clinical sensitivity and specificity of 100%.³⁹ ADAP was developed in 2016 for improved detection of antibody biomarkers for conditions such as type 1 diabetes, autoimmune diseases, and

thyroid cancers.³⁷ More advancement in ADAP oral fluid assays could light the need for a more accurate oral fluid test method.³⁸

Developing multiplex tests. The concern is growing in the development of new multiplex self-tests, self-test devices with the ability to test concurrently for more than one disease using a single specimen and one test procedure or test run.¹² The availability and introduction of multiplex self-tests may reduce missed opportunities for those who choose to self-test for HIV to screen for other conditions, thus maximizing the personal and public health benefits of self-testing.¹² Possible combinations being explored include HIV, syphilis, hepatitis B, and hepatitis C, among others. Recently, a few numbers of WHO prequalified multi-disease rapid diagnostic assays are available for professional use.⁴⁰ For example, three HIV/syphilis combination professional-use RDTs have received the CE (European conformity) mark, and WHO has prequalified them. Three HIV, hepatitis B, and C combination professional-use RDTs have received the CE mark. One CE-marked professional-use RDT can simultaneously detect HIV, syphilis, and hepatitis B and C.⁴⁰ None of these has yet been adapted or approved for self-testing by a stringent regulatory authority.¹²

Self-testing for STIs is another possibility that needs exploration. Self-collection systems currently exist for certain STIs (chlamydia, gonorrhea, human papillomavirus).^{41,42} However, there are currently no approved self-tests for STIs.¹²

Discussion

This systematic review evaluates available studies on HIVST implementation prospects and potential hurdles to implementation among men and women over the age of 18 years in Africa's top 10 high-burden HIV countries. Despite increased focus and research in recent years, adults in sub-Saharan Africa are still not testing at the predicted rates. The findings of this review are essential for understanding the larger range of characteristics that may permit or discourage HIVST acceptance, as well as the HIVST experiences of adult users in top 10 high-burden HIV countries of Africa, and how they might be integrated into broader HIV testing programs. These findings have significance for future studies evaluating the feasibility of HIVST and give useful information for HIV stakeholders and interventionists.

To realize the prospective of HIVST, its incorporation into larger testing programs is necessary, particularly when prudently planned execution science assessments are built into the program designs. The programs should also offer both self-testing options, the most acceptable but less accurate oral fluid testing, and the more accurate but less acceptable fingerstick blood test. However, future research should focus on continuing to improve user acceptability and accuracy of the test performance.

The following possible enabling characteristics of HIVST were frequently noted in this literature: availability of HIVST, privacy, confidentiality, convenience, and disclosure to serostatus.⁴³⁻⁴⁵ Increased confidentiality of HIV test results, as well as perceived autonomy and self-empowerment in decision-making to test were also identified as potential benefits of HIVST.^{23,34} The ability of HIVST to decrease barriers like stigma and discrimination and avoid facility-based barriers were also found among participants in this synthesis.^{23,34} A qualitative study on MSM in Uganda revealed similar findings of preference of HIVST over the conventional testing because it is confidential and non-stigmatizing.⁴⁶

This synthesis suggests that factors such as the unreliability of self-testing results, low literacy, the high cost of self-test kits, and fear and anxiety associated with positive test results may limit the effectiveness of HIV testing in various settings in Africa, which is consistent with prior research on potential obstacles to HIV testing globally.⁴⁷⁻⁴⁹ The perceived difficulty of self-test kits to accurately test for HIV, as well as misinterpretation of test findings, may potentially impair self-test kit adoption.

Regardless of current global data on the potential benefits of HIVST,^{34,43,47,50} participants in this synthesis raised critical concerns about HIVST, including human rights concerns, a lack of quality assurance systems, a lack of linkage to care, and a lack of face-to-face counseling. According to Johnson and colleagues, state regulation is important to realize quality assurance, and hence promote the quality of self-test kits, however, state regulations like age limitation to restrict access to HIVST need caution, because the purchase of HIVST kit should be considered to be a personal decision that should not be interfered by the state.^{48,51}

More research is needed to assess the protocols and strategies that will allow for adequate linkage to care following HIVST.⁵² In two qualitative studies documenting HIVST experiences among adult men and women in Kenya, Malawi, and South Africa, participants noted that the availability of HIVST creates a potential for re-initiation of ART.⁵³

The main cause of user errors and inaccuracy regarding HIVST use was misunderstandings on how to use self-test kits, particularly with unsupervised HIVST.^{53,54} This emphasizes the need to provide training on HIVST use, accompanied by clear pictorial instruction-for-use in the local language on how to perform HIVST, easy steps to interpret the test result, and linkage to support and counseling services.^{54,55} Caution should be made by manufacturers to develop a user-friendly HIVST product, to reduce the rates of user errors when considering new HIVST products.^{23,34}

Limitations

Despite the fact that this review delves into detail information on HIVST in HIV-endemic African nations, it has

limitations. The first constraint is that only articles from five countries were considered due to a lack of published articles on HIVST. Second, while less-affected nations in West and Central Africa have their own unique characteristics (higher stigma), this analysis mainly focused on the top 10 high-burden HIV African countries.

Conclusions

Generally, the implementation of HIVST in the top 10 high-burden African countries is a complex process influenced by complex and interlinked factors. This synthesis contributed to a literature gap on HIVST by identifying important opportunities for HIVST and potential barriers to HIVST among adults in the top 10 high HIV burden Sub Sahar African countries. HIVST interventionists should develop strategies and policies that are specific to the context and culturally appropriate to increase the uptake of HIVST. Most HIVST users choose oral-fluid self-testing to finger-stick/whole blood-based self-testing because it is easy to use, less invasive, and painless. The existence of different products of HIVST and the lack of clear instructions on how to use self-test kits increases rates of user errors. Adopting HIVST as a complimentary HIV testing services (HTS) option could enable early detection, early care, early treatment, and prevention of the disease. HIVST may also be an essential tool in increasing access to HIV care, treatment, and prevention to achieve the 95-95-95 goal by 2030. Further study is necessary to explore the actual practices related to HIVST among different populations in Africa.

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Author contributions

HM is a major contributor to writing the manuscript. All others reviewed and approved the manuscript.

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