



ELSEVIER

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijidINTERNATIONAL
SOCIETY
FOR INFECTIOUS
DISEASES

Perspective

HIV self-testing: The key to unlock the first 90 in West and Central Africa

Didier K. Ekouevi^{a,b,c,*}, Alexandra M. Bitty-Anderson^{c,d}, Fifonsi A. Gbeasor-Komlanvi^{a,b}, Ahuatchi P. Coffie^{d,e,f}, Serge Paul Eholie^{d,e,f}^a Université de Lomé, Faculté des Sciences de la Santé, Lomé, Togo^b Centre Africain de Recherche en Épidémiologie et en Santé Publique, Lomé, Togo^c ISPED, Université de Bordeaux & Centre INSERM U1219 – Bordeaux Population Health, Bordeaux, France^d Programme PACCI, site ANRS, Abidjan, Cote d'Ivoire^e Unité pédagogique de Dermatologie et Infectiologie, Unité de Formation et de Recherche en Sciences Médicales, Université Félix Houphouët-Boigny, Abidjan, Cote d'Ivoire^f Centre de Recherche sur les Maladies Infectieuses et les Pathologies Infectieuses, Université Félix Houphouët-Boigny, Abidjan, Cote d'Ivoire

ARTICLE INFO

Article history:

Received 13 November 2019

Received in revised form 7 February 2020

Accepted 11 February 2020

Keywords:

HIV Self-testing

Challenges

Implementation

West and Central Africa

ABSTRACT

The West and Central African region (WCAR) still registers some of the highest rates of new HIV infections worldwide (16%) despite a low prevalence of HIV (1.9%). In this region, only 48% of people living with HIV are aware of their HIV status. To fill this gap, HIV Self testing (HIVST) could potentially be an additional approach to overcome the barriers to diagnose HIV infected patients, therefore being one of the keys to unlock the first 90 as recommended by the World Health Organization (WHO) since 2016. However, many challenges remain for the adoption of HIVST in routine clinical practice in low prevalence settings and need to be contextualized to WCAR settings. We report in this paper some of the challenges and discuss opportunities for a successful implementation of HIVST in the WCAR.

© 2020 The Authors. Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

In 2014, the Joint United Nations Program on HIV/AIDS (UNAIDS) introduced a strategy aimed at eliminating the HIV epidemic by 2030, by achieving the following goals: diagnose 90% of all HIV-positive persons, provide antiretroviral therapy (ART) to 90% of those diagnosed and achieve viral suppression for 90% of those treated, by 2020 (Levi et al., 2016). Since then, there has been a global surge from national entities with the goal of reaching those goals by 2020.

Sub-Saharan Africa (SSA) is the region of the world with the highest burden of the HIV epidemic. The West and Central African region (WCAR), which comprises 25 countries, is home to 7% of the world population and to 17% (6.1 million) of all people living with HIV (PLHIV) worldwide (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2020). The average prevalence of HIV in WCAR is relatively low compared to that of Eastern and Southern Africa with 1.9% vs. 6.8% in 2017 (AVERT, 2020a; AVERT, 2020b), but WCAR still

registers some of the highest rates of new HIV infections worldwide (16%) (AVERT, 2020; Joint United Nations Programme on HIV/AIDS (UNAIDS), 2020) and 21% of AIDS-related deaths (AVERT, 2018). The WCAR continues to lag behind the rest of SSA with only 8% and 24% declines in new infections and AIDS related deaths, respectively, since 2010, while new infections declined by 29% in the Eastern and Southern Africa region over the same period (UNAIDS, 2019). In regard to the cascade of care, only 48% of PLHIV are aware of their HIV status, 40% of PLHIV are on antiretroviral therapy (ART) and 29% are virally suppressed (AVERT, 2018). The latest report of UNAIDS underlines these disparities in WCAR where less than 60% of the HIV population is tested. The report also pointed out the difficulties in this region specifically in key and vulnerable populations, which are still stigmatized and discriminated in this region more than in other settings in SSA (UNAIDS, 2019).

Based on these gaps, HIV Self testing (HIVST) could potentially be an additional approach to overcome the barriers to diagnose HIV-infected patients, therefore being one of the keys to unlock the first 90 as recommended by the World Health Organization (WHO) since 2016 (World Health Organization, 2020).

Self-testing is defined as a process in which a person who wants to know his or her HIV status uses a kit to collect a specimen,

* Corresponding author at: Université de Lomé (Togo), Faculté des Sciences de la Santé, Département de Santé Publique, Togo.

E-mail address: didier.ekouevi@gmail.com (D.K. Ekouevi).

performs a test and interprets the test results for himself or herself (World Health Organization, 2020). Multi-country evidence from Eastern and Southern Africa confirms high feasibility, acceptability and accuracy of HIVST across many delivery models and populations, including adolescents, men and female sex workers, with reassuringly minimal harm (World Health Organization, 2020; Figueroa et al., 2015; Choko et al., 2018; Choko et al., 2015; Lippman et al., 2018; van Dyk, 2013). Two pilot studies on HIVST were funded by UNITAID in sub-Saharan Africa (SSA). The ongoing STAR Initiative is a five-year project divided into two phases. The first phase (2015–2017) in Malawi, Zambia, and Zimbabwe generated information about how to distribute HIVST products effectively, ethically, and efficiently, and answered questions about the feasibility and acceptability of HIVST in the general population (Ingold et al., 2019; Hatzold et al., 2019). The second phase of this project is ongoing with added countries of South Africa, Swaziland and Lesotho, and will distribute 4.8 million HIVST kits by 2020. The second project, ATLAS, launched in 2018 aiming to assess the feasibility and acceptability of HIVST among people with the highest risk of contracting HIV in three countries in West Africa: Côte d'Ivoire, Mali, and Senegal (UNITAID, 2019). A recent study conducted in the Democratic Republic of Congo has shown the same findings and an excellent practicability comparable to Eastern and Southern Africa (Tonen-Wolyec et al., 2019a). To date, 18 WCAR countries have adopted HIVST in their national HIV testing policy guidelines, nine set up pilot studies, and only one (Nigeria) has implemented it with a roll out plan (WHO, 2020). Many challenges remain for the adoption of HIVST in routine clinical practice in low prevalence settings and need to be contextualized to WCAR settings. The objective of this paper is to examine these challenges and discuss opportunities for a successful implementation.

First challenge: identify the best the target population

Public health strategies should target and prioritize three populations: men, adolescents and well-known key populations. HIV testing is a public health priority especially among key populations such as female sex workers (FSWs), clients of female sex workers, sex partners of other key populations and men who have sex with men. In WCAR, 64% of new HIV infections occurred in these populations (UNAIDS, 2019). However, the population of WCAR is predominantly young, with more than 64% of the population under the age of 24 (United Nations Population Fund, 2018). This population, with 62,000 adolescents newly infected with HIV in 2016, has the highest rate of HIV incidence (UNAIDS, 2020). In general, adolescents rarely have a point of entry into the health care system and structures of HIV testing and counselling (HTC) specifically dedicated to them are practically non-existent, which makes them particularly vulnerable. HIVST would offer the opportunity for adolescents to access HIV testing and would contribute to increasing the rates of HIV testing in this population. For adolescents, there are multiple approaches that could be used to promote access to HIVST: the door-to-door HIVST approach which constitutes an innovative way to distribute self-test kits; m-Health including social media platforms in local languages to raise awareness and to present the video-based instructions for use of the HIVST; and facilitating the delegation of tasks allowing community health workers to facilitate access to HIVST by adolescents in a community-based approach (Tonen-Wolyec et al., 2019c).

In WCAR, although women are disproportionately affected by the HIV epidemic with higher prevalence and incidence of HIV compared to men, men are still important in breaking the cycle of heterosexual HIV transmission (Kharsany and Karim, 2016; Sileo et al., 2018). There are no dedicated services for men for HIV testing

similar to those for women, who are systematically offered HIV testing during antenatal consultation. Moreover, men are less likely to access HIV care services, including HIV testing services due to cultural and gender norms, and other structural barriers (facility operating hours, lack of confidentiality) (Camlin et al., 2016). For this population, HIVST would palliate to those barriers and contribute to men having access to health care.

For key populations, HIVST should be a strategy additional to other available approaches since the prevalence and incidence of HIV in these populations is still elevated (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2010). Table 1 summarizes the barriers to expanding HIV testing in WCAR according to the population.

Second challenge: acceptability of HIVST

Overall, interventions on the implementation of HIVST in SSA have proven to be successful with higher rates of HIV testing uptake with HIVST compared to the standard of care (Bateganya et al., 2010). Different strategies could be put in place to implement HIVST in SSA: community-based or health facilities based (supervised) HIVST. In both strategies, the main reason for the preference for self-tests is the fact that testing is initiated by the client rather than the health care provider, compared to classic HIV testing and counselling, which are initiated by the provider and remove the patient's autonomy and potentially in the African context, confidentiality (van Dyk, 2013). Community-based HIVST consists in providing HIV self-tests to residents of community clusters, with pre- and post-counselling offered by community workers. This strategy has been shown to be successful in the uptake and increase of the number of people getting tested and being linked to HIV care, especially due to community workers (Choko et al., 2015; Mulubwa et al., 2019). HIVST at health facilities refers to the self-administration of an HIV self-test inside the site often under the supervision of the health care provider (van Dyk, 2013). In both cases, HIVST has the advantages of being highly acceptable and of increasing HIV testing uptake among populations that are difficult to reach with routine HTC (male partners, young women, adolescents, students, female sex workers (Hatzold et al., 2019; Tonen-Wolyec et al., 2019a; Mulubwa et al., 2019; Harichund and Moshabela, 2018; Pintye et al., 2019). HIVST has several benefits. Several studies reported increased confidentiality and privacy, decreased burden on the healthcare system, decreased coercive testing by healthcare workers, and decreased stigma and discrimination associated with HIVST (Harichund and Moshabela, 2018). Autonomy to make one's own choice of HIV testing method was also cited as advantageous by van Dyk et al. (van Dyk, 2013). Makusha et al., reported that HIVST has the potential to address gender disparate barriers to testing, often encountered by males at HIV testing centers, such as non-male friendly testing spaces, inconvenient operating hours and healthcare provider attitudes that may not be sensitive to men's needs (Makusha et al., 2015). Also, study outcomes from current literature on the advantages of HIVST reiterate the argument that HIVST should be offered as a complementary HIV diagnosis or screening method to overcome current barriers associated with conventional HIV testing approaches (voluntary counselling and testing, provider-initiated counselling and testing, etc.) (Harichund and Moshabela, 2018).

Third challenge: strategies for the distribution of HIVST

Two complementary approaches have been suggested by the WHO and the Liverpool School of Tropical Medicine in 2013 for the implementation of self-testing. In the first approach, "supervised testing", a health care worker from the community or the health center is involved at several steps in the provision, in the

Table 1
HIV self-testing barriers.

	Barriers
MSM	<ul style="list-style-type: none"> - Stigmatization and discrimination - Limited access to HIV services for testing - Inadequate services
FSW	<ul style="list-style-type: none"> - Stigmatization and discrimination - Limited access to care - Negative attitude of health care workers - Limited accessibility to health care services
DU	<ul style="list-style-type: none"> - Stigmatization and discrimination - Personal isolation - Criminalisation - Lack of services for testing and treating HIV
Adolescents	<ul style="list-style-type: none"> - No entry points into the health care system - Lack of health care structures for HIV testing - Low level of knowledge on HIV - Low risk perception
Men	<ul style="list-style-type: none"> - Fear and worry of knowing HIV status - Accessibility of health services
Women	<ul style="list-style-type: none"> - Drugs and reagents stock out - Long waiting lines at clinics - Late antenatal visits
Couples	<ul style="list-style-type: none"> - Lack of provision for testing of couples - Lack of social support

DU: Drug users; FSW: Female sex workers; MSM: Men who have sex with men.

administration and interpretation of the self-test. In the “unsupervised approach” to self-testing, HIV self-tests would be distributed by health care workers in health care centers or would be provided from a regular pharmacy (Johnson et al., 2014). Access to self-tests could be facilitated by vending machines, as is the case for condom distribution. The level of education of people using HIVST would then be the main factor of choice for the supervised or unsupervised HIVST. Hence, for those with high levels of education, the probability of errors in reading the results of the test and interpreting is low. On the contrary, among those with low educational levels, the “supervised testing” would be the recommended approach to limit the risk of errors. In the African context, studies have demonstrated that the preferred choice of HIVST between the oral fluid self-test and the finger-prick self-test, was the first method, due to the ease of use and painlessness (Indravudh et al., 2018; Sibanda et al., 2019). HIV pre- and post-counseling are an essential aspect of HIV testing, for the psychological support of people willing to test for HIV (van Rooyen et al., 2015). Depending on the approach to self-testing, on the level of education and on socio-economic factors, the counseling modalities vary. The ATLAS project is an example of an implementation project that could help to better describe the type of HIV self-testing kit and counselling (e.g., phone, regular clinical visit) that could be delivered to West and Central African communities.

Fourth challenge: linkage to HIV prevention and care services/facilities

This challenge is particularly important to achieve the second and third 90 targets. There is also the issue of post-test counseling and linkage to care, which in the context of SSA and WCAR remains an important issue. The goal of increasing the number of people who get tested for HIV is to be able to get people under treatment and to ultimately have PLHIV with undetectable viral load. Ensuring linkage to care should then be a condition for self-testing to be effective, in addition to post-test counseling for

behavioral change in the case of a negative HIV test (Bain et al., 2016). Linkage to care is limited in WCAR, with a weak health system and a lack of policies on HIVST. To increase the linkage to care after using HIVST, some strategies are tested such as the use of smartphone applications and mHealth interventions (Adeagbo et al., 2019; Balán et al., 2020). Innovative approaches are needed to refer HIV-infected patients in the context of low prevalence of HIV.

Fifth challenge: funding/sustainability/subsidy

Cost is one of the major concerns for policies that would like to implement HIVST. However, the largest gap between resource availability and the 2020 resources needs target has been observed in WCAR. At the same time, international funding support tended to slow down in the recent years. Funding, cost, and quantification/forecasting of HIVST are other critical aspects to take into consideration. Information is scarce and insufficient to estimate the needs of HIVST at the national level in a scaling up process. A study in Malawi explored cost-effectiveness of HIVST compared to facility-based HTC, and found that HIVST cost was significantly lower than facility-based HTC for the client; however, it was more costly than facility-based HTC when needing to identify HIV-positive individuals and administer treatments, hence a heavier burden for health care providers (Maheswaran et al., 2016). In another study on costs of HIVST, respondents indicated that the government should be responsible for the procurement of tests, and should be paying at least some part of the cost of test kits; respondents also drew a parallel between the distribution and availability of self-tests and that of condoms (van Rooyen et al., 2015). Since 2017, financial support provided by donors to bring the unit cost of the OraQuick self-test kit down to US\$2 in selected sub-Saharan African, removed a critical cost barrier to HIVST expansion (Indravudh et al., 2018; OraSure Technologies, 2013). Funding for self-tests could in fact be subsidized by local government, within the framework of controlling the HIV/AIDS epidemic. Hopefully, the Global Fund (GF) and PEPFAR would expand access and support for HIVST in SSA (Resource Mobilization, 2020; PEPFAR, 2018). The recent pledges of 14 billion USD for the replenishment of GF offer an expectation to reinforce programs in global health for HIV testing through novel differentiated services and facilities models adapted to low-prevalence HIV settings such as WCAR countries (Resource Mobilization, 2020). This donor funding, historically reduced in WCAR, will probably help countries in this region to unlock the first 90 and reach UNAIDS 95-95-95 to ending AIDS in 2030 (The Lancet HIV, 2017). The sustainability of HIV testing depends not only on the acceptability and feasibility of HIVST but also on the financial support which can have a critical effect on HIVST accessibility. First, a needs assessment is crucial to identify the target population. The private sector implication will be essential, as well as a private and public partnership. Also, a cost-effectiveness of various delivery models is needed to identify the best population to prioritize in order to achieve the first 90.

Sixth challenge: research gaps

In WCAR, research on HIV self-testing is limited (Table 2). Only two research studies are planned in Nigeria. The first (NCT03874663) is to study the acceptability and performance of HIVST in a youth population aged 14–24 years, and the second one (NCT 04070287), with the enrolment of youth aged 14–24, is a prospective one-year assessment of five youth participatory interventions. Further research is needed to ensure the feasibility of HIVST, and the adaptation of the best approach for a successful scale up in an integrated and comprehensive package of HIV diagnosis in the context of WCAR. The project ATLAS, which is not a research project,

Table 2
Summary on main results on HIV self-testing in West and Central Africa.

Reference Number	Country	Population	HIV ST kits	Main results
Tonen-Wolyec et al. (2019a)	DRC – Bunia	N = 1,012 University Students	Blood based HIV ST	<ul style="list-style-type: none"> - 81.4% acceptability of HIVST - Better acceptability among students >24-year-old - Acceptability associated with prior knowledge of HIV self-testing - Posttest counseling supported by 86.9% of older students (>24 years old) and by 80.7% of younger students (<24 years old)
Tonen-Wolyec et al. (2019b)	DRC - Kisangani	N = 628 Adolescents (15 to 19 years old)	Blood based HIV ST (Exacto Test HIV kit)	<ul style="list-style-type: none"> - 95.1% acceptability of HIV testing - 96.1% correctly used the self-test
Lyons et al. (2019)	Senegal	N = 1,149 Through convenience sample	Oral test (OraQuick HIV self-test kit)	<ul style="list-style-type: none"> - 94.3% reported using HIVST - 74.5% reported being comfortable using HIVST - 86.1% found the instructions easy to follow
Grésenguet et al. (2017)	Central African Republic – Bangui	N = 300 adult volunteers	Blood based test (Exacto Test HIV kit)	<ul style="list-style-type: none"> - 96.9% of HIV self-test were correctly interpreted - 91.6% correctly performed the HIV self-test and 23% asked for oral assistance
Izizag et al. (2018)	DRC - Kikwit university	N = 290 University Students Media	Not mentioned	<ul style="list-style-type: none"> - Acceptability of HIVST: 81.4% - Willingness to confirm a HIV positive self-test result at a local health care facility: 66.1%
Tun et al. (2018)	Nigeria	N = 257 MSM Median age 25 years old	Oral test (OraQuick HIV antibody test)	<ul style="list-style-type: none"> - 97.7% reported having used the HIV self-test kits - Post-test counseling was sought for all 14 who tested positive
Tonen-Wolyec et al. (2018)	DRC – Kisangani and Bunia	N = 322 General population and health care workers Mean age = 30 years old	Blood based test (Exacto Test HIV kit)	<ul style="list-style-type: none"> - 79.6% of participants correctly understood the instructions for use of the test - 90.2% of tests were correctly interpreted

launched in 2018 falls within this approach, by targeting populations that have never been tested before and key populations. The project provided these populations with a total of 500,000 HIV oral self-tests in three francophone countries of West Africa, Mali, Senegal and Côte d'Ivoire. The study will document the impact of HIVST as a complementary screening strategy, will assess the necessary requirements for the scale-up of HIVST strategy by local governments and will identify the distribution models that are most cost-effective (UNITAID, 2019). Finally, the lack of studies and interventions on HIVST in WCAR represent a challenge to the effective implementation of HIVST in WCAR. Very few studies and interventions have explored the different aspects of the implementation of HIVST in the context of the WCAR. Additional research groups should focus on identifying the challenges and opportunities for the successful implementation of HIVST in the cultural, political and social context of the WCAR. We are urgently calling for more research in this region to inform stakeholders of HIV self-testing opportunities. This could be an additional strategy to increase the first 90 in this region.

Conclusion

HIVST represents an opportunity and a key to unlock the first 90 in WCAR and catch up to the rest of the continent and the world. With the urgent need to implement such an opportunity in WCAR, a framework that would take into account priority populations such as key populations and also adolescents and men is needed. This strategy should rely on community health workers and should be integrated into national strategic policies. Additional research is needed to address some challenges that would remain, such as linkage to care and cost-effectiveness of this strategy.

Conflict of interest

The authors have no conflicts interest to declare.

Funding source

This opinion paper was not funded.

Ethics approval and consent to participate

This study was opinion paper and ethical approval was not requested.

References

- Adeagbo O, Herbst C, Blandford A, McKendry R, Estcourt C, Seeley J, et al. Exploring people's candidacy for mobile health-supported HIV testing and care services in rural KwaZulu-Natal, South Africa: qualitative study. *J Med Internet Res* 2019;21(November(11)):e15681.
- AVERT. West and Central Africa 90-90-90 progress. 2018 [Available from]: <https://www.avert.org/infographics/west-and-central-africa-90-90-90-progress-2018>. [Accessed 27 June 2019].
- AVERT. HIV and AIDS in West and Central Africa Overview. 2020 [Available from]: <https://www.avert.org/hiv-and-aids-west-and-central-africa-overview>. [Accessed 27 June 2019].
- AVERT. HIV and AIDS in East and Southern Africa regional overview. 2020 [Available from]: <https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/overview>. [Accessed 27 June 2019].
- Bain LE, Ditah CM, Awah PK, Ekwuke NC. Ethical implications of HIV self-testing: the game is far from being over. *Pan Afr Med J* 2016;25:114–6 [Available from]: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5325486/>. [Accessed 2 February 2020].
- Balán IC, Lopez-Rios J, Nayak S, Lentz C, Arumugam S, Kutner B, et al. SMARTtest: a smartphone app to facilitate HIV and syphilis self- and partner-testing, interpretation of results, and linkage to care. *AIDS Behav* [278_TD\$DIFF]2020; 24(5):1560–73. doi:<http://dx.doi.org/10.1007/s10461-019-02718-y>.

- Bateganya M, Abdulwadud OA, Kiene SM. WITHDRAWN: Home-based HIV voluntary counseling and testing in developing countries. *Cochrane Database Syst Rev* 2010;(February (2)):CD006493.
- Camlin CS, Ssemmondo E, Chamie G, El Ayadi AM, Kwarisiima D, Sang N, et al. Men “missing” from population-based HIV testing: insights from qualitative research. *AIDS Care* 2016;28(Suppl. 3):67–73.
- Choko A, MacPherson P, Webb EL, Willey BA, Feasy H, Sambakunsi R, et al. Uptake, accuracy, safety, and linkage into care over two years of promoting annual self-testing for HIV in Blantyre, Malawi: a community-based prospective study. *PLoS Med* 2015;12(September (9)):e1001873. doi:http://dx.doi.org/10.1371/journal.pmed.1001873.
- Choko AT, Nanfuka M, Birungi J, Taasi G, Kiseembo P, HELLERINGER S. A pilot trial of the peer-based distribution of HIV self-test kits among fishermen in Bulisa, Uganda. *PLoS One* 2018;13(11):e0208191.
- Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and acceptability on HIV self-testing among key populations: a literature review. *AIDS Behav* 2015;19(November (11)):1949–65.
- Grésenguet G, Longo JDD, Tonen-Wolyec S, Mboumba Bouassa R-S, Bélec L. Acceptability and usability evaluation of finger-stick whole blood HIV self-test as an HIV screening tool adapted to the general public in the Central African Republic. *Open Aids J* 2017;11:101–18.
- Harichund C, Moshabela M. Acceptability of HIV Self-Testing in Sub-Saharan Africa: scoping study. *AIDS Behav* 2018;22(2):560–8.
- Hatzold K, Gudukeya S, Mutseta MN, Chilongosi R, Nalubamba M, Nkhoma C, et al. HIV self-testing: breaking the barriers to uptake of testing among men and adolescents in sub-Saharan Africa, experiences from STAR demonstration projects in Malawi, Zambia and Zimbabwe. *J Int AIDS Soc* 2019;22(March (1)):e25244.
- Indravudh PP, Choko AT, Corbett EL. Scaling up HIV self-testing in sub-Saharan Africa: a review of technology, policy and evidence. *Curr Opin Infect Dis* 2018;31(February (1)):14–24.
- Ingold H, Mwerinde O, Ross AL, Leach R, Corbett EL, Hatzold K, et al. The Self-Testing Africa (STAR) Initiative: accelerating global access and scale-up of HIV self-testing. *J Int AIDS Soc* 2019;22(March (1)):e25249.
- Izizab B, Situakibanza H, Mbutiwi T, Ingwe R, Kiazayawoko F, Nkondila A, et al. Factors associated with acceptability of HIV self-testing (HIVST) among university students in a Peri-Urban Area of the Democratic Republic of Congo (DRC). *Pan Afr Med J* 2018;27(31):248. doi:http://dx.doi.org/10.11604/pamj.2018.31.248.13855.
- Johnson C, Baggaley R, Forsythe S, van Rooyen H, Ford N, Napierala Mavedzenge S, et al. Realizing the potential for HIV self-testing. *AIDS Behav* 2014;18(July (4)):391–5.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). New HIV infections by mode of transmission in West Africa: A multi-country analysis. UNAIDS; 2010.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). Global HIV & AIDS statistics –2019 fact sheet. [318_TD\$DIFF]UNAIDS; 2020 [Available from]: <https://www.unaids.org/en/resources/fact-sheet>. [Accessed 27 June 2019].
- Joint United Nations Programme on HIV/AIDS (UNAIDS). West and Central Africa [Available from]: <https://www.unaids.org/en/regionscountries/westandcentralafrica>. [Accessed 27 June 2019] 2020.
- Kharsany ABM, Karim QA. HIV Infection and AIDS in Sub-Saharan Africa: current status, challenges and opportunities. *Open AIDS J* 2016;10(April (1)):34–48.
- Levi J, Raymond A, Pozniak A, Vernazza P, Kohler P, Hill A. Can the UNAIDS 90-90-90 target be achieved? A systematic analysis of national HIV treatment cascades. *BMJ Glob Health* 2016;1(2):e000010.
- Lippman SA, Gilmore HJ, Lane T, Radebe O, Chen Y-H, Mlotshwa N, et al. Ability to use oral fluid and fingerstick HIV self-testing (HIVST) among South African MSM. *PLoS One* 2018;13(11):e0206849.
- Lyons CE, Coly K, Bowring AL, Liestman B, Diouf D, Wong VJ, et al. Use and acceptability of HIV self-testing among first-time testers at risk for HIV in Senegal | SpringerLink. *AIDS Behav* 2019;23(Suppl. 2):130–41.
- Maheswaran H, Petrou S, MacPherson P, Choko AT, Kumwenda F, Lalloo DG, et al. Cost and quality of life analysis of HIV self-testing and facility-based HIV testing and counselling in Blantyre, Malawi. *BMC Med* 2016;(February (14)):34.
- Makusha T, Knight L, Taegtmeier M, Tulloch O, Davids A, Lim J, et al. HIV self-testing could “Revolutionize Testing in South Africa, but It Has Got to Be Done Properly”: perceptions of key stakeholders. *PLoS One* 2015;10(3):e0122783.
- Mulubwa C, Hensen B, Phiri MM, Shanaube K, Schaap AJ, Floyd S, et al. Community based distribution of oral HIV self-testing kits in Zambia: a cluster-randomised trial nested in four HPTN 071 (PopART) intervention communities. *Lancet HIV* 2019;6(February(2)):e81–92.
- OraSure Technologies. OraSure Technologies - OraQuick® Self-Test [Internet], [cited 2019 Oct 31]. [Available from]: <https://www.orasure.com/products-infectious/products-infectious-oraquick-self-test.asp>. OraSure Technologies 2013.
- PEPFAR. Annual Report to congress 15 years of saving lives through American generosity and partnership [Available from] <https://www.state.gov/wp-content/uploads/2019/08/PEPFAR-2018-Annual-Report-to-Congress.pdf>. [Accessed 4 February 2020]. 2018.
- Pintye J, Drake AL, Begnel E, Kinuthia J, Abuna F, Lagat H, et al. Acceptability and outcomes of distributing HIV self-tests for male partner testing in Kenyan maternal and child health and family planning clinics. *AIDS* 2019;33(8):1369–78.
- Resource Mobilization. Resource Mobilization – The Global Fund to Fight AIDS, Tuberculosis and Malaria [Available from]: <https://www.theglobalfund.org/en/replenishment>. [Accessed 2 February 2020]. 2020.
- Sibanda EL, d’Elbée M, Maringwa G, Ruhode N, Tumushime M, Madanhire C, et al. Applying user preferences to optimize the contribution of HIV self-testing to reaching the “first 90” target of UNAIDS Fast-track strategy: results from discrete choice experiments in Zimbabwe. *J Int AIDS Soc* 2019;22(March (1)):e25245.
- Sileo KM, Fielding-Miller R, Dworkin SL, Fleming PJ. What role do masculine norms play in men’s HIV testing in Sub-Saharan Africa?: A scoping review. *AIDS Behav* 2018;22(August (8)):2468–79.
- The Lancet HIV, The Lancet HIV. Divergent paths to the end of AIDS [Editorial]. *The Lancet HIV*, [Available from]: [https://www.thelancet.com/journals/lanhiv/article/PIIS2352-3018\(17\)30157-1/fulltext](https://www.thelancet.com/journals/lanhiv/article/PIIS2352-3018(17)30157-1/fulltext). [Accessed 4 February] 9 *The Lancet HIV* 2017.
- Tonen-Wolyec S, Batina-Agasa S, Muwonga J, Fwamba N’kulu F, Mboumba Bouassa RS, Bélec L. Evaluation of the practicability and virological performance of finger-stick whole-blood HIV self-testing in French-speaking sub-Saharan Africa. *PLoS One* 2018;13(January (1)):e0189475. doi:http://dx.doi.org/10.1371/journal.pone.0189475.
- Tonen-Wolyec S, Mbopi-Kéou FX, Batina-Agasa S, Kalla G, Noubom M, Bouassa RS, et al. Acceptability of HIV self-testing in African Students: a cross-sectional survey in the Democratic Republic of Congo - PubMed. *Pan Afr Med J* 2019a;33:83. doi:http://dx.doi.org/10.11604/pamj.2019.33.83.18586.
- Tonen-Wolyec S, Batina-Agasa S, Muwonga J, Mboumba Bouassa R-S, Kayembe Tshilumba C, Bélec L. Acceptability, feasibility, and individual preferences of blood-based HIV self-testing in a population-based sample of adolescents in Kisangani, Democratic Republic of the Congo. *PLoS One* 2019b;14(7):e0218795.
- Tonen-Wolyec S, Mbopi-Kéou FX, Koyalta D, Filali M, Batina-Agasa S, Bélec L. Human immunodeficiency virus self-testing in adolescents living in Sub-Saharan Africa: an advocacy - PubMed. *Hum Immunodef Virus Self-Test Adolesc Living Sub-Sahar Afr Advocacy* 2019c;60(4):165–8.
- Tun W, Vu L, Dirisu O, Sekoni A, Shoyemi E, Njab J, et al. 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. *J Int AIDS Soc* 2018; (Suppl. 5):e25124. doi:http://dx.doi.org/10.1002/jia2.25124.
- UNAIDS. UNAIDS Data. 2019 [Available from]: https://www.unaids.org/sites/default/files/media_asset/2019-UNAIDS-data_en.pdf. [Accessed 27 June 2019].
- UNAIDS. West and Central Africa left behind in global HIV response [Internet] [cited 2019 Jun 19]. Available from: https://www.unaids.org/en/resources/press-centre/pressreleaseandstatementarchive/2017/december/20171205_wca. [Accessed 27 June 2019]. 2020.
- UNITAID, UNITAID. The ATLAS project in West Africa: a big innovation at local level to achieve the global HIV screening goal by 2020 [Internet], Unitaid. [cited 2019 Jun 19]. [Available from]: <https://unitaid.org/news-blog/avec-le-projet-atlas-en-afrique-de-louest-une-innovation-majeure-au-plus-pres-du-terrain-pour-atteindre-lobjectif-mondial-lie-au-depistage-du-vih-dici-2020>. [Accessed 2 February 2020] UNITAID 2019.
- United Nations Population Fund. Adolescents and Youth report: West and Central Africa. 2018.
- van Dyk AC. Client-initiated, provider-initiated, or self-testing for HIV: What do South Africans prefer?. *J Assoc Nurses AIDS Care* 2013;24(6):e45.
- van Rooyen H, Tulloch O, Mukoma W, Makusha T, Chepuka L, Knight LC, et al. What are the constraints and opportunities for HIVST scale-up in Africa? Evidence from Kenya, Malawi and South Africa. *J Int AIDS Soc* 2015;18:19445.
- WHO. HIV self-testing [Available from] https://www.who.int/hiv/topics/self-testing/HIVST-policy_map-jul2019-a.png?ua=1. [Accessed 27 June 2019]. 2020.
- World Health Organization. WHO recommends HIV self-testing. World Health Organization (WHO) [Available from]: <https://apps.who.int/iris/bitstream/handle/10665/251549/WHO-HIV-2016.21-eng.pdf;jsessionid=60B7484F1C89B7D32054E1B2C41210B6?sequence=1>. [Accessed 27 June 2019]. 2020.