Practicability and effectiveness of the unassisted HIV self-testing compared to the directly assisted HIV self-testing in the Democratic Republic of the Congo: A Randomized Implementation Trial

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Abstract

Background. HIV self-testing (HIVST) may be use free or assisted by health care workers. The aim of this trial was to assess the practicability and effectiveness of unassisted HIVST (UH) versus directly assisted HIVST (DAH) in field settings in the Democratic Republic of the Congo (DRC).

Methods. A non-inferiority evaluation using a blood-based HIV self-test was conducted in Kisangani, DRC. Participants were randomized in a 1:1 ratio to UH or DAH. Practicability was defined as the successful performance and the correct interpretation of the result. The linkage to care and the willingness to buy self-test constituted the outcome for HIVST effectiveness.

Results. The rate of successful performance of the test was same (93.2%) in UH and DAH. The rate of correct interpretation of the results was 86.9% in UH versus 93.2% in DAH yielding the difference of -6.3% (95% CI: -10.8 to 2.5). UH significantly decreased the rate of correct interpretation of results as compared to DAH (aRR: 0.60 [95% CI: 0.36 to 0.98]; P=0.019). None significant difference was found between two arms in evaluating the linkage to care. Willingness to buy HIV self-test was higher in UH as compared to DAH (92.3% versus 74.1%; aRR: 4.20 [95% CI: 2.42 to 7.32]; P<0.001).

Conclusion. This study demonstrates that both UH and DAH show high level of practicability and effectiveness for HIVST. However, additional support tools will be need to improve the practicability of the test in UH. Taken together, UH as well as DAH should improve access to HIV testing in DRC.

Trial registration: PACTR201904546865585. Registered 03 April 2019 - Retrospectively registered, https://pactr.samrc.ac.za/TrialDisplay.aspx?TrialID=6032

Background

Despite the progress in scaling up HIV testing worldwide, 25% of all people living with HIV remain unaware of their HIV infection [1]. Recent modelling suggests the global 90–90–90 targets will not be achieved by 2020 unless efforts are increased, more focused, and innovations are used strategically [2, 3]. HIV self-testing (HIVST) is one innovation that has potential to increase uptake of HIV testing, particularly among populations not well-served by existing HIV testing services [4, 5]. The HIVST may be use free (unassisted) or directly assisted by health care workers.

According to the world health organisation (WHO) [6], the directly assisted HIVST (DAH) refers to trained providers, peer educators or community health workers giving an individual an in-person demonstration before or during HIVST on how to perform the test and interpret the test result. This approach can be used to support self-testers with disabilities, low literacy levels, and individuals who may require or request direct assistance in the form of in-person demonstrations and explanations before, during and/or after testing. On the other hand, the unassisted HIVST (UH) refers to when an individual self-tests for HIV and uses an HIVST kit with instructions for use provided by the manufacturer without the help of a trained provider or peer [6].

The individuals' ability to use HIV self-tests and to interpret the results correctly remains under debated [7-14]. Several studies in sub-Saharan Africa assessing the practicability of the DAH [4, 15], the UH [8, 10, 16, 17], and the both together [18] showed that the difficulties in interpreting the self-test results was the main barrier to achieving the performance of the self-test [9]. The errors in interpreting of the self-test can be controlled in DAH, in the other hand the gap will persist in UH due to lack of sufficient support tools [8, 9]. Consequently, all misinterpreted self-test could have implications for the risk of spreading HIV especially when a positive test is read as negative [19]. To our knowledge, few field studies have sought to compare the practicability of the HIVST with the unassisted *versus* directly assisted approach. While it is equally important to orient, on the basis of scientific evidence, HIV programs in a programmatic implementation of the HIV self-testing.

In the Democratic Republic of Congo (DRC), where 46% of people living with HIV do not know their HIV status [20], the policy support HIVST is under development [21]. Although some field evidence on the practicability and performance of DAH has been reported in the general population [8] and key populations such as female sex workers [13] and young adolescents [22], to our knowledge, no study has yet compared UH to DAH in the DRC. This study aims to assess the practicability and effectiveness of UH *versus* DAH using a randomized, non-blinded, non-inferiority trial among high-risk population for HIV infection acquisition in health facilities in Kisangani, Democratic Republic of the Congo.

Methods

Study design and participants. This randomized implementation trial was conducted between August and November, 2018 in Kisangani, DRC. Trained research assistants (physicians or nurses) enrolled participants at four facilities (University hospital of Kisangani, General Hospital of Kabondo, and the health centers of Neema and Saint Joseph). Participants were eligible for the study if they were between 18 and 49 years, at high risk for acquiring HIV infection, unknowing their HIV status, lived or worked in Kisangani for at least 6 months prior to enrolment, and available and accessible by phone. High risk for HIV infection acquisition was defined as sexually active participants with: a history of unprotected intercourse with one or more partners of unknown HIV sero-status within the past 6 months, new sex partners in the past 6 months, symptoms of sexually transmitted infections (STIs) in the same period, commercial sex activity, or being in a known HIV discordant partnership [18].

Randomization procedures. Participants were randomized to a ratio of 1:1 through block randomization (block size 4, 6, 8). Eligible participants were randomly assigned to one of two self-testing groups (Fig. 1): DAH or UH by using a sealed randomization envelope sequentially. Because of the nature of intervention, study participants and study staff could not be blinded. However, study staff and participant were unaware of the assignment until the envelope is opened.

Study procedures and data collection. The blood-based HIVST was done using the Exacto® Test HIV (Biosynex, Strasbourg, France) self-test kit which included A3 format color printed pictorial simplified instructions for use in French, Lingala, and Swahili, as previously reported [8]. After obtaining written informed

consent and before randomization, participants were administered a baseline questionnaire that measured their demographic characteristics, sexual behaviour, and HIV testing history using self-administrated questionnaire, then they received adequate pre-test HIV counselling.

In the DAH arm, a brief, 10-min face-to-face demonstration of how to use the self-test familiarized participants with the contents of the self-test kit. After this, participant were asked to perform the HIV self-test in a confidential room supervised by trained research assistants (supervisors). Once the test was completed and the participant had recorded the practicability report on a standardized sheet. The supervisor-interpreted results and the appeals for oral assistance were recorded by supervisor on a standardized sheet. Not that, the supervisors had received rigorous training, including how to talk to participants asking for any support concerning the HIVST.

In the UH arm, participants were asked to perform the HIV self-test at home or in a convenient private location, and read the results guided by the instructions for use without 10-min demonstration and supervision. Participant received training to self-record within 10 minutes after performing the self-test the practicability report on a standardised sheet. Furthermore, participant was invited to return with test cassette and the standardised sheet (putted in a sealed envelope) to the facility within 12–72 h for rereading of test results and additional evaluation. Telephone assistance was offered to the participant if needed. The need for assistance from a trusted person was self-declared by the participant, and recorded by investigators.

In each study arm, confirmatory HIV test using national algorithm rapid tests [21, 22] was performed after HIVST if the test was reactive. If seropositivity was confirmed, participants were referred to the care services. Post-test counselling were provided to participant if needed. The standardised sheet included the information on the confirmation of blood presence in the square well of the test, appearance of a control strip on the self-test, and the overall interpreted self-test result. The overall results were recorded as one of three outcomes: (i) may have HIV (preliminary positive); (ii) don't have HIV (preliminary negative); and (iii) test not working (invalid). There was a 24-hour helpline for participants in which the anonymity was assured by recommending participants to introduce themselves using their three-character randomization code. The investigator recorded all information about the telephone assistance on a follow-up sheet.

An exit questionnaire was self-administered after all testing process. It concerned the satisfaction questionnaire, the willing to by HIV self-test kit and the unit purchase price of the test in United State dollar (USD).

Study Outcomes. The primary outcomes was the difference in practicability of the Exacto® Test HIV (Biosynex) self-test kit, comparing the UH *versus* DAH. Practicability was defined as the successful performance of HIV self-test and the correct interpretation of the HIV self-test result. The successful performance of the HIV self-test was conditioned by the presence of the control strip. Secondary outcomes included the proportions of participants who requested for assistance, the retention rate, the linkage to care, and willing to buy HIV self-test kit if locally available. Retention rate was defined as the number of included participant who completed all evaluation process through the follow-up period. We determined the above secondary outcomes as our measures of implementation effectiveness of HIVST comparing UH to DAH in field conditions of the DRC.

Sample size. A one-sided design to test non-inferiority between groups was used, specifically to test the hypothesis that the practicability of UH is objectively non-inferior to that of DAH. The sample size was estimated using the following formula:

$$n = 1/\Delta_L^2 \left(Z_{1-\alpha}\sqrt{[\pi_N(1-\pi_N)+\pi_R(1-\pi_R)]} + Z_{1-\beta}\sqrt{[2\pi_R(1-\pi_R)]}\right)^2$$

with πN and πR the percent of practicability's success of UH and DAH, respectively; with α = 0.05 for a 95% confidence interval; and b = 0.2 for a power of 80%; with the non-inferiority limit (ΔL) corresponding to the greatest loss of effectiveness that is possible to consent [23]. The non-inferiority limit was conventionally set at −10 %, guided by previous studies [8, 13, 22]. We assumed that πN=98% and πR=88%. The sample size (n=456) was increased by 10% of lost to follow up, giving a final sample size of 530.

Statistical analysis. Primary analysis involved descriptive statistics using mean (standard deviation) or median (interquartile range) for normally distributed or skewed distribution, respectively, then a comparison of outcome measures in study arms was computed by using Pearson's chi-squared test for categorical data or Student *t* test for means. For the analysis of the primary study outcome, we compared the successful performance of HIV self-test and the correct interpretation of HIV self-test results within individuals between the two arms. For the analysis of the secondary study outcome, we compared the requested for assistance, retention rate, linkage to care, and willing to buy HIV self-test kit if locally available between the two arms. A one sided Wald asymptotic test was used to assess for non-inferiority. The confidence interval for the difference was based on the Wald asymptotic method, at an alpha level of 0.05 corresponding to 95 % confidence limits. Non-inferiority was defined as a lower limit > −10 of the 95% CI around the difference in outcomes. Percent agreement and Cohen's κ coefficient were used to estimate agreement between the participant-interpreted results and investigator-interpreted results.

The satisfactions were assessed using arbitrary quantitative Likert scale based on four different scale ranging from 1 (most difficult), 2 (difficult), 3 (easy) to 4 (very easy). The mean and standard deviation for Likert scale data were calculated and compared between the two arms, using Student *t* test.

In order to determine the effects of interventions (UH *versus* DAH) on primary and secondary outcomes, risk ratios from regression of Poisson were evaluated, using two-sided statistical tests with significance level set at $P < 0.05$. Note that, participants who were not successfully followed up were not included in the analyses as it was not possible to determine the primary and secondary outcomes for them. All analyses were done with SPSS 20.0 (SPSS Inc, Chicago, IL).

Ethical statement. This study received ethical approval from the ethics committee of the Health Public School of Kinshasa's University. All participants provided written informed consent. No compensation were provided for participating in this study. The study was conducted by the Research, Teaching, and Care Unit of the Faculty of Medicine and Pharmacy of Kisangani's University. This trial was retrospectively registered by the Pan African Clinical Trial Registry (www.pactr.org) database, ID number PACTR201904546865585.

Results

Recruitment and participant characteristics. Between August and November, 2018, a total of 748 participants were assessed for eligibility. Among those, 530 were enrolled and randomized, however follow-up was completed for 500 (94.3%) comprising 263 (99.2%) in the DAH arm and 237 (89.4%) in the UH arm. Note that, 28 persons were lost to follow up in the UH arm and 2 participants withdrew from study in DAH arm (Fig. 1).

Participants in the two study groups had largely similar characteristics at baseline (Table 1). In brief, participants were predominantly female, aged 25 to 49 years, currently single. Majority was student and had university education level. All participants had evidence of high risk behaviours. Indeed, more than four-fifth participants had unprotected intercourse with one or more partners in the past six months. Nearly half of the participants had tested for HIV in the past, but majority had no knowledge about HIVST before this survey.

Practicability of HIV self-test kit. As shown in Table 2, the rate of successful performance of HIV self-test was high in two arms without difference (93.2% in UH arm versus 93.2% in DAH arm). The rate of correct interpretation of the HIV self-test results was 86.9% in UH arm and 93.2% in DAH yielding the absolute difference of -6.3% (95% CI: -10.8 to 2.5), non-inferiority not shown. In evaluating interpretation of results in two arms (Table 3), a total of 25% of positive results were misinterpreted as negative in DAH group whereas 16.7% of positive results were misinterpreted as invalid in UH group. Overall the Cohen's k coefficients assessing the concordance between the results of reading by participants and the expected results were 0.69 versus 0.44 in DAH and UH, respectively, giving substantial concordance in DAH and moderate concordance in UH.

The determining of the effects of UH on the practicability by using regression of Poisson showed that UH significantly decreased the rate of correct interpretation of results as compared to DAH (adjusted RR: 0.60 [95% CI: 0.36 to 0.98]; P=0.019) (Table 2).

Finally, according to the Likert scale of satisfaction as shown in Table 4, the responses on how participants found the interpretation of HIV self-test result showed significantly higher mean note in DAH compared to UH (2.4/4 versus 2.3/4; *P*=0.026).

Secondary outcomes. None significant difference was found between two arms in evaluating the request for help and the linkage to care (Table 2). However, the retention rate was significantly lower in UH arm as compared to DAH arm (89.4% *versus* 100%; difference: -10.6 [95% CI: -18.9 to 2.9]; adjusted RR: 0.13 [95% CI: 0.03 to 0.51]; P=0.004). Finally, willingness to buy HIV self-test kit was higher in UH arm than in DAH arm (91.6% *versus* 74.1%; difference: 18.2 [15.1 to 21.8]; adjusted RR: 4.20 [95% CI: 2.42 to 7.32]; P<0.001) (Table 2). The mean of self-test purchase price was estimated at 2.80 USD in the UH arm while it was 2.96 USB in the DAH arm.

Discussion

Our study reports on a trial using blood-based and facility-based HIVST conducted in Kisangani, DRC to evaluate the practicability and effectiveness of UH *versus* DAH using a randomized, non-blinded, non-inferiority trial among high-risk population for HIV infection acquisition. This study demonstrates in the cultural context of Kisangani that both UH and DAH showed high the rate of successful performance of HIV self-test and correct interpretation of HIVST results. Taken together, this study indicate that UH significantly decreased the rate of correct interpretation of results as compared to DAH. Additionally, our findings show that UH as well as DAH were effective in scaling up HIV testing and linking seropositive person to care even if the will to buy an HIV test was significantly elevated in the UH arm.

In DRC, the progress toward achieving the first 90 target is slower. Thus, a major shift will be needed in the approach to testing to improve effectiveness and efficiency in finding those with an undiagnosed HIV infection [24]. This study is a great opportunity to shed light on both approaches for HIVST distribution in understanding their practicability and effectiveness. Although the rate of successful performance of HIV self-test were high in each arm in our series, the error rate was not also different in UH *versus* DAH contrary to what Asiimwe and colleagues had found in Uganda where high error rate was observed when participants performed the oral test in UH [18]. Furthermore, greater attention to training before testing may be needed to optimize the use of the HIV self-test in DAH approach [9, 16, 18].

Although previous studies found no difference in interpretation between self-testers and health-care workers, our findings showed that the concordance in interpretation was substantial between self-testers and health-care workers in DAH with Cohen's k coefficients of 0.69 whereas it was moderate in UH with Cohen's k coefficients of 0.44. Difficulties in interpreting the results have frequently been reported in the literature with difference according the used approach [8, 9, 13, 22]. Given that the misinterpretation of the positive results could have negative consequences in the control of the HIV epidemic [19], and that HIVST is considered a test for triage [6, 24], a recent systematic review showed that the positive results were frequently misinterpreted as invalid (2.7 to 6.7%) in studies using the DAH, whereas in those using the UH, the reactive results were often misinterpreted as nonreactive (0.01 to 4.8%) [9]. Nevertheless, our findings show the opposite with 25% of positive results which were misinterpreted as negative in DAH arm and 16.7% of positive results which were misinterpreted as invalid in UH arm. As previously demonstrated, the low educational level could be another explanatory variable beyond interventions (UH and DAH) [8, 11, 13] because in our series, the proportion of participants with no formal education or primary school was not negligible.

The impact of HIVST in the continuum of care is still poorly documented in sub-Saharan Africa. A field study in Zambia demonstrated a high rate (90%) of linkage to care after HIVST. In our series, non-inferiority of UH concerning the retention rate was not shown. Asiimwe and colleagues observed in Uganda that 5 % of participants in the unsupervised self-test arm did not return to report the test result or complete the exit interview [18]. Because of the confidential manner in which self-tests were performed in UH arm, the study team were not able to tract lost individuals to follow-up. Further counselling may be needed to motivate individuals who self-test in UH approach to return to the facility for confirmatory tests, post-counselling and care. However, in our series, most participants who tested HIV seropositive were linked to care in UH arm without difference between UH and DAH, thereby indicating the potential value of UH as way to test and treat person with HIV. However, the monitoring and evaluation of UH remains a real challenge [25].

The cost of an HIV self-test kit has been identified as a potential barrier to adoption, willingness to use, purchase, and the uptake of HIVST, particularly among people in poor-resource settings as Congolese [26-28]. In our series, willingness to buy HIV self-test kit was higher in UH arm than in DAH arm (91.6% *versus* 74.1%). This is supported by a systematic review by Figueroa and colleagues reporting that participants were more willing to pay for unsupervised HIVST than for supervised HIVST, which authors hypothesize to be due to the perception that supervised HIVST is similar to clinic-based voluntary counselling and testing, which is often subsidized in public health care settings [9]. Mokgatle and Madiba showed that the willingness of student in South Africa to purchase a self-test kit was 74.7% without differentiating that this concerned UH or DAH [29]. Assuming that stated willingness to pay in a health research survey likely overestimates actual HIVST purchasing behaviours, market uptake of HIVST is almost certain to be far from optimal. Public funding for HIVST programs would likely improve uptake, and a relevant future research topic is to explore the optimal combination of service provision and subsidy to maximize HIVST uptake among key populations with low or suboptimal levels of recent HIV testing [25].

Strengths and limitations. The strengths of this survey lie in the randomization, which reduced potential confounding factors between study arms. To our knowledge, this is the first trial in a French speaking country of Africa assessing the practicability and effectiveness of UH *versus* DAH. Among the limitations of this study, re-reading by the research team of self-test device brought back by participants in sealed envelopes could lead to an error in test interpretation because other studies using the oral fluid-based self-test have shown that delayed re-reading of used oral self-tests is not currently a valid methodological approach to quality assurance and monitoring and may overestimate true HIV-positivity [30]. Our protocol had validated the re-reading of the Exacto® HIV self-test because a preliminary investigation assessing the stability of 30 performed self-tests of which 15 positive and 15 negative had shown none modification of the results 72 hours after use.

Conclusion

In conclusion, our study showed that UH is practicable and effective as DAH among individuals at high risk for HIV infection in Kisangani, DRC. Even if errors in reading the self-test's results and gaps in monitoring are observed in UH group, additional support tools such as the instructional videos, the 24-hour helpline contact, the internet based applications, and the standard counselling prior to UH will need to be explored to improve the practicability and linkage to care. Taken together, UH as well as DAH should improve access to HIV testing in DRC.

Abbreviations

aRR: Adjusted risk ratio

CI: Confidence internal

DAH: Directly assisted HIV self-test

DRC: Democratic Republic of the Congo

HIV: Human immunodeficiency virus

HIVST: HIV self-testing

STI: Sexually transmitted infection

UH: Unassisted HIV self-test

WHO: World Health Organization

Declarations

Ethics approval and consent to participate. This study received ethical approval from the ethics committee of the Health Public School of Kinshasa's University. All participants provided written informed consent. No compensation were provided for participating in this study. The study was conducted by the Research, Teaching, and Care Unit of the Faculty of Medicine and Pharmacy of Kisangani's University. This trial was registered by the Pan African Clinical Trial Registry (www.pactr.org) database, ID number PACTR201904546865585.

Consent for publication. Not applicable

Availability of data and materials. All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing interests. The authors declare that they have no competing interests.

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Authors' contributions. ST-W, CKT, SB-A, and LB have conceived and designed the research; ST-W was involved in volunteer's recruitment and follow up; ST-W have performed the experiments; ST-W and RMD performed statistical analyses; ST-W, MPH and LB analysed the results and drafted the manuscript.

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References

1. Global AIDS Update 2018: Miles to go: Closing gaps, breaking barriers, righting injustices. Geneva: Joint United Nations Programme on HIV/AIDS; 2018. Accessed February 21, 2020.
2. Stover J, Bollinger L, Izazola J, Loures L, DeLay P, Ghys P. What is required to end the AIDS epidemic as a public health threat by 2030? The cost and impact of the fast-track approach. PLoS ONE. 2016; 11(6):e0158253.
3. World Health Organisation. HIV self-testing strategic framework a guide for planning, introducing and scaling up HIV testing services. October 2018.
4. Choko AT, Desmond N, Webb EL, Chavula K, Napierala-Mavedzenge S, Gaydos CA, et al. The uptake and accuracy of oral kits for HIV self-testing in high HIV prevalence setting: a cross-sectional feasibility study in Blantyre, Malawi. PLoS Med. 2011; 8: 10 e1001102.
5. Johnson CC, Kennedy C, Fonner V, Siegfried N, Figueroa C, Dalal S, et al. Examining the effects of HIV self-testing compared to standard HIV testing services: a systematic review and meta-analysis. J Int AIDS Soc. 2017; 20(1):21594.
6. World Health Organisation. Guidelines on HIV self-testing and partner notification: supplement to consolidated guidelines on HIV testing services. December 2016. Available at http://apps.who.int/iris/bitstream/handle/10665/251655/9789241549868-eng.pdf;jsessionid=B043673B59952F021C313F076554ABA6?sequence=1 Accessed February 04, 2020.
7. Sarkar A, Mburu G, Shivkumar PV, Sharma P, Campbell F, Behera J, et al. Feasibility of supervised self-testing using an oral fluid-based HIV rapid testing method: a cross-sectional, mixed method study among pregnant women in rural India. J Int AIDS Soc. 2016 Sep 12;19(1):20993.
8. Grésenguet G, Longo JD, Tonen-Wolyec S, Mboumba Bouassa RS, Belec 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; 11:101-118
9. Figueroa C, Johnson C, Ford N, Sands A, Dalal S, Meurant R, et al. Reliability of HIV rapid diagnostic tests for self-testing performed by self-testers compared to health-care workers: a systematic review and meta-analysis. Lancet HIV. 2018; 5(6):e277-e290.
10. Tonen-Wolyec S, Batina-Agasa S, Muwonga J, Fwamba N'kulu F, Mboumba Bouassa RS, Belec 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:e0189475.
11. Tonen-Wolyec S, Mboup S, Grésenguet G, Bouassa RB, Bélec L. Insufficient education is a challenge for HIV self-testing. Lancet HIV. 2018; 5(7):e341.
12. Ortblad KF, Musoke DK, Ngabirano T, Nakitende A, Haberer JE, McConnell M, et al. Female Sex Workers Often Incorrectly Interpret HIV Self-Test Results in Uganda. J Acquir Immune Defic Syndr. 2018; 79(1):e42-e45.
13. Tonen-Wolyec S, Batina-Agasa S, Longo JDD, Mboumba Bouassa RS, Bélec L. Insufficient education is a key factor of incorrect interpretation of HIV self-test results by female sex workers in Democratic Republic of the Congo: a multicenter cross-sectional study. Medicine. 2019 Feb;98(6):e14218.
14. Devillé W, Tempelman H. Feasibility and robustness of an oral HIV self-test in a rural community in South-Africa: An observational diagnostic study. PLoS One. 2019 Apr 15;14(4):e0215353
15. Martínez Pérez G, Steele SJ, Govender I, Arellano G, Mkwamba A, Hadebe M, et al. Supervised oral HIV self-testing is accurate in rural KwaZulu Natal, South Africa. Trop Med Inter Health. 2016; 21: 759–67.
16. Pant Pai N, Sharma J, Shivkumar S, Pillay S, Vadnais C, Joseph L, et al. Supervised and unsupervised self-testing for HIV in high- and low-risk populations: a systematic review. PLoS Med. 2013;10(4):e1001414
17. Kurth AE, Cleland CM, Chhun N, Sidle JE, Were E, Naanyu V, et al. Accuracy and acceptability of oral fluid HIV self-testing in a general adult population in Kenya. AIDS Behav. 2016; 20: 870–79.
18. Asiimwe S, Oloya J, Song X, Whalen CC. Accuracy of Un-supervised Versus Provider-Supervised Self-administered HIV Testing in Uganda: A Randomized Implementation Trial. AIDS Behav. 2014 December; 18(12): 2477–2484.
19. Prazuck T, Karon S, Gubavu C, Andre J, Legall JM, Bouvet E, et al. A finger-stick whole-blood HIV selftest as an HIV screening tool adapted to the general public. PloS One. 2016; 11(2):e0146755.
20. HIV testing, Democratic Republic of the Congo. http://aidsinfo.unaids.org/ Accessed February 14, 2020.
21. Programme National de Lutte contre le Sida. Guide de prise en charge intégrée du VIH en République Démocratique du Congo. Available at http://www.pnmls.cd/doc/guide-de-prise-en-charge-integree-du-vih-en-republique-democratique-du-congo.pdf Accessed February 21, 2020.
22. Tonen-Wolyec S, Batina-Agasa S, Muwonga J, Mboumba Bouassa R-S, Kayembe Tshilumba C, Bélec L. Acceptability, feasibility, and individual preferences of bloodbased HIV self-testing in a population-based sample of adolescents in Kisangani, Democratic Republic of the Congo. PLoS ONE.

14(7):e0218795.

23. Elie C, Touzé E. Les essais de non-infériorité. Sang Thrombose Vaisseaux 2012; 24 (2): 93-9 doi:10.1684/stv.2012.0682
24. World Health Organization [WHO]. HIV Self-Testing Strategic Framework: A Guide For Planning, Introducing And Scaling Up HIV Testing Services. Geneva 2018. Available at: https://apps.who.int/iris/bitstream/handle/10665/275521/9789241514859-eng.pdf?ua=1 Accessed February 14, 2020.
25. Steehler K, Siegler AJ. Bringing HIV self-testing to scale in the United States: a review of challenges, potential solutions, and future opportunities. J Clin Microbiol. 2019; 57:e00257-19.
26. Estem KS, Catania J, Klausner JD. HIV Self-Testing: a Review of Current Implementation and Fidelity. Current HIV/AIDS Reports. 2016; 13(2):107±15.
27. Ng OT, Chow AL, Lee VJ, Chen MI, Win MK, Tan HH, et al. Accuracy and user-acceptability of HIV selftesting using an oral fluid-based HIV rapid test. PLoS One. 2012; 7(9):e45168.
28. World Bank Document. Republique Democratique du Congo, Etude sur le decoupage. 2010. http://documents.banquemondiale.org/curated/fr/915621468245668283/pdf/506750ESW0P1041Box353763B001PUBLIC1.pdf Accessed January 11, 2020.
29. Mokgatle MM, Madiba S. High acceptability of HIV self-Testing among technical vocational education and training college students in Gauteng and North West Province what are the implications for the scale up in South Africa? PLoS ONE. 2017; 12(1): e0169765.
30. Watson V, Dacombe RJ, Williams C, Edwards T, Adams ER, Johnson CC. Re-reading of OraQuick HIV-1/2 rapid antibody test results: quality assurance implications for HIV self-testing programmes. J Int AIDS Soc. 2019 Mar;22 Suppl 1:e25234.

Tables

Table 1. Baseline characteristics of study participants by study arms.

Participant characteristics	Directly assisted HIV self-testing (*N*=265)	Unassisted HIV self-testing (*N*=265)	Total (*N*=530)	p-value[a]
Sex, *n* (%)				0.859
Male	104 (39.2)	106 (40.0)	210 (39.6)	
Female	161 (60.8)	159 (60.0)	320 (60.4)	
Age (years), mean (SD)	26.9 (6.7)	26.8 (6.7)	26.9 (6.7)	0.881
Age group, *n* (%)				0.861
Younger 18 to 24 years	114 (43.0)	112 (42.3)	226 (42.6)	
Older 25 to 49 years	151 (57.0)	153 (57.7)	304 (57.4)	
Marital status, *n* (%)				0.589
Single	189 (71.3)	195 (73.6)	384 (72.5)	
Married/partnered	73 (27.5)	65 (24.5)	138 (26.0)	
Separated/divorced or widowed	3 (1.1)	5 (1.9)	8 (1.5)	
Occupation, *n* (%)				0.778
Student	141 (53.2)	136 (51.3)	277 (52.3)	
Employed	63 (23.8)	61 (23.0)	124 (23.4)	
Unemployed	61 (23.0)	68 (25.7)	129 (24.3)	
Educational level, *n* (%)				0.176
No formal education/ Primary school	37 (14.0)	53 (20.0)	90 (17.0)	
College or technical school	101 (38.1)	96 (36.2)	197 (37.2)	
University	127 (47.9)	116 (43.8)	243 (45.8)	
Religion, *n* (%)				0.355
Catholic Christianity	68 (25.7)	52 (19.6)	120 (22.6)	
Protestant or Pentecostal Christianity	77 (29.1)	80 (30.2)	157 (29.6)	
Islam	33 (12.5)	32 (12.1)	65 (12.3)	
Others	87 (32.8)	101 (38.1)	188 (35.5)	
Recruited participants with the coupon method, *n* (%)	88 (33.2)	98 (37.0)	186 (35.1)	0.363
HIV transmission risk factor in the past six months, *n* (%)				
Unprotected intercourse with one or more partners, or new sex partners	227 (85.7)	218 (82.3)	445 (84.0)	0.287
Commercial sex activity	73 (27.5)	86 (32.5)	159 (30.0)	0.218
Symptoms of sexually transmitted infections (STIs)	35 (13.2)	47 (17.7)	82 (15.5)	0.149
Being in a known HIV discordant partnership	6 (2.3)	3 (1.1)	9 (1.7)	0.313
Previously tested for HIV, *n* (%)				0.728
Never tested	135 (50.9)	131 (49.4)	266 (50.2)	
Ever tested	130 (49.1)	134 (50.6)	264 (49.8)	
Previous knowledge about HIV self-testing, *n* (%)				0.584
Yes	89 (33.6)	95 (35.8)	184 (34.7)	
No	176 (66.4)	170 (64.2)	346 (65.3)	

[a] Statistical comparisons were assessed by Pearson Chi-2 test or Student t test.

Table 2. Characteristics of practicability and effectiveness of HIV self-testing in unassisted versus directly assisted approach and effects of unassisted approach on the practicability and effectiveness of HIV self-testing.

Outcome	Directly assisted HIVST	Unassisted HIVST	Difference[a] % (95% CI)	Non-inferiority of unassisted HIVST[b]	Adjusted Risk Ratio[c] (95% CI)	p-value[c]
Primary outcomes, *n/N* (%)						
- Successful performance of HIV self-test	245/263 (93.2)	222/237 (93.7)	0.5 (-0.1 to 1.1)	Yes	1.11 [0.68 to 1.81]	0.817
- Correct interpretation of HIV self-test results	245/263 (93.2)	206/237 (86.9)	-6.3 (-10.8 to 2.5)	No	0.60 [0.36 to 0.98]	0.019
Secondary outcome, *n/N* (%)						
- Assistance requested	110/263 (41.8)	80/237 (33.8)[d]	-8.0 (-13.9 to 2.7)	No	0.87 [0.67 to 1.14]	0.063
- Retention rate[e]	263/265 (99.2)	237/265 (89.4)[f]	-9.8 (-15.9 to 4.9)	No	0.13 [0.03 to 0.51]	0.004
- Linkage to care	7/9 (77.8)	3/4 (75.0)	-2.8 (-9.5 to 5.1)	Yes	0.89 [0.42 to 1.89]	0.763
- Willing to buy HIV self-test kit if locally available[g]	195/263 (74.1)	217/237 (91.6)	17.5 (14.1 to 21.1)	Yes	4.20 [2.42 to 7.32]	<0.001

[a] Difference assessed with Wald asymptotic test;

[b] Non-inferiority was defined as a lower limit > -10 of the 95% CI around the difference in outcomes;

[c] Estimates and confidence intervals are marginal effect from regression of Poisson;

[d] Majority (72/80; 90%) requested assistance via telephone; and 8 (10%) participants declared to have been assisted by a trusted person;

[e] Return rate was defined as the number of included participant who completed the evaluation throughout the follow-up period;

[g] The mean of self-test purchase price was estimated at 2.80 USD per test (limit: 0.33 – 5.41) in the unassisted HIV self-testing group while it was 2.96 USB per test (limit: 0.3 10.25) in the directly assisted group.

CI: Confidence internal; HIVST: HIV self-testing

Table 3. Interpretation of self-test results in the hands of lay users compared to health care worker.

		Directly assisted HIV self-testing				Unassisted HIV self-testing		
		Health care worker results				Health care worker results		
		Positive (n=12)	**Negative** (n=233)	**Invalid** (n=18)		**Positive** (n=6)	**Negative** (n=216)	**Invalid** (n=15)
Participant results	**Positive** (n=12)	9 (75.0%)	3 (1.3%)	0 (0%)	**Positive** (n=20)	5 (83.3%)	15 (6.9%)	0 (0%)
	Negative (n=232)	3 (25.0%)	224 (96.1%)	5 (27.8%)	**Negative** (n=195)	0 (0%)	190 (88.0%)	5 (33.3%
	Invalid (n=19)	0 (0%)	6 (2.6%)	13 (72.2%)	**Invalid** (n=22)	1 (16.7%)	11 (5.1%)	10 (66.7%
		Estimate (% [95% CI])				**Estimate (% [95% CI])**		
Agreement		93.5% [90.5 to 96.5]				84.4% [80.0 to 88.8]		
Cohen's k coefficient		0.69 [0.63 to 0.75]				0.44 (0.38 to 0.50)		

Table 4. Results of the satisfaction questionnaire.

Items	Directly assisted HIV self-testing (*N*=263)	Unassisted HIV self-testing (*N*=237)	Total (*N*=500)	p-value[£]
Satisfaction questionnaire, mean (SD)[*]				
- How did you find the identification of components of the kit	2.3 (0.7)	2.3 (0.7)	2.3 (0.7)	0.358
- How did you find the overall use of the HIV self-test	2.3 (0.5)	2.2 (0.5)	2.2 (0.5)	0.092
- How did you find the interpretation of HIV self-test result	2.4 (0.6)	2.3 (0.5)	2.3 (0.5)	0.026

[*] The scale of response of satisfaction questionnaire was assessed by a Likert scale ranging from 1 (most difficult) to 4 (very easy); the results are mean ± 1 standard deviation (SD)

[£] Statistical comparisons were assessed by Student *t* test for the comparisons of means.

Figures

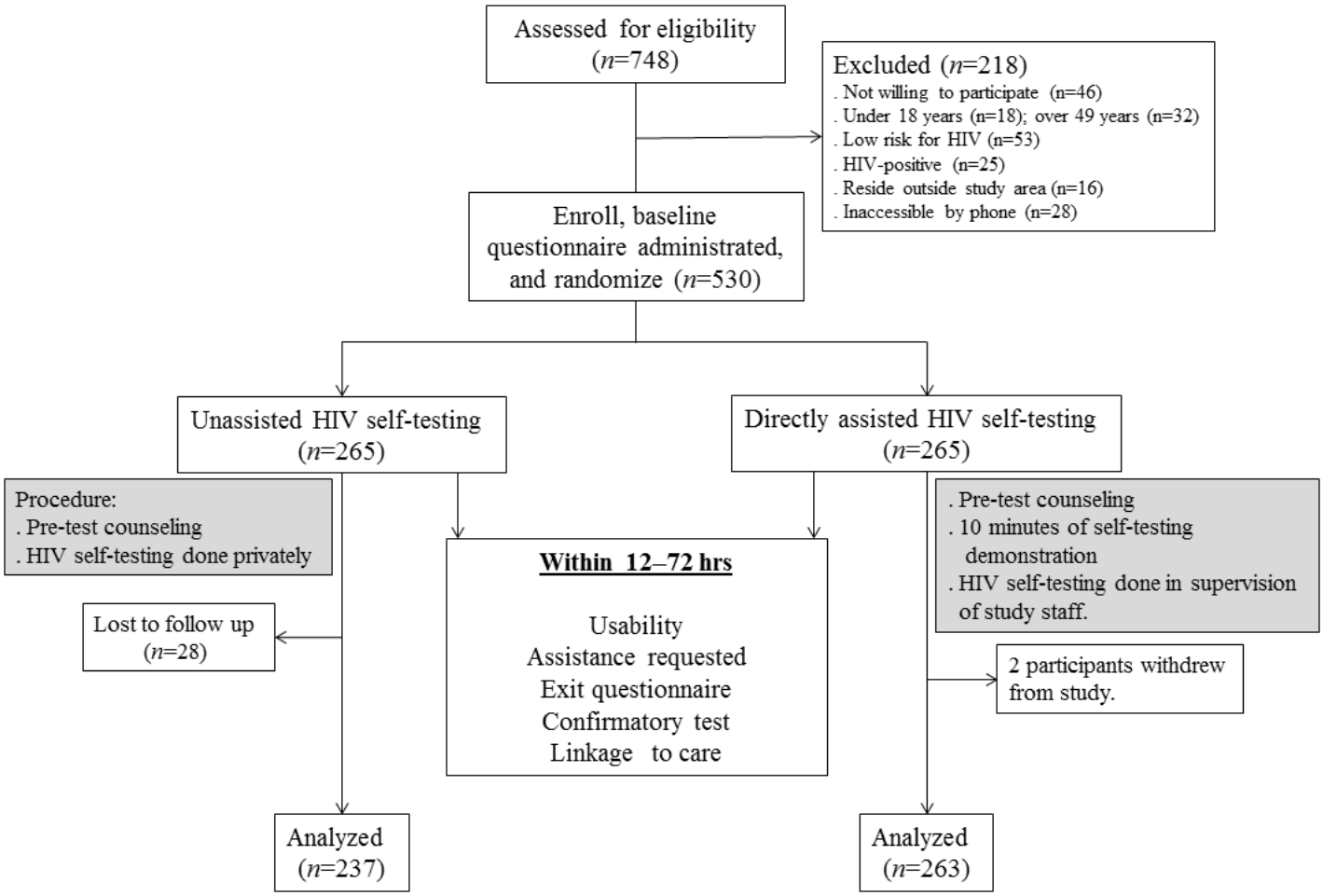

Figure 1

Flow charts showing enrolment, randomization and follow-up of study participants.

Supplementary Files

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