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Comparative acceptability of saliva-based self-testing versus blood-based self-testing for HIV screening among key populations in Kisangani

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Abstract

Introduction HIV self-testing represents a convenient and confidential option for HIV testing—the present study aimed to assess the acceptability of blood versus saliva self-tests among key populations in Kisangani.

Methods This study was an analytical cross-sectional study. Our sample size was 363 subjects. After obtaining their consent, we administered a questionnaire to participants. We asked participants to choose between blood and saliva self-testing. We defined the acceptability of the self-test (saliva or blood) as the intention to use the self-test using a 5-point Likert scale. Descriptive statistics were described by estimating proportions for categorical variables and means with standard deviations for symmetrically distributed quantitative variables. The variable of interest was the acceptability of self-testing, which was dichotomized (Very Likely/Unlikely). The corresponding endpoint was the proportion of participants accepting the self-test in HIV screening. A bivariate analysis was performed to determine factors related to the acceptability of the self-test, using Pearson's Chi-square ($\chi 2$) and ANOVA followed by 2-to-2 multiple comparisons (Bonferroni) for comparison of means and proportions. A progressive stepwise logistic regression model at the 5% threshold included variables with a bi-variate association.

Results The acceptability of the blood self-test was 71.6% compared to 28.4% for the saliva self-test. Factors associated with acceptability of the self-test were higher level of education aOR CI95%: 1.5(0.4–5.5) $p=0.006$; non-use of condoms with casual partners aOR CI95%: 2.8(1.4-5) $p=0.003$; knowledge of the type of self-test aOR CI95%:2.4(1.02–5.65) $p=0.043$ and the obstacle to acceptability of the self-test was non-availability of the self-test aOR CI 95%: 18.9(6.5–54.9) $p<0.0001$.

Conclusion Our study showed that key populations in Kisangani preferred blood self-testing over saliva self-testing. Blood self-tests must be made available to key population groups, as this would improve access to testing for these populations, thus boosting the first UNAIDS target 95.

Keywords Acceptability, Self-testing, HIV, Key populations, Kisangani

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Introduction

Self-testing for HIV represents a practical and confidential option for HIV screening. Since 2016, the World Health Organization (WHO) has recommended HIV self-testing as a safe, reliable, and effective means of reaching individuals who might not undergo testing, including key populations [1].

Key populations are defined groups who, because of specific high-risk behaviors, are at greater risk of HIV infection, regardless of the type of epidemic or local context. They include men who have sex with men, injecting drug users, people in prisons and closed settings, sex workers, and transgender people [2].

HIV self-testing is the process by which an individual collects his/her sample (saliva or blood) using a simple and rapid HIV test, performs the test, and interprets the result whenever and wherever he/she prefers [3]. Several countries across the world have implemented this recommendation. For example, in France, over-the-counter blood self-tests are available in pharmacies and represent an alternative to traditional serological and rapid diagnostic tests [4].

In Africa, several English-speaking countries, including Nigeria, Malawi, Kenya, South Africa, Zambia, Uganda, and Zimbabwe, have implemented self-testing among target populations, such as men who have sex with men (MSM), sex workers (FSW), students, and the general population [5, 6].

In French-speaking Africa, very few countries have shown interest in self-testing, except for Benin, the Central African Republic, Cameroon, and the Democratic Republic of the Congo (DRC) [7].

In 2016, the DRC developed a policy to support HIV self-testing. Since 2019, studies on the feasibility and performance of self-testing among the general population, sex workers, and adolescents have been carried out [8, 9].

According to the WHO, Individuals wishing to know their HIV status can perform an HIV themselves, by taking their own biological sample (gingival fluid or capillary whole blood taken from the finger) and interpreting the result themselves, usually in private or with another trusted person [10]. One of the objectives and commitments of the HIV prevention roadmap for 2025 is to prioritize key populations at high risk of HIV infection [11]. The global strategy to combat HIV-AIDS, 2021–2026 calls for rapidly maximising the impact of affordable and effective HIV testing technologies and practices, and increasing the adoption of differentiated HIV testing strategies where available, in particular HIV self-testing [12].

In the DRC, self-tests provided at healthcare facilities and friendly centers for key populations are of the saliva type. Partners working with key populations did not provide Blood self-tests.

However, in the DRC, the saliva self-tests currently deployed in favor of key populations are not sufficiently used by the beneficiaries (PNLS Report 2022).

Studies assessing the acceptability of saliva self-tests versus blood self-tests have shown contradictory results. In Kenya, Ndungu et al. demonstrated that the majority of men who have sex with men (MSM) believed that blood self-tests could be more accurate than oral self-tests [5]. On the other hand, Mantell et al., who conducted their study among truck drivers in Kenya in 2022, found no preference for either blood or saliva self-testing [13].]. A different observation was made by Ritchwood and colleagues in South Africa in 2017, showing that the majority of participants in the study preferred HIV saliva self-testing instead of the blood type [14]. Similarly, a study conducted in DRC by Tonen et al. in 2019 showed an identical trend among the general population [9]. The study by Tonen et al. was carried out in the general population. In the DRC, key populations are the engine of the HIV epidemic, and HIV self-testing is one of the strategies for HIV prevention in this population group. Too few studies in the DRC have assessed the acceptability of blood or saliva self-testing in key populations. As a result, the country lacks sufficient evidence on the type of self-testing preferred by key populations to facilitate the planning of specific interventions to improve testing in this population group.

The present study aimed to evaluate the acceptability of blood self-tests versus saliva self-tests among key populations in Kisangani.

Methodological approaches

a. Study design

This cross-sectional analytical study compared the acceptability of saliva self-tests versus blood self-tests among key populations.

b. Study setting

The study was conducted in Kisangani from April 20 to May 31, 2023. We chose two friendly centers for key populations (Makiso and Tshopo) for this survey due to their high attendance and easy accessibility for key populations. We also included the medical center of the central prison of Kisangani to facilitate access to the prison population.

c. Study population

This study population was the key population in Kisangani. According to WHO, key populations include men who have sex with men, people who inject drugs, individuals living in prison or other closed settings, sex workers, and transgender people [2]. For this study, four categories of key populations were targeted, including three among mobile populations (sex workers, men who have sex with

men, and people who use drugs) and one population in a prison setting, specifically the inmates of the central prison of Kisangani.

d. Sampling, sample, subject selection, and recruitment

We calculated the sample size based on the formula:

$$n = ((Za^2 \times p \times q))/d^2$$

Where *n* is the minimum sample size, α is the type I error (1.96), representing a 5% error risk, p is the proportion of acceptability of the self-test (78.6%) [9], q is the difference of p (1-p), and d is the desired precision level set at 5%.

$$n = ((1.96^2 \times 0.786 \times 0.214))/0.05^2 = 258,$$

The minimum sample size was 284, anticipating a 10% non-response rate. We included subjects in the study until reaching the minimum sample size proportionally to the demographic weight of each category [15], specifically 133 sex workers, 45 men who have sex with men, 50 people who use drugs, and 135 prisoners. The total size of our sample was 363 subjects.

The inclusion criteria for this study were: (i) being a member of one of the targeted key population categories; (ii) being 18 years of age or older; (iii) agreeing to complete the process of performing the blood or saliva self-test; (iv) giving consent to participate in the study. The exclusion criterion was the refusal to complete the process of performing the blood or saliva self-test.

e. Selection and recruitment of participants

We mobilized mobile key populations (sex workers, people who use drugs, men who have sex with men) through friendly centers, and we raised awareness through peer educators from each category. Their recruitment was consecutive until reaching the minimum sample size expected for each category, and the healthcare providers at the central Kisangani Medical Center's central prison sensitized the prisoners. Trained prisoner peer educators carried out sensitization in the fight against HIV. The recruitment of the prisoners was done consecutively until reaching the minimum sample size expected.

f. Protocol

Presentation of saliva and blood self-tests

i. Saliva self-tessst The OraQuick HIV self-test is an in vitro diagnostic test device for HIV (HIV-1 and HIV-2) for home use, using an oral fluid sample. The test detects the body's reaction (produced antibodies) to fight against HIV. Oraquick is a self-test that detects 2nd generation HIV-1 and HIV-2 antibodies in the oral mucosal transudate (fluid rich in anti-HIV antibodies)—ease-of-use score: 98%. A positive result is preliminary, and additional testing at a healthcare facility is required to confirm the test.

Oraquick is a 20-minute immunological assay with visual reading performed manually for the qualitative detection of anti-HIV-1 and anti-HIV-2 antibodies. The test strip contains synthetic peptides that represent the HIV envelope region, and a procedural control (goat anti-human IgG) immobilized on a nitrocellulose membrane in the test zone (T) and the control zone (C), respectively.

How to read the OraQuick HIV self-test result? A line will appear next to "C" on your test stick. If no line is next to "C," your test is invalid.

Ii. Blood self-test The Mylan self-test is a rapid lateral flow immunological test for detecting anti-HIV antibodies of type 1 and 2, requiring only a single drop of blood. The device is approved with whole blood samples obtained by venipuncture or fingerstick phlebotomy. The Mylan HIV self-test has recently received CE marking by an EU body. The test requires a minimum of 2 to 5 µl of blood.

Both self-tests (saliva and blood) contain simplified supports and instructions that can easily be read in French. A video version of the instructions is also available in French in electronic format.

Study procedure

Figure 1 shows the study procedure.

After explaining the study's objective to the participants, We asked them to give their written consent by completing and signing the informed consent form. Then, the participants were asked to respond to survey questionnaires regarding sociodemographic information, risky behaviors related to HIV infection, regularly used HIV prevention methods, drug use, knowledge of self-testing, and types of self-tests. Subsequently, We gave the participants a choice between the blood self-test and the saliva self-test.

Consent was obtained for either test to evaluate the proportions of consent (acceptability) for the saliva self-test and the blood self-test. We administered a post-test questionnaire to gather their opinions on the use of self-testing, the handling of the test, the assessment of the reliability of each type of self-test, facilitators, and barriers to self-test utilization, followed by the disclosure of results.

Follow-up

We referred all participants with positive results to healthcare facilities (friendly centers) for confirmation tests and necessary care. All participants who had a negative test received counseling on risk reduction behaviors, prevention methods, and, if interested, Pre-Exposure Prophylaxis (PrEP).

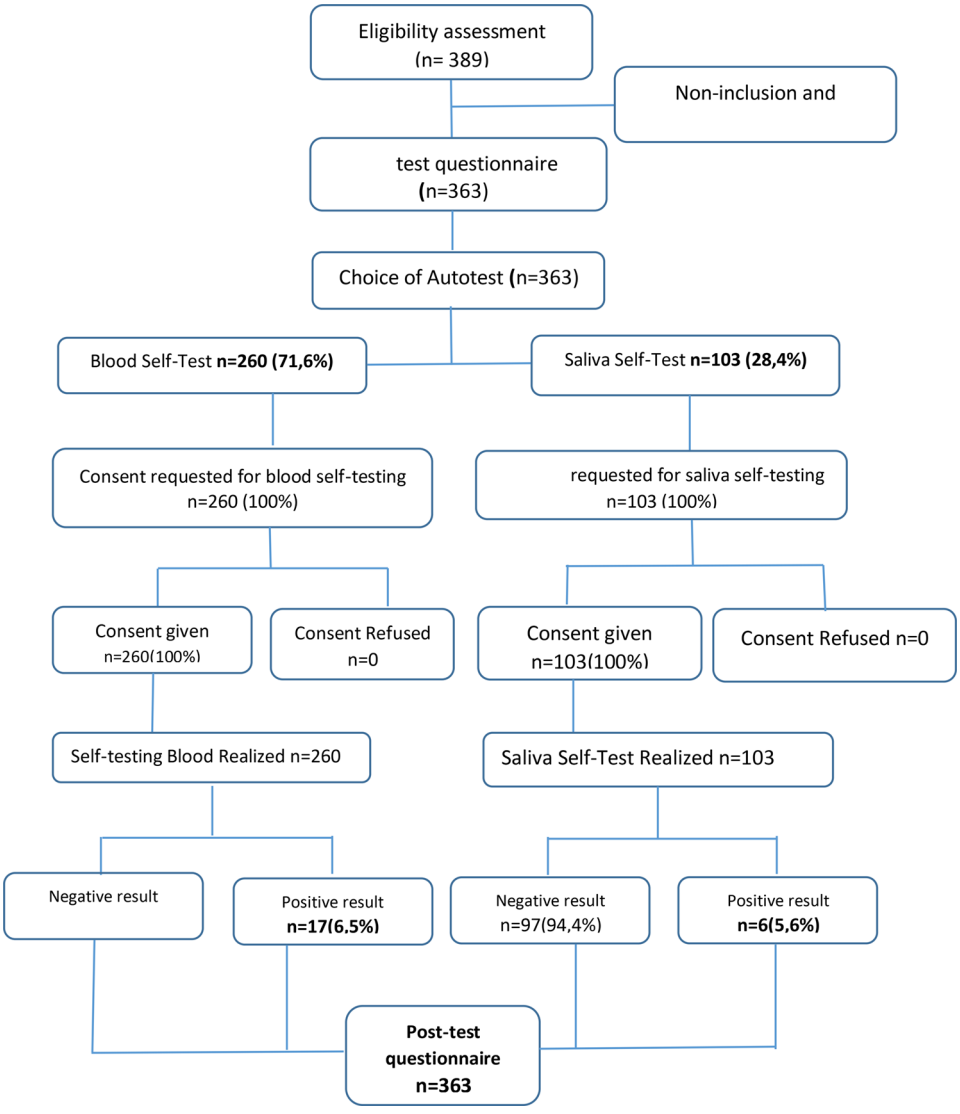

Fig. 1 Study procedure diagram

g. Data collection

The OraQuick and Mylan HIV self-tests were the prototypes used in this study. Participants received a briefing on how to use these self-tests. Participants who understood the procedure were allowed to perform the self-test and interpret the results independently. In contrast, the investigators assisted those who did not understand the procedure or had difficulty understating the self-test procedure. To ensure quality control of the results, investigators conducted a second reading to ensure result conformity. We used a structured questionnaire to collect sociodemographic information, risky behaviors related to HIV infection, regularly used HIV prevention methods, drug use, knowledge of self-testing, types of self-tests, handling, reliability, facilitators, and barriers to self-test utilization, as well as the results of the tests performed.

h. Variables

Dependent variable

The dependent variable was the acceptability of self-testing, defined as the intention to use the self-test. Intention represents the motivation or willingness to engage in a behavior and is defined as the perceived likelihood of adopting a behavior [16]. In this study, we used a five-point Likert scale, ranging from "Very likely" [5] to "Unlikely" [1]. We asked participants the following question: "If the self-test (saliva or blood) were made available in Kisangani, would you intend to use it as a means of HIV diagnosis?" After providing uniform information about blood and saliva self-tests to all study participants, we asked this question.

Independent variables

Sociodemographic data (age, gender, education level, marital status, primary occupation).

Sexual characteristics: sexual orientations (homosexual, bisexual, heterosexual).

History of STIs in the past six months (presence of genital ulcers, vaginal and urethral discharge).

Assessment of the risk of contracting HIV on a Likert scale (1=Not at all high, 2=Not high, 3=Neutral 4=High 5=Very high).

Sexual behaviors in the past six months (number of sexual partners, frequency of unprotected vaginal and anal intercourse, condom use on a Likert scale (1=Never, 2=Rarely, 3=Occasionally, 4=Frequently, 5=Very often).

Have anal and oral sex with both types of partners 1=Not always 2=Occasionally 3=Always.

Drug and alcohol consumption.

Knowledge of self-testing (Yes/No).

Assessment of Intention to use self-testing as a means of diagnosing HIV on a five-point Likert scale 1=Unlikely 2=Unlikely 3=Neutral 4=Likely 5=Very Likely.

Assessment of self-test reliability on a four-point Likert scale (1=Very reliable, 2=Reliable, 3=Quite reliable, 4=Less reliable).

Perceived ease of self-test handling on a five-point Likert scale (1=Very difficult, 2=Difficult, 3=Neutral, 4=Easy, 5=Very easy).

Facilitators and barriers to self-testing: We asked participants to rate the importance of these perceptions on a five-point Likert scale (1=not important at all, 2=not significant, 3=neutral, 4=important, 5=very important).

Potential facilitators: (1) Not having to pay for the self-test; (2) Access to free HIV screening tests through self-testing; (3) Access to individual support and support regarding the use of self-testing; (4) Access to information on the use of self-testing; (5) Not going to a CS/Friendly Center to obtain the self-test; (6) Availability of the self-test; (7) There are no constraints in obtaining the self-test. Potential barriers: (1) Cost of the self-test; (2) Unavailability of the self-test; (3) Lack of peer or provider support or counseling; (4) The need to go to the healthcare center/Friendly Center every quarter to obtain the self-test; 5—a fear of the result (mainly a positive result).

h. Statistical analysis

We recorded all data on paper, then encoded it in an Excel spreadsheet and analyzed it using Stata 13. Descriptive statistics were reported by estimating proportions for categorical variables and means with standard deviations for symmetrically distributed quantitative variables, considering the different categories of key populations. We presented the results in tables. Analytical statistics: The variable of interest was the acceptability of self-testing (salivary or blood-based), defined as a dichotomous variable (Very likely/Not very likely). The corresponding outcome measure was the proportion of participants accepting self-testing for HIV screening. We performed a bivariate analysis to determine factors associated with the acceptability of self-testing using Pearson's chi-square ($\chi 2$) test and ANOVA, followed by pairwise comparisons using Bonferroni correction for means and proportions. We included all variables showing an association in the bivariate analysis in a stepwise logistic regression model, including significant variables from the bivariate analysis at a threshold of 5%. We tested model adequacy using the Hosmer-Lemeshow test. We presented adjusted odds ratios (aOR) and their corresponding confidence intervals derived from the model and the p-values from the Wald chi-square test.

i. Ethical considerations

We submitted the Protocol to the University of Kisangani ethics committee for ethical approval. Authorization was also obtained from the provincial health and justice divisions of Tshopo before the study was conducted. Participants signed written informed consent. A financial compensation of 5000FC (approximately 2 US dollars) was provided to each participant to compensate for the study's time and cover transportation costs.

Results

Sociodemographic characteristics by category of key populations

This study (Table 1) revealed that the average age of key populations was 27.3±7 years. There was a statistically significant difference in the mean ages among the different categories of key populations. The lowest mean age was observed among sex workers (23.8±5.4 years), and the highest mean age was observed among prisoners (30.8±6.6 years). There was also a statistically significant difference in proportions according to educational level, with a higher proportion of men who have sex with men (MSM) having a higher education level. In contrast, a significant proportion of sex workers (FSWs) and prisoners had a primary education level. In the majority of cases, FSWs, MSM, and people who use drugs (PWID) lived without a partner (71.9%) and were unemployed (65.3%). The Christian religion was predominant among all categories of key populations. We also noted that these key populations belonged to esoteric orders, with percentages of 7.5% among FSWs, 20% among MSM, 10% among PWID, and 7.4% among prisoners. There were differences in proportions of sexual orientation, with 13.2% identifying as homosexual, 79.9% as heterosexual, and 6.9% as bisexual.

Table 1 Sociodemographic characteristics by key population category

Variables	Key populations category					
	WS	MSM	IDU	Prisoner	All	*p*
	n(%)	*n*(%)	*n*(%)	*n*(%)	*n*(%)	
Age year (Mean ± SD)	23,8 ± 5,4	29,2 ± 7,7	25,1 ± 6,4	30,8 ± 6,6	27,3 ± 7,0	< 0,0001**
18–24	85(63,9)	13(28,9)	28(56)	23(17,04)	149(41,1)	< 0,0001*
≥ 25	48(36,1)	32(71,1)	22(44)	112(82,96)	214(58,9)	
Sex						
Male	0(0)	45(100)	50(100)	135(100)	230(63,4)	< 0,0001***
Female	133(100)	0(0)	0(0)	0(0)	133(36,6)	
Study level						
Primary	58(43,6)	1(2,2)	4(8)	54(40)	116(31,9)	< 0,0001**
Secondary	66(49,6)	1(2,2)	32(64)	77(57,04)	176(48,4)	
Higher/university	9(6,7)	43(95,6)	14(28)	4(2,96)	71(19,5)	
Marital status						
lives without a spouse	130(97,7)	42(93,3)	40(80)	46(34,1)	261(71,9)	< 0,0001***
living with a spouse	3(2,3)	3(6,7)	10(20)	89(63,9)	102(28,1)	
Occupancy						
Unoccupied	88(66,2)	2(4,4)	29(58)	9(6,7)	126(34,7)	< 0,0001***
With occupation	45(33,8)	43(95,6)	21(42)	126(93,3)	237(65,3)	
Religion						
No religion	2(1,5)	5(11,1)	4(8)	2(1,5)	11(3.0)	< 0,0001*
Christian	118(87,4)	31(68,8)	32(64)	112(82,9)	295(81,2)	
Islamic	3(2,3)	0(0)	9(18)	11(8,2)	23(6,3)	
Esoteric order	10(7,5)	9(20)	5(10)	10(7,4)	34(9,4)	
Sexual orientation						
Homosexual	0(0)	41(91,1)	2(4)	5(3,7)	48(13,2)	< 0,0001***
Heterosexual	133(100)	0(0)	47(94)	109(80,7)	290(79,9)	
Bisexual	0(0)	4(8,9)	1(2)	21(15,5)	25(6,9)	

* Pearson's chi-square (χ2), **ANOVA, *** Ficher's exact test

Evaluation of sexual behaviors and HIV-related risks

Overall, access to HIV testing was low, with 47.1% of key populations having had access to testing. Table 2 shows a statistically significant difference in the distribution of key populations tested in the last 12 months. The duration of the median since the last HIV test was seven months. We observed the shortest duration among prisoners compared to FSWs, MSM, and PWID. Most key populations, particularly FSWs, MSM, and prisoners, presented with genital ulcerations suggesting the presence of sexually transmitted infections (STIs), except for PWID, where no cases of genital ulceration were reported, and the difference was statistically significant. The proportion of SW considering themselves at risk of contracting HIV was higher than that of prisoners and PWID, while MSM considered the level of risk to be low. The median number of sexual partners in the last six months was 3, with a minimum of zero and a maximum of 40. The difference in the median number of sexual partners in the last six months was statistically significant between the different categories of key populations. The rate of condom use was low (8.3% with regular partners vs. 39.9% with occasional partners). Among prisoners, the proportion of condom use with regular partners was zero. There was a statistically significant difference in the proportion of condom use with occasional partners. We found the highest proportion of condom use among FSWs (82.9%) and the lowest among prisoners (4.1%). All categories of key populations have sex after taking drugs or alcohol. The highest proportion is found among sex professionals (91.7%) and the lowest among prisoners (2.9%), and the difference is statistically significant.

Choice of blood versus saliva self-testing among key populations in Kisangani

Figure 2 shows that in all categories of key populations, the choice of self-testing was statistically higher for blood self-testing than for saliva self-testing (71.6% versus 28.4%, $p < 0.0001$); among FSWs(83.5% versus 16.5%), MSM (64.4% versus 35.6%), PWID (70% versus 30%) and prisoners (62.9% versus 37.1%).

Knowledge, handling, and use of the self-test

Table 3 shows that all categories of key populations have heard of self-testing (54.3%) and know the types of self-testing (salivary and blood). We found the highest proportion among PWID (90%) and the lowest among prisoners (2.9%) - the difference is statistically significant.

Table 2 Assessment of sexual behavior and HIV-related risks

Variables	Key populations category					
	FSWs	MSM	PWID	Prisoner	All	*p*
	n(%)	*n*(%)	*n*(%)	*n*(%)	*n*(%)	
Have been tested in the last 12 months						
Yes	44(33,6)	34(75,6)	37(74)	56(41,5)	171(47,1)	< 0,0001*
No	89(66,4)	11(24,4)	13(26)	79(58,5)	192(52,9)	
Time since last test month (Median(P25-P75))	9(5–18)	5(3–9)	7(5–7)	6(3–7)	7(4–9)	< 0,0001**
Genital ulceration in the last 12 months						
Yes	41(30,8)	3(6,7)	0(0)	10(7,4)	54(14,9)	< 0,0001***
No	92(69,2)	42(93,3)	50(100)	125(92,6)	309(75,1)	
Perceived level of risk of contracting HIV						
(5 + 4)	56(42,1)	6(13,3)	4(8)	17(12,6)	77(21,1)	< 0,0001***
(3 + 2 + 1)	77(57,9)	39(86,7)	46(92)	118(87,4)	286(78,9)	
Number of sexual partners last six months (Median(Min-Max)	6(5–40)	2(1–4)	3(1–10)	1(0–4)	3(0–40)	< 0,0001****
Condom use with regular partners in the last six months						
(5 + 4)	15(11,3)	2(4,4)	13(26)	3(2,2)	30(8,3)	< 0,001***
(3 + 2 + 1)	118(88,7)	43(95,6)	37(74)	132(97,8)	333(91,7)	
Condom use with casual partners over the last six months						
(5 + 4)	112(82,9)	14(31,1)	4(8)	15(4,1)	145(39,9)	< 0,0001***
(3 + 2 + 1)	23(17,1)	31(68,9)	46(92)	120(95,9)	218(58,1)	
Have had anal intercourse with both types of sexual partner in the last six months						
Always	54(40,6)	36(80)	5(10)	3(2,2)	98(27)	< 0,0001***
Not always or occasionally	79(59,4)	9(20)	45(90)	132(97,8)	265(73)	
Having oral sex with both types of sexual partners						
Always	68(51,1)	12(26,7)	14(28)	3(2,2)	97(26,7)	0,006***
Not always or occasionally	65(48,9)	33(73,3)	36(72)	132(97,8)	266(73,3)	
Having sex after taking drugs or alcohol						
Yes	122(91,7)	31(68,9)	24(48)	4(2,9)	181(49,8)	< 0,0001***
No	11(8,3)	14(31,1)	26(52)	131(97,1)	182(50,2)	

* Pearson's chi-square (χ2), **ANOVA, *** Ficher's exact test, ****Kwallis

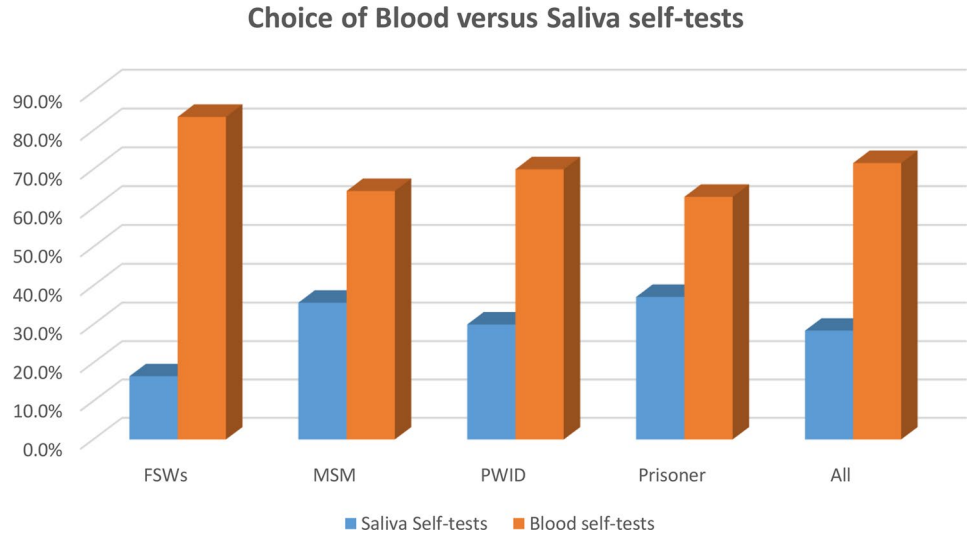

Fig. 2 Choice of blood versus saliva self-tests

Table 3 Knowledge, handling, and use of the self-test

Variables	Key populations category					
	FSWs	MSM	PWID	Prisoner	All	*p*
	n(%)	*n*(%)	*n*(%)	*n*(%)	*n*(%)	
Have you Heard Spoken of the self-test						
Yes	125 (93,9)	29 (64,4)	45(90)	4(2,9)	197 (54,3)	< 0,0001*
No	8(6,1)	16(35,6)	5(10)	131(97,1)	166(45,7)	
Knowledge of self-test types						
Yes	96(72,2)	33(73,3)	45(90)	4(2,9)	178(49,1)	< 0,0001*
No	37(27,8)	12(26,7)	5(10)	131(97,1)	185(50,9)	
The different types of self-tests available						
Salivary	34(25,6)	13(28,9)	21(42)	2(1,48)	70(19,8)	< 0,0001*
Blood	62(46,6)	20(44,4)	21(42)	2(1,48)	105(28,9)	
Salivary and blood	0(0)	0(0)	3(6)	0(0)	3(0,9)	
Do not know	37(27,8)	12(26,6)	5(10)	131(97,03)	185(51,3)	
Intention to use the self-test						
(5 + 4)	115(86,5)	44(97,8)	46 (92)	67 (49,6)	276(76,1)	< 0,0001*
(3 + 2 + 1)	18(13,5)	1(2,2)	4 (8)	68(50,4)	87(23,9)	
I wish I could handle the self-test alone.						
(5 + 4)	62 (46,6)	42(93,3)	46(92)	111(82,2)	268(73,8)	< 0,0001*
(3 + 2 + 1)	71(53,4)	3(6,7)	4(8)	24(17,8)	95(26,2)	
: **The probability of using the self-test every quarter**						
(5 + 4)	76 (57,1)	42(93,3)	46(92)	64(47,4)	235(64,7)	< 0,0001*
(3 + 2 + 1)	57(42,9)	3(6,7)	4(8)	71(52,6)	128(35,3)	
Reliability of blood self-testing						
Highly reliable (1 + 2)	116(87,2)	27(60)	43(86)	131(97,1)	321 (88,4)	< 0,0001*
Fairly reliable (3 + 4)	17(12,8)	18(40)	7(14)	4(2,9)	42(11,6)	
Reliability of saliva self-testing						
Highly reliable (1 + 2)	45(33,8)	11(24,4)	3(6)	18(13,3)	74(20,4)	< 0,0001*
Fairly reliable (3 + 4)	88(66,2)	34(75,6)	47(94)	117(86,7)	289(79,6)	
Availability of the blood self-test						
(5 + 4)	3(2,3)	1(2,2)	3(6)	3(2,2)	10(2,8))	0,004*
(3 + 2 + 1)	130(97,7)	44(97,8)	47(94)	132(97,8)	353(97,2)	
Availability of the saliva self-test						
(5 + 4)	36(27,1)	32(71,1)	42(84)	3(2,2)	110(30,3)	< 0,0001*
(3 + 2 + 1)	97(72,9)	13(28,9)	8(16)	132(97,8)	253(69,7)	

* Ficher's exact test

Most key populations intended to use the self-test as a diagnostic tool (Acceptability), 76.1%. Most key populations wanted to handle the self-test alone. Most key populations thought blood self-testing was more reliable (88.4%) than saliva self-testing (20.4%). However, for both types of self-test, we noted a low availability of 30.3% for saliva self-testing and 2.8% for blood self-testing.

Bivariate analysis of self-test acceptance based on sociodemographic characteristics, risk behaviors, knowledge of self-tests, facilitators, and barriers to self-test utilization

Table 4 shows that several factors demonstrated a statistically significant association in bivariate analysis with acceptability for both self-test types. Sociodemographic factors that showed a statistically significant association with acceptance of self-test utilization were age ($p<0.04$) and educational level ($p<0.0001$). Other factors such as knowledge of the type of self-test ($p<0.0001$), presenting signs of STIs ($p<0.0001$), non-use of condoms with casual partners ($p<0.0001$), and group injection drug use ($p<0.0001$) also showed a statistical association with the acceptability of blood and saliva self-tests. The absence of constraints for obtaining self-tests was the only facilitator of self-test utilization that showed a link. The barriers to self-test utilization that showed a link were the unavailability of self-tests ($p<0.0001$), unavailability of confirmatory tests ($p<0.0001$), fear of a positive result ($p<0.0001$), and unavailability of peer or provider support or counseling.

Table 4 Bivariate analysis of acceptance of self-testing according to sociodemographic characteristics, risk behavior, knowledge of self-testing, facilitators, and barriers to self-testing

Variables	Acceptability of the Saliva Self-Test		Acceptability of the Blood Self-Test		Acceptability of self-test (All)		
	Yes *n*(%)	*p*	Yes *n*(%)	*p*	Yes *n*(%)	OR	*p*
1. Sociodemographic characteristics							
Age range (year)							
18–24	29(87,8)	0,001	95(81,9)	0,038	124(83,2)	1	0,0003
≥ 25	39(55,7)		102(70,8)		141(65,9)	0,4(0,2 – 0,6)	
Marital status							
lives without a spouse	50(87,7)	< 0,0001	164(81,9)	< 0,0001	214(82,9)		
living with a spouse	18(39,1)		33(55,9)		51(48,6)		
Study level							
Primary	25(67,6)	0,029	60(75)	< 0,0001	85(72,6)	1	< 0,0001
Secondary	26(55,3)		88(68,2)		114(64,8)	0,6(0,4 – 1,2)	
Higher/university	17(89,5)		49(96,1)		66(94,3)	6,2(2,0–19,3)	
2. Sexual behavior and practices							
Present the signs of STIs							
Yes	12(85,7)	0,094	35(87,5)	0,060	47(87,1)	2,1(1,1–3,9)	0,011
No	56(62,9)		162(73,6)		218(70,6)	1	
Non-use of condoms with occasional partners							
Yes	34(85,0)	0,001	89(84,8)	0,005	123(84,8)	2,9(1,7 – 5,1)	< 0,0001
No	34(53,9)		108(69,7)		142(65,1	1	
Group injection drug use							
Yes	18(100,0)	0,001	46(90,2)	0,007	64(92,8)	5,9(2,5–15,6)	< 0,0001
No	50(58,8)		151(72,3)		201(68,4)	1	
3. Knowledge of self-testing							
Knowledge of self-test types							
Yes	41(93,2)	< 0,0001	125(93,3)	< 0,0001	166(93,2)	12,01(5,6–24,9)	< 0,0001
No	27(45,8)		72(57,1)		99(53,5)	1	
4. Self-testing facilitator							
.There are no constraints on self-testing							
Very important (5 + 4)	35(100,0)	< 0,0001	93(93,9)	< 0,0001	128(95,5)	14,3(5,6–36,5)	< 0,0001
Not important (3 + 2 + 1)	33(48,5)		104(64,6)		148(64,6)	1	
5. Obstacle to using the self-test							
Unavailability of self-tests							
Very important (5 + 4)	48(100,0)	< 0,0001	113(95,8)	< 0,0001	161(96,9)	28,8(9,8–84,4)	< 0,0001
Not important (3 + 2 + 1)	20(36,4)		84(59,2)		104(52,8)	1	
Unavailability of confirmation tests for self-test results							
Very important (5 + 4)	32(100,0)	< 0,0001	90(90,9)	< 0,0001	122(93,1)	8,4(3,8–18,3)	< 0,0001
Not important (3 + 2 + 1)	36(50,7)		107(66,4)		143(61,6)	1	
Fear of positive results							
Very important (5 + 4)	37(100,0)	< 0,0001	90(90)	0,001	127(92,7)	8,1(3,8–17,03)	< 0,0001
Not important (3 + 2 + 1)	31(46,9)		107(66,9)		138(61,1)	1	
Unavailability of a peer or provider for support or counseling							
Very important (5 + 4)	31(100,0)	< 0,0001	84(93,3)	0,001	115(95,1)	11,8(4,7–29,5)	< 0,0001
Not important (3 + 2 + 1)	37(51,4)		113(66,5)		150(61,9)	1	

Multivariate analysis of self-test acceptability based on characteristics, risk behavior, facilitators, and barriers

After adjusting for various factors included in the model, the significant predictors (adjusted OR in Table 5) of self-test acceptance among key populations are non-use of condoms with casual partners and knowledge of self-test types. The ORs indicate that these two factors double the acceptability of self-test utilization. The other predictor of self-test acceptability is educational level. The ORs indicate that the acceptability of self-test utilization increases with educational level. One predictable obstacle in self-test utilization is the unavailability of self-tests, a barrier that will limit the use of self-tests as a screening method among key populations.

Table 5 Multivariate analysis of self-test acceptability as a function of characteristics, risk behavior, facilitators, and barriers

Variables	Acceptability of self-test		
	aOR	IC 95%	*p*
Characteristics			
Age range (year)			
18–24	1		
≥ 25	0,6	(0,3 – 1,1)	0,096
Study level			
Primary/Secondary	1		
Higher/university	1,5	(0,4–5,5)	**0,006**
Risk behavior and knowledge of the self-test			
Non-use of condoms with occasional partners			
Yes	2,8	(1,4–5,6)	**0,003**
No	1		
Knowledge of self-test types			
Yes	2,4	(1,02–5,65)	**0,043**
No	1		
Obstacle			
Unavailability of the self-test			
Very important (5 + 4)	18,9	(6,5–54,9)	**< 0,0001**
Not important (3 + 2 + 1)	1		

Discussion

The present study showed that overall, respondents had a preference for blood-based self-tests (71.6%) compared to saliva-based self-tests (28.4%). Among sex workers, this preference for blood-based self-tests over saliva-based self-tests was 83.5% vs. 16.5%; among men who have sex with men (MSM), it was 64.4% vs. 35.6%; among injectable drug users (PWID) it was 70% vs. 30%, and among prisoners, it was 62.9% vs. 37.1% (Fig. 2).

In different studies conducted in the Democratic Republic of Congo (DRC) and elsewhere in Africa, when the choice of HIV blood-based self-test was compared to that of HIV saliva-based self-test, opinions were divergent but mostly favorable towards blood-based self-tests. In Kenya, studies by Ndungu et al. showed that 72.7% of MSM believed that blood-based self-tests could be more accurate than oral self-tests [5]. This observation was also found in the study by Lippman et al. (2018) in South Africa, which showed that MSM preferred blood-based HIV self-tests [17]. The study by Mantell et al. (2022) among truck drivers in Kenya did not find a general preference for blood-based or saliva-based self-tests. However, if blood-based self-tests were offered, some participants preferred blood-based self-tests [13]. However, in the study by Ritchwood et al. (2019), 80% of participants preferred saliva-based HIV self-tests. The most participants reported that they were very comfortable using the saliva test (84%), that it was painless (100%), and very easy to collect the sample and the test (95%) [14]. In the DRC, studies by Tonen et al. (2019) in the population aged 18 to 49 with a high risk of HIV showed a preference for oral fluid-based self-tests over blood-based self-tests (85.6% vs. 78.6%; $p=0.008$), but the preference for blood-based self-tests was greater among participants with a university education (86.1%; $p=0.016$) [18]. In our series, the preference for blood-based self-tests among key populations was justified because they believed blood-based self-tests were more reliable than saliva-based self-tests in accuracy (88.2% vs. 20.7%, $p<0.0001$).

We found that the majority of key populations had a good acceptance of self-testing and intended to use it as a means of HIV diagnosis (76.1%) (Table 3). One way to determine the acceptability of self-testing is to know the type of self-test available. This acceptability of self-testing has been documented in several studies, including Billabong et al. (2021) among key populations in Cameroon [19], Grésenguet et al.(2020) among students, sex workers, and men who have sex with men in Bangui Central African Republic [7], Boisvert, et al. (2022) among sex workers in Cotonou, Benin [20], Ben Moussa et al.(2022) among sex workers and men who have sex with men in Morocco [21], and Tonen et al. (2019) among adolescents and sex workers in the DRC [18].

The level of education is also a factor influencing the acceptability of self-testing. Higher education level was significantly associated with self-test acceptability. The study by Tonen et al. (2019) also showed that participants with a university education preferred blood sampling for self-testing [9]. On the other hand, Ben Moussa et al. in Morocco and Grésenguet et al. in the Central African Republic found that low education levels could be a barrier to self-test utilization.

Non-availability of the self-test was the main obstacle to its acceptability (Table 5). This barrier was also found in the study by Haidara, A.C. (2020) in Bamako, Mali, among healthcare professionals due to the unavailability of tests, where 81.2% had never been offered self-testing [22].

In our study, the non-use of condoms with casual partners was significantly associated with the acceptability of self-test use.

Other documented factors include making the test free of charge, the absence of any constraint in accessing self-testing, fear of a positive result, and the unavailability of a peer or provider for support/counseling. However, these factors did not show a statistically significant association. The studies by Boisvert et al. in Benin found that making self-testing free of charge facilitated acceptance. At the same time, the obstacles were fear of unreliability and lack of psychological support. Studies by Ndungu K et al. in Nairobi, Kenya, showed that the high costs of self-test kits and lack of knowledge about their use were the main obstacles to adopting HIV self-testing [5]. The Njau et al. systematic review [23] showed that the high cost of self-testing kits emerged as one of obstacles. This obstacle

was also sought in our study, but was not identified for simple reason that in Kisangani (DRC), self-testing kits were not yet available in pharmacies. The self-tests available were provided by the national HIV program and distributed free of charge to key populations.

It should be noted that in the context of a generalized HIV epidemic (prevalence of 1.2% in the general population) and low screening performance (74% in 2020 in Kisangani), despite being the gateway to all efforts to control the HIV pandemic, as is the case in the DRC, the implementation of self-testing could make a decisive contribution. This is even truer for accelerating efforts among key populations, the primary vectors of propagation. The prevalences recorded in the present study (6.5% VS 5.6%, depending on the type of self-test) confirm this population's enormous potential for contamination. This is all the more true given that the most accessible means of prevention is not widely used.

Study limitations

Our study focused on key populations in Kisangani, and we could not reach all key populations in the entire province. As the prison population was predominantly male, we could not achieve an equitable proportion for both sexes. A priori, most people were already familiar with saliva self-tests. However, very few were aware of blood self-tests, so offering a new test unknown before the study could influence their choice. In the same way it is possible that the brand or packing influenced the choice, but we believe that the explanations given before making the choice could minimize them.

On the other hand, some of the questions on risk behavior asked for a six-month memory, so we think that some of the participants could have forgotten certain facts, with the possibility of errors due to the memory of past events.

Conclusion

This study showed that key populations in Kisangani preferred blood-based self-tests over saliva-based self-tests. The problem is the unavailability of self-tests, especially blood-based ones, in their environments, which limits their use. The prevalence of HIV is very high among key populations, but the utilization of prevention methods remains low. Making blood-based self-tests available to key populations is necessary to make blood-based self-tests available to key populations making blood-based self-tests available to key populations, as this would improve their accessibility to testing and contribute to achieving the UNAIDS 95-95-95 target. The study also revealed low condom use as a prevention method, and PrEP would be an alternative to provide these populations with effective prevention means.

Supplementary Information

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Supplementary Material 1

Author contributions

TT and LL Conceived and designed the research. TT and FS were in charge of recruiting participants and supervising field interviewers. TT, TW, PL and LL analysed the results and drafted the manuscript. All the autors reviewed the manuscript and approved the submitted version.

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Data availability

The datasets analyzed during the current study are available for the corresponding author on reasonable request.

Declarations

Ethical approval

The studies involving human participants were rewiewed and approved by the Ethics committee of kisangani University. Written informed consent to participate in this study was provid by participants.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

Competing interests

The authors declare no competing interests.

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