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Enhancing HIV self-testing uptake among university students in Rwanda: the proportion, barriers, and opportunities

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Abstract

Introduction University students in Rwanda are at high risk for HIV, yet they have a low uptake of HIV self-testing, which is crucial for HIV diagnosis and prevention. This study investigated their knowledge, behaviors, and perceptions towards HIV self-testing, highlighting the barriers and opportunities whose consideration is necessary for the improvement of HIV self-testing uptake in this population.

Method A concurrent mixed-method design was used, and it involved 424 students from five universities across Rwanda. Quantitative data was collected through surveys, and descriptive statistics were performed. Chi-square tests were performed, and sociodemographic variables were stratified against the awareness of HIV self-testing and HIV self-testing for the past 12 months variables. Qualitative data was collected through in-depth interviews and focus group discussions using interview guides developed based on the Health Belief Model (HBM) framework; data was then analyzed thematically.

Results The mean age was 23 (IQR: 21; 24), with 51.2% ($n = 214/424$) females. 64.7% ($n = 261/424$) of students had never heard of HIV self-testing, yet 37.74% (160/424) were sexually active. Among sexually active students, 17.87% were aware of HIV self-testing, but 35.82% had never used it. The reported perceived HIV self-testing barriers include high cost, unavailability of testing kits, lack of awareness, misinformation, and absence of post-test counseling. However, some HIV self-testing opportunities, like the availability of testing kits and motivating factors for university students to test, were also reported.

Conclusion Although university students reported the needs and benefits of HIV self-testing, uptake remains low due to misinformation, unawareness, unavailability, and the high cost of HIV self-testing kits. Increasing awareness, availing HIVST kits, and addressing the other reported barriers to HIV self-testing, is essential for the achievement of the universal goal of HIV status awareness among university students.

Keywords Awareness, Barriers, Benefits, HIV self-testing, Perceptions, University students, Rwanda

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Introduction

HIV remains a significant global health challenge, with 39.9 million people reported to have been living with the virus by the end of 2023 [1]. Despite a global gradual decline in HIV infection, Sub-Saharan Africa (SSA) still bears a disproportionate burden, accounting for 52.1% of the cases globally [2]. The youth (15–24 years) are particularly affected, with new infections escalating in this group due to their increased vulnerability [3, 4]. Recent studies show that half of the global new HIV diagnoses occur among youth, particularly those aged 15–24 years, with university students being especially susceptible due to the high prevalence of the disease among their sexually active peers [5–11].

In Rwanda, where the youth contribute about 78% of the total population [7], HIV prevalence is at 3% in the general population. Among young adolescents (10–14 years) and young adults (20–24 years), it stands at 0.4% and 2.6%, respectively [12, 13]. There has been a rise in HIV incidence particularly noted from 2010 to 2015 among this population, with an increase from 1.8 to 2.4% among young women, and from 0.5 to 1% among young men [14]. The reported rise in new HIV diagnoses is largely due to low HIV testing rates, unhealthy sexual behaviors, and insufficient sexual/HIV knowledge [3, 15–17]. To address this, HIV self-testing has been introduced in Rwanda [18, 19]. Several studies have shown that youth's access to HIV testing in health facilities is often hindered by fear of stigma, discrimination, and judgmental attitudes from healthcare providers [20, 21]. The recent self-reported HIV testing prevalence stands at 55.4% among youth aged 15–24 in Rwanda [22]. Research in SSA suggests that self-testing methods or HIV testing services outside traditional health facilities could significantly increase testing uptake among young people [19, 21, 23]. The impact has also been observed among university students [23]. The increased uptake may be influenced by factors such as self-testing's perceived autonomy, privacy, cost, and reliability [24].

Owing to the introduction of HIV self-testing and other targeted efforts by Rwanda's Ministry of Health, the country has made significant strides towards the 95-95-95 UNAIDS strategy, achieving over 95% in each category [25]. Although HIV self-testing kits are available in Rwanda's hospitals and health centers, most university students prefer to buy them from community pharmacies, which they believe are more private and faster to access [26, 27]. Despite these efforts, Rwanda, like many SSA countries, continues to struggle with high rates of new HIV diagnoses among adolescents and young adults [28, 29]. This may be attributed to the knowledge, awareness, and uptake of the HIV self-testing gap (21%) among the youth as revealed by studies done in Rwanda [30, 31]. These gaps hinder timely HIV diagnosis and treatment,

crucial for all, especially the youth [32, 33]. Understanding the proportion of sexually active students, those who use HIV self-testing kits, and the level of awareness and perceptions surrounding HIV self-testing, among the youth in Rwanda is essential to enhance testing rates and timely diagnosis, thereby preventing new HIV diagnoses.

The current study assessed the level of awareness, perceptions, and uptake of HIV self-testing among university students in Rwanda. The findings will help relevant stakeholders in Rwanda improve HIV self-testing kits' accessibility, alleviate HIV testing-related stigma among university students, align other interventions to prevent new HIV diagnoses among the youth, and achieve maximum goals in HIV prevention, diagnosis, and treatment.

Methods

Study design

This study employed a concurrent mixed methods design to assess the level of awareness, barriers, and opportunities of HIV self-testing among students at selected universities in Rwanda. The design allowed for the concurrent data collection and analysis of both quantitative and qualitative data. The study received ethical approval from the CMHS Institutional Review Board (IRB) (509/CMHS IRB/2024).

Study setting and population

The study was conducted in Rwanda, a country composed of 5 provinces, i.e., East, West, North, South, and Kigali City. The prevalence of HIV in these provinces stands at 2.8, 2.8, 2.2, 2.8, and 3.8, respectively [31]. The study was done across the six selected universities. The inclusion criteria were based on the geographical location and the number of students currently enrolled at the university at the time of data collection. The university with the highest number of enrolled students was selected from each province, and the universities with fewer enrolled students were excluded from the study. The total number of university students in Rwanda as of 2020/2021 (The latest available data) was 88,448 students [34]. The selected universities included: (1) the University of Kigali (6500 enrolled students); (2) IPRC Kigali (1,921 enrolled students), both universities are located in the city of Kigali; (3) the University of Tourism, Technology, and Business Studies (UTB) in Rubavu District, Western Province (1900 enrolled students); (4) INES-Ruhengeri in Musanze District, Northern Province (3,999 enrolled students); (5) the University of Rwanda Nyagatare campus in the Eastern Province (2,585 enrolled students); and (6) the University of Rwanda Huye campus in the Southern Province (3,378 enrolled students).

Based on the population size (88,488 university students in Rwanda), OpenEpi was used to calculate the sample size at a confidence interval of 95%, and it was

382 students. Convenience sampling was used in the selection of participants, whereby every eligible participant who met the inclusion criteria and was present at the data collection site was included in the study. The quantitative part of the study included students who were currently enrolled at the selected universities, and whose age group was between 15 and 24 years, whereas, in addition to these criteria, participants had to have participated in the quantitative study to be included in the qualitative study.

The participants for both the quantitative and qualitative parts of the study were university students currently enrolled at any of the selected universities who were willing and who consented to participate in the study, but in addition to this criteria, qualitative study participants were individuals who had participated in the quantitative study. Data collection was conducted between June 14th, 2024, and June 20th, 2024, with one day dedicated to data collection at each university.

Data collection procedure

The university dean of students and guild president assisted in informing students about the study, the time, and the location for data collection. Research assistants placed banners around the universities to guide participants to the data collection sites. Upon arrival at the designated rooms, students were given detailed information about the study, its aims, and its rationale. Students who were willing to participate in the study signed written informed consent forms and research assistants handed them the self-administered questionnaire to which they privately responded. Convenience sampling was used to select individuals who had responded to the questionnaire to participate in the interviews or focus group discussions (FGD) to gain an understanding of the barriers, and opportunities of HIV self-testing. We conveniently selected students who had responded to the questionnaire, and thereafter accepted to participate in the qualitative part of the study before others. We selected university student leaders to participate as key informants, and any other students who were available for the in-depth interviews were recruited. Students were selected for the in-depth interview category to collect data regarding their personal experiences and perspectives towards HIV self-testing, whereas university student leaders were selected for the key-informant category interviews to gain an understanding of high-level and systemic factors that influenced student perceptions of HIV self-testing. For the selection of focus group participants, convenience sampling was used; male and female university students in the same age group formed a discussion group each, whereas the third focus group had both male and female university class leaders, and this was done to understand the leadership roles and peer

influence regarding the different perspectives of HIV self-testing among university students.

Quantitative method

A cross-sectional design was employed for quantitative data collection to assess the level of HIV self-testing awareness among university students. Data was gathered using a structured questionnaire. Before data collection, the questionnaire was pilot-tested, and the issues in relevance and clearance were fixed until it was fit for data collection. The questionnaire was in English, the official language used at the university in which lectures are delivered. The data collected included demographic information (age, sex, marital status, and provinces) and questions related to HIV self-testing awareness, barriers, and opportunities. The questionnaire was adapted from similar previous studies and modified to suit this study's context [18].

Quantitative data was analyzed using Stata version 17. Descriptive statistics were performed, and the Gaussian assumption was assessed using a histogram and Shapiro-Wilk test. Due to the non-normal distribution of the data, the median and interquartile range were reported for continuous variables (i.e., age). The proportion and percentage were calculated for categorical variables and presented in Table 1. Additionally, Chi-square tests were performed, and sociodemographic variables were stratified regarding the awareness of HIV self-testing and HIV self-testing for the past 12 months variables. These tests were conducted at a confidence interval of 95%, and a p-value of < 0.05 was considered statistically significant.

Qualitative method

The qualitative component of the study explored university students' awareness, perceived barriers, and opportunities for HIV self-testing. Data was collected from university students who had participated in the quantitative survey. The formation of the interview guides, which addressed the perceived proportion of university students with HIV, the needs, benefits, and barriers of HIV self-testing was guided by the Health Belief Model (HBM), (a conceptual framework widely used in health behavior research studies, and in supporting interventions for changing health behaviors) [35].

The HBM framework provided a basis for the formation of questions about the HIV self-testing behaviors of university students grounded in their beliefs about attached benefits and risks. The interview guide had been pilot-tested before data collection, and all issues were addressed to make it easy to understand and better for collecting the needed data. The in-depth interviews and focus group discussions were both conducted for triangulation purposes and to explore individual perceptions of HIV self-testing and participants' ideas and collective

Table 1 Participant characteristics and their stratification based on awareness of HIV self-testing and the use of HIV self-testing in the past 12 months

Characteristic	Frequency (%)	Awareness of HIV self-testing			HIV Self Testing in the past 12 months		
		No	Yes	P-value	No	Yes	P-values
Age median (interquartile range)	23 (21–24)						
Sex							
Female	214 (51.2%)	127(64.1%)	71(35.86%)	0.910	140(68.3%)	65(31.7%)	0.089
Male	204 (48.8%)	130(64.7%)	71(35.3%)		151(75.9%)	48(24.1%)	
Marital status							
Married	24 (6.28%)	14(60.9%)	9(39.1%)	0.634	16(69.6%)	7(30.4%)	0.781
Single	358 (93.72%)	224(65.7%)	117(34.3%)		250(72.2%)	96(27.8%)	
University province							
East	23 (7.64%)	10(43.5%)	13(56.5%)	0.004	12(54.6%)	10(45.5%)	0.014
Kigali	118 (39.2%)	76(66.1%)	39(33.9%)		82(71.3%)	33(28.7%)	
North	76 (25.25%)	58(79.5%)	15(20.6%)		64(85.3%)	11(14.7%)	
South	27 (8.97%)	15(55.6%)	12(44.4%)		16(59.2%)	11(40.7%)	
West	57 (18.94%)	28(53.9%)	24(46.1%)		38(67.9%)	18(32.1%)	
Awareness of HIV self-testing							
No	261 (64.76%)				216(84%)	41(15.9%)	< 0.001
Yes	142 (35.24%)				73(52.5%)	66(47.5%)	
HIV test in the last 12 months							
No	295 (72.3%)	216(74.7%)	73(25.2%)	< 0.001			
Yes	113 (27.7%)	41(38.3%)	66(61.7%)				
Number of current sexual partners							
No sexual partner	189 (54.15%)	134(72.4%)	51(27.6%)	0.003	146(78.9%)	39(21.1%)	0.006
One sexual partner	91 (26.07%)	46(52.9%)	41(47.2%)		58(63.7%)	33(36.2%)	
Two to four sexual partners	56 (16.05%)	28(52.8%)	25(47.1%)		37(66.1%)	19(33.9%)	
Five and more	13 (3.72%)	7(53.9%)	6(46.2%)		6(46.1%)	7(53.8%)	
Sexually active							
Yes	160 (37.74%)	81(52.94%)	72(47.1%)	< 0.001	194(78.2%)	59(36.8%)	0.001
No	264 (62.26%)	180(72.0%)	70(28.0%)		101(63.1%)	54(21.8%)	
History of HIV self-testing							
No	281 (71.32%)	234(84.5%)	43(15.5%)	< 0.001	231(83.7%)	45(16.3%)	< 0.001
Yes	113 (28.68%)	19(17.4%)	90(82.6%)		50(45.0%)	61(54.9%)	

insights on the topic, respectively. Conducting both in-depth interviews and focus group discussions also facilitated broader perspectives about HIV self-testing among university students.

These interviews were conducted in one day at each university. Data collection was conducted by 7 research assistants who had been trained for 3 days by the study's principal investigator and project coordinator. This training was done before the start of data collection to familiarize research assistants with the tools and objectives of the study. Since participants had consented, interviews were audio-recorded, and these recordings were later transcribed verbatim by the research assistants before data analysis.

Deductive data analysis was conducted with transcripts from in-depth interviews and FGDs coded, and to have a deeper exploration of individuals' perceived barriers and opportunities for the uptake of HIVST, thematic analysis was employed. A preliminary coding structure was

developed based on the interview guides and relevant literature. Operational definitions were added for each code, and NVivo version 14 was used for coding. As analysis progressed, additional sub-codes were developed, and codes were reassessed based on emerging themes, broader literature, and the study's objectives. Several codes were then grouped, and a set of macro codes was identified. Categories were checked against the data and compared to develop final themes. Relevant verbatim quotes were used to report the findings and guide the interpretation of the results within each theme. Qualitative data analysis was done by a group of four research assistant coders, who continuously addressed any code queries.

The data collection research team comprised both males and females to ensure participants' convenience and openness. The research assistants had diverse professional backgrounds, including public health, medicine, pharmacy, and communications. For purposes of

trustworthiness [36], the research team agreed on the structure of the interview guide, how interviews would be conducted, how probes would be used during interviews, and how participant reactions would be handled. Results were discussed and agreed upon by all members of the team.

Mixed-methods integration

The integration of both qualitative and quantitative results guided the study's discussion and conclusion. This integration was employed at the interpretation stage of the study, where the qualitative data provided contextual explanations for the quantitative results, offering a comprehensive understanding of HIV self-testing awareness and perceived barriers and opportunities among university students in Rwanda.

Results

Participant's social demographic characteristics

A total of 424 university students participated in the study, with a median age of 23 years (interquartile range: 21–24). The majority of participants were female 51.2% (214/424). Notably, 64.7% of the students had never heard of HIV self-testing. Despite this, 37.7% (160/424) reported being sexually active. Among the sexually active, 17.9% (72/424) were aware of HIV self-testing, yet 35.8% of them had never used it. Overall, only 28.7% of the participants had ever self-tested for HIV. Of female university students, 31.7% ($n=65/214$) had done HIV self-testing in the last 12 months, more than their male counterparts, 24.1% (48/204). University students from the Eastern province were more aware of HIV self-testing (56.5%) and had self-tested in the last 12 months (45.5%) more than university students from other provinces (Table 1).

Qualitative results

Qualitative data were collected from 49 participants: 19 in-depth interviews with university students, 9 key informants, and 21 FGD participants. Among the 19 university students interviewed, 11 were male and eight were female, with an age range of 21–24 years. The key informants included five university student leaders, three student gender ministers, and one university nurse. The FGDs were composed of three groups: one with seven males, another with seven females, and the third with four females and three males.

Themes from qualitative analysis

From qualitative data analysis, 3 major themes were developed. They included (i) the perceived need for self-testing, (ii) perceptions towards HIV self-testing, and (iii) HIV self-testing opportunities.

Theme 1: Perceived needs for HIV self-testing.

Participants expressed varying perceptions regarding their needs for HIV self-testing. While some university students had never used HIV self-testing kits and had limited knowledge about them, others emphasized the importance of understanding and using them. These perceived needs were driven by the assumed high prevalence of HIV, its impact on health, and the vulnerability of university students to HIV infection.

Sub-theme 1: perceived prevalence of HIV among university students

Although most university students didn't know the exact prevalence of HIV infection among Rwanda's university students, they had several ideas about its level. To most of them, the perceived HIV infection prevalence was high, and this was accounted for by different reasons, which included the unhealthy sexual relationships (sexually involved with multiple partners, having condomless sex) between students, poverty that led several students to sex work, and the negligence of their peers in regards to HIV prevention and timely testing.

The prevalence of HIV among university students is quite concerning. Many students engage in sexual activity, so the prevalence within this group is likely high" Mentioned a 25-year-old male medical student from UR-Huye.

"...I would say the prevalence is high and will keep increasing...", said a 23-year-old female UTB student.

The perceived prevalence of HIV among university students is among the factors that contributed to the expressed need for HIV self-testing. Participants believed that HIV self-testing would help most university students know their status, give them a better sense of HIV prevention, and consecutively reduce this perceived increasing HIV prevalence.

Sub-theme 2: perceived impact of HIV on university student's health

Different perceptions of HIV infection's impact on their university students' health were similar for most participants. The perceived negative impacts were physical, like physical illness, and mental challenges (mostly depression and loneliness), and they mentioned that these health challenges would affect their academic performance.

Having HIV infection may cause depression to some students, and they lose focus on their future and may even fail to study," said a 24-year-old female UTB student.

It's a serious issue because students with HIV often face stigma, which significantly impacts their lives. Their concentration in class suffers, leading to poor academic performance. Additionally, their mental well-being is affected, especially when they know that other students are aware of their status." Mentioned a 22-year-old Huye Student.

“The consequences I see for them, are their life can change, they can get depression, stress, and loneliness. They feel that learning is useless and it can even make them drop out of school” mentioned a 23-year-old female FGD participant from INES.

The perceived negative impacts of HIV on university students shaped their mentioned needs for HIV self-testing and timely diagnosis to prevent the increasing HIV infection in this population.

Sub-theme 3: perceived vulnerability of university students to HIV University students believe they are more vulnerable to HIV infection. This perception was linked to several factors, which included their age group having limited awareness about more convenient HIV testing techniques and their exposure to unhealthy sexual relations like being sexually involved with multiple partners and engaging in sex without condoms.

Many students are hesitant to buy condoms because they fear being judged by others. They're concerned that people might talk about them, and since many share living spaces, it's hard for them to be open about their status. This often leads to situations where they put their partners at risk;” reported a 22-year-old Huye student.

I think university students are more vulnerable than other people because they associate with many partners of the same age which puts them at risk...” said a 21-year-old INES student.

“... actually, here in the university getting HIV is very easy because most of us don't live in hostels, we live together in ghettos so it's very easy to have unprotected sex. So, the incidence of AIDS in the university is very high compared to other Rwandans...” reported a 26-year-old male FGD participant from INES.

Based on their perception of vulnerability to HIV, participants mentioned the need for HIV self-testing to reduce HIV infections.

Theme 2: barriers, opportunities, and perception towards HIV self-testing

The different barriers, benefits, and ease of use of HIV self-testing kits guided participants' perceptions toward HIV self-testing. Most university students reported barriers like unavailability and high cost of HIV self-testing kits, fear, and lack of post-test counseling services, among others. However, different benefits like convenience, ease of use, privacy, and others were also reported. It is on the mentioned factors that students' perception regarding HIV self-testing was based.

Sub-theme 1: perceived barriers to self-testing University students mentioned several hindrances to the accessibility of HIV self-testing techniques. Although they acknowledged the need to use HIV self-testing meth-

ods, they did not use them as required due to the different barriers. The reported barriers, like inadequate information about HIV self-testing kits, the high cost, and several other barriers, shaped university students' perceptions toward HIV self-testing.

‘The main challenge I see is the cost, especially for students who may not have much money to purchase a self-test...’ said a 25-year-old female UTB student, Rubavu.

A similar barrier was re-echoed by another student from INES who said *“The issue with self-testing kits is that they are expensive, now when you want it, you go and buy it in the pharmacy, but they are 5000rwf, so it is expensive to us students”* a 24-year-old male student, INES.

“Thank you! I believe that inadequate information and concerns about result accuracy are major issues. Lack of awareness about HIV self-tests contributes to these challenges” reported an 18-year-old male University of Kigali student.

“Self-testing without a counselor can be very challenging, especially if you receive a positive result, which can be difficult to accept...” said a 22-year-old female, a student from UR-Huye campus.

Sub-theme 2 Perceived benefits of self-testing.

Some of the participants had heard about HIV self-testing kits, and used them or even both. These participants recognized the benefits attached to using self-testing kits. These benefits were from the experiences they had while using them, or what they had heard about them. Some of the benefits reported were privacy, convenience, ease of use, and others.

“Self-testing allows you to see your results privately, which is a big advantage...” mentioned an FGD participant, a 25-year-old male medical student, UR-Huye campus.

“The advantage is that it is private, meaning that you do it yourself, which is different from going to a clinic. Additionally, it's easy for someone to do it on their own, and it doesn't take much time, which is important since students have limited time and many tasks to handle, so this self-testing tool is the best thing which is needed by many university students” mentioned a 23-year-old female, UR-Nyagatare.

The reported benefits were among the reasons participants recognized the need for use of HIV self-testing. The convenience and ease of using HIV self-testing kits shaped participant's perceptions towards the availability and usage of HIV self-testing kits.

Sub-theme 3: ability to self-test University students perceived their ability to self-test by acknowledging their understanding and confidence in using the self-testing kits on themselves and even on their friends if there was a need.

"I have a high level of confidence in performing the HIV self-test on myself..." said a 22-year-old male, a University of Kigali student.

"I find the HIV self-test easy to use because interpreting the results isn't difficult at all. I'm confident in using the test and interpreting the results myself" reported a 25-year-old male FGD participant, UTB student.

For participants who were confident with their skills to use the HIVST kits, had a positive perception towards these kits, however for those who had not used them before could only talk about their perception using the benefits or barriers of using it.

Theme 3: HIV self-testing opportunities

The different HIV self-testing opportunities were based on the availability of HIV self-testing kits, and the different motivations for carrying out HIV self-testing. It was reported that the HST Kits were not readily available to the students although they had sufficient motivation to test.

Sub-theme 1: availability of self-testing kits The availability of self-testing kits was assessed by their availability and ease of access in public healthcare facilities, in retail pharmacies in the proximity of some University students dictated their HIV self-testing uptake, whereas the HIV self-testing uptake for university students who reported unavailability of self-testing kits was lower. Additionally, the cost of HIVST kits was based on determining the availability of HIV self-test kits. Most participants expressed inadequate availability of these kits, and this hindered their HIV self-testing opportunities.

"The fact that they are not available in many different places can reduce access and might lead to reduced number of people seeking the service." Said a 23-year-old male UR-Nyagatare student.

"This could be a challenge if obtaining the HIV self-test might involve costs that some individuals, especially students, find prohibitive... If the test were distributed in local pharmacies or near university campuses, it would be more accessible and convenient for everyone." Mentioned a 23-year-old female, UTB student.

Sub-theme 2: motivation of HIV self-testing University students mentioned different reasons that would encourage them to do HIV self-testing. Some of the reported reasons were based on the benefits of using HIV self-testing kits (HIST) compared to other testing methods, the perceived needs of HIST, and their different perceptions of HIST.

I think what can motivate university students to use HIV self-tests is the privacy aspect.. Plus, it's super convenient..." Mentioned a 23-year-old female student at UTB.

"...Accessibility is also key, if it's available in pharmacies and on university campuses, that would be even better." Mentioned a 21-year-old female student at the University of Kigali.

"What can really motivate university students to use this HIV self-test is if it's affordable and cost-effective. It's great that the test is quick and easy to use, but if it's not affordable, students won't be motivated to use it" reported a 24-year-old FGD male participant from UTB.

Participants reported that the knowledge about the convenience, privacy, and ease of use of HIVST kits would motivate university students to use them. Availability of these kits to students would also motivate them, and in addition, alleviating the barriers attached to using HIVST kits like unawareness would further motivate and encourage them to use the kits.

Discussion

The study aimed to assess the level of awareness and perceptions of HIV self-testing among students in selected universities in Rwanda. The findings indicated that a significant number of students had never heard of HIV self-testing, despite a portion of them being sexually active. Females were more aware of HIV self-testing and had used the HIV self-testing kits in the last 12 months than their male counterparts. The Eastern province university students were more aware of HIV self-testing and had used it in the last 12 months than other students. The qualitative findings revealed varying perceptions of HIV self-testing needs, benefits, and barriers, as well as opportunities for improving its uptake among university students.

The quantitative data indicated a low level of HIV self-testing awareness among university students in Rwanda, aligning with findings from Namibia, which also reported low awareness among Namibian students [37]. However, these findings contrast with studies from South Africa [19] and Nigeria [38], where awareness levels were higher. This discrepancy highlights the need for targeted awareness campaigns in Rwanda.

The low HIV self-testing awareness revealed in this study may explain the expressed need for HIV self-testing identified in this study. University students mentioned how important HIV self-testing is, particularly for their group. The expressed need for HIV self-testing among university students was driven by the perceived high prevalence of HIV, frequent sexual activities, and peer pressure. These findings are consistent with studies from Uganda, South Africa, Ethiopia, and Zimbabwe [11, 19, 39].

The need for HIV self-testing was also said to be associated with the perceived impacts of HIV on university students' health, where students explained that having an HIV infection affected their mental and physical health,

their academic performance, and consequently their lives in general. Similar findings were reported in Kenya, where the negative impacts of HIV infection influenced self-testing acceptability [40]. Besides the mentioned negative impacts, the perceived vulnerability of university students to HIV infection was also mentioned to be among the reasons for the reported need for HIV self-testing. This vulnerability was explained by the reported unhealthy sexual relations among university students and limited awareness about HIV self-testing.

University students' perceptions of HIV self-testing were shaped by the benefits and barriers associated with the practice. Benefits such as privacy, convenience, and ease of use were significant motivators, as reported in studies from Canada, South Africa, and Zimbabwe [19, 41, 42]. However, barriers such as high cost, unavailability of testing kits, inadequate information, and lack of post-testing counseling hindered uptake. These barriers were also noted in studies from the DRC and Kenya, which found that despite high acceptability, similar obstacles impeded self-testing [40, 43]. However, similar studies reported elsewhere have documented some of the barriers that hinder university students from using HIV self-testing kits despite the mentioned benefits. The absence of post-testing counseling services was a critical barrier identified in this study, echoing findings from another research [23, 44]. Additionally, this issue was similarly reported in previous studies [19, 45]. The lack of proper information about HIV self-testing among university students contributed to poor usage of HIV self-testing kits, with many students either unaware of the kits or misinformed about the kits.

Additionally, the study findings revealed that the availability and affordability of HIV self-testing were based on the availability of HIV self-testing kits and other motivating factors. Students cited the unavailability and high costs of HIV self-test kits as primary reasons for not using them, consistent with findings from South Africa and Nigeria reported [19, 45]. Addressing these barriers is essential for increasing the uptake of HIV self-testing among university students in Rwanda.

Strengths and limitations

The current study is the first to be carried out in Rwanda to assess the level of awareness and perceptions of HIV self-testing among university students. However, several limitations of this study are acknowledged. Study data collection took place at a time when some university students were on holiday, and only one day was dedicated to data collection at each university, potentially limiting the number of participants. No stratification was done, and the number of students enrolled at each university was not used, as well as the year of study for each university student, and this could lead to misrepresentation

of the sample used in the study and affect generalization. Future studies should consider extending the data collection period and including a larger, more diverse sample to enhance the generalizability of the findings.

Conclusion and recommendation

This study provides valuable insights into the level of awareness and perceptions of HIV self-testing among university students in Rwanda. The findings revealed a low level of awareness and uptake of HIV self-testing among university students despite the recognized benefits. Addressing barriers such as cost, availability, and lack of information is essential for improving self-testing rates and achieving timely HIV diagnosis among university students. Leveraging HIV self-testing motivation among students due to benefits like convenience, ease of use, and privacy is essential in creating targeted awareness campaigns and the provision of affordable, accessible self-testing kits, along with post-testing counseling services, which are recommended to enhance the uptake of HIV self-testing in this population.

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Author contributions

This study's authors made different significant contributions, from study design, data collection, analysis and interpretation, writing reports and manuscripts, and other areas to the completion of this study. All authors agree to be accountable for all aspects of this work.

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Data availability

The datasets will be made available to appropriate academic parties on request from the corresponding author.

Declarations

Ethics approval and consent to participate

The present study was conducted per the Declaration of Helsinki 2013. The study was approved by the CMHS Institutional Review Board (IRB) (No 509/CMHS IRB/202) and all participants provided informed consent before participation in the study. All of the participants' information was anonymously presented in this study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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