Acceptability and correlates of HIV self-testing among university students in northern Nigeria

Zubairu Iliyasu[1,2], Radeeyah B Kassim[1], Bilkisu Z Iliyasu[1], Taiwo G Amole[1], Nafisa S Nass[1], Salisha E Marryshow[3] and Muktar H Aliyu[3,4]

Abstract

Concerns about stigma and confidentiality limit the uptake of HIV testing and counseling (HTC) among young adults. HIV self-testing has been offered as a youth-friendly alternative to conventional HTC. We conducted a cross-sectional study to assess HTC uptake, willingness to self-test, and their predictors among university students ($n = 399$) in Kano, Nigeria. Anonymous self-administered questionnaires were provided to participants. Adjusted odd ratios were generated for predictors with logistic regression models. The results showed that only 35.8% ($n = 143$) of participants had previous HTC.Most respondents (70.4%, $n = 281$) were willing to self-test. HTC was associated with year of college (500 Level vs. 100 Level), adjusted odds ratio (AOR, [95% Confidence Interval (CI)] = 0.44 (0.19–0.97), campus residence (off- vs. on-campus, AOR = 0.45; 95%CI: 0.28–0.73), sexual activity in the past six months (AOR = 0.39; 95%CI: 0.24–0.64), willingness to self-test (AOR = 0.38; 95%CI: 0.22–0.66), and consistent condom use (AOR = 4.45; 95%CI: 1.41–14.08). Students who were older (≥ 30 vs. <20 years, AOR = 0.20; 95%CI: 0.05–0.90) and female (AOR = 0.56; 95%CI: 0.32–0.98) were less likely to be willing to self-test, whereas students who were more senior (500 Level vs. 100 Level, AOR = 5.24; 95%CI: 1.85–14.84), enrolled in clinical science programs (vs. agriculture, AOR = 4.92; 95%CI: 1.51–16.05) or belonging to "other" ethnic groups (vs. Hausa–Fulani, AOR = 2.40; 95%CI: 1.11–5.19) were more willing to self-test. Overall HTC uptake was low, but acceptability of self-testing was high. College seniority, age, ethnicity, and program of study were associated with willingness to self-test. Our findings support the feasibility of scaling up HIV self-testing among university students in Nigeria.

Keywords

HIV self-testing, acceptability, Nigeria, students

Introduction

HIV testing and counseling (HTC) has increased access to antiretroviral therapy, yet nearly one in five persons living with HIV are unaware of their status.[1] These numbers are even lower in West and Central Africa—at the end of 2018, less than two-thirds (64%) of people living with HIV in the sub-region knew their HIV status, compared to 85% in East and Southern Africa.[1] Although East and Southern Africa is the most affected sub-region (adult prevalence of 7%), the HIV response there has been more effective, with improved availability of HIV testing and access to antiretroviral treatment (67%) compared to West and

[1]Department of Community Medicine, Bayero University, Kano, Nigeria
[2]Centre for Infectious Diseases Research, Bayero University, Kano, Nigeria
[3]Department of Health Policy and Vanderbilt Institute for Global Health, Vanderbilt University Medical Center, Nashville, TN, USA
[4]Vanderbilt Institute for Medicine & Public Health, Vanderbilt University Medical Center, Nashville, TN, USA

Corresponding author:
Zubairu Iliyasu, Centre for Infectious Diseases Research, College of Health Sciences, Bayero University, Kano, Nigeria.
Email: ziliyasu.cmed@buk.edu.ng

Central Africa, where the adult HIV prevalence is 1.5% with only 53% of HIV-infected persons accessing antiretroviral treatment.[1]

HIV self-testing (HIVST), the performance and interpretation of a rapid diagnostic test on one's own oral fluid or blood sample in private, is an additional approach to increasing uptake of HIV testing services.[2] However, HIVST has its drawbacks, including requiring confirmation, risk of self-harm and partner violence, and missed opportunities for counseling and prompt linkage to care.[3] Nevertheless, in some settings, HIVST has doubled the uptake and frequency of HIV testing uptake, with minimal risk.[4] The reported acceptability of HIVST among young adults in some African countries range from 60.3% to 96.4%,[5–7] while among students it ranged from 81.4% to 87.1%.[8–14]

Nigeria is Africa's most populated country, with a population of ∼200 million, half of whom are young adults. The national HIV prevalence in Nigeria is 1.4%, with a three-fold higher prevalence (1.3%) among young women aged 20–24 years, compared to men of the same age group (0.4%).[15] University students are at increased risk of contracting HIV and other sexually transmitted infections, due to increased opportunities for sexual experimentation and risky sexual activities associated with new-found social freedoms.[16] The cultural milieu in northern Nigeria also encourages early marriage, intergenerational marriage, and concurrent sexual partnerships. Furthermore, child labor, female genital cutting, divorce, re-marriage, low pre-marital HIV screening, and low condom use increase the risk among young adults.[17]

Despite their increased risk, HIV testing rates among young Nigerians is very low—in 2017, only 9.5% of males aged 15–24 years and 12.1% of females of the same age in Nigeria reported having tested for HIV in the prior year and received the results of their test.[18] The World Health Organization (WHO) has encouraged the adoption of HIVST,[19] yet little country-specific research has focused on university students in Nigeria. Variable HIVST acceptance rates have been reported in sub-Saharan Africa,[8–10,20,21] but to our knowledge, none of these studies was conducted among students in Nigeria. Being the most educated cohort, university students could serve as peer educators and link youths to treatment, thereby enabling the achievement of the 95–95–95 target of ending the AIDS epidemic by 2030.[1]

Objective

The objective of this study is to examine the acceptability of HIVST and identify factors associated with the uptake of HIVST services among university students in Kano, Nigeria. Improved understanding of HIV testing history and attitudes toward HIVST among university students could inform the development of targeted programs, facilitate HIVST, and expand access to HIV prevention and treatment services.

Materials and methods

Study area and population

The study was conducted on the two campuses of Bayero University and its affiliated teaching hospital. Bayero University is located in Kano, northern Nigeria, and has two colleges, two schools, and 19 faculties with an undergraduate student population of 21,682.[22] The majority of students are from Kano and neighboring states, but a sizeable proportion come from other parts of Nigeria and West Africa.[22] The study population consisted of registered undergraduate students. We excluded postgraduate students, students on postings outside Kano, on sick leave, and those who withheld consent.

Study design and sampling

The study was cross-sectional in design. The sample size was obtained using Fisher's formula for a single proportion,[23] with the confidence level set at 95%, and a tolerable error of 5%. We assumed that half of the 21,682 students would be willing to self-test, as a prior stakeholder survey reported that about half of the students (54.8%) supported the introduction of HIVST, and a $p = 0.50$ minimizes sampling error and provides maximum sample size.[24] The sample size ($n = 384$) was increased by 10% to account for non-response, giving a final sample size of 427.

A multistage sampling method was used. In the first stage, 25% of the faculties/courses of study were selected using a one-time ballot. Pieces of paper with serial numbers were mixed in a box and five picked, representing the sampled faculties. In the second stage, one department was selected from each sampled faculty/course of study using the same method. In the third stage, proportionate numbers were allocated to each department and level. Students were systematically recruited from each level.

Ethical clearance was obtained from the Aminu Kano Teaching Hospital Ethics Review Committee (approval number NHREC/21/08/2008/AKTH/EC/2512). Informed consent was obtained after providing detailed information about the study to potential participants. Students were informed that participation was voluntary and that non-participation had no consequences. No incentives were provided. Students who required counseling or health services were referred to the University health services. Questionnaires were

anonymous and participants were identified by unique serial numbers in the database.

Data collection and measures

Data were collected using a structured questionnaire adapted from a previous study.[25] The first section had 12 items eliciting participants' socio-demographic characteristics, including age, marital status, religion, ethnicity, faculty/course of study, and level of study and residence. The second section consisted of 17 items that inquired about previous HIV counseling and testing, place, frequency, motivations for testing, and reasons for not testing. The questionnaire also assessed awareness of self-testing for HIV. The third section ascertained participant's willingness to self-test. The final section centered on previous HIVST, self-reported sexual activity, and risk behavior, including the number of sexual partners and condom use.

The questionnaire was pre-tested for clarity and cultural sensitivity on 40 students of Maitama Sule University, another university located in Kano, Nigeria. The test–retest correlation was used. The questionnaire was administered among the same participants three weeks after the first assessment. Content validity was ascertained by infectious disease specialists and community physicians at Aminu Kano Teaching Hospital. Reliability estimates were based on Cronbach's alpha values. The sections on HIV testing history, willingness to self-test, and risky sexual behavior had Cronbach's alpha values of 0.83, 0.88, and 0.82, respectively.

The two main outcomes of this study were: (1) previous HIV counseling and testing and (2) willingness to self-test for HIV. Previous HIV counseling and testing was determined using the question "Were you ever counseled and tested for HIV?", with two options: "Yes", coded as "1", and "No", coded as "0". Similarly, willingness to self-test for HIV was assessed using "Are you willing to test yourself with HIV self-test kit?", with two choices: "Yes", coded "1", and "No", coded as '0'.

The explanatory variables for the two outcomes included socio-demographics (gender, age, ethnic group, religion, state of origin), faculty/course of study, and level of study, residence, sexual activity, and risk behavior (number of sexual partners, condom use). Willingness to self-test for HIV was included as an independent variable in the model for previous HIV counseling and testing, while previous HIV counseling and testing was included as an independent variable for willingness to self-test.

Procedures

Students were informed of the study through union and department representatives and fliers/posters. Trained research assistants provided self-completed questionnaires to sampled students during lunch break and retrieved it after completion. All questionnaires were checked for completeness and data were double-entered independently by clerks into a password-protected database at the Centre for Infectious Diseases Research.

Data analysis

Data were coded, sorted, and processed using SPSS software version 22 (IBM Corp., Armonk, NY).[26] After data cleaning, continuous data were summarized using means with standard deviation or median with range. Categorical data were presented as frequencies and percentages. At the bivariate level, Pearson's chi-square was used for comparison of the frequencies, while Fisher's exact test was used when the validity conditions of the latter test were not verified.[27] Multicollinearity was checked between independent variables using collinearity statistics, with a tolerance value cut off of <0.2. The criteria used for multicollinearity was tolerance and it's reciprocal, the variance inflation factor (VIF). If the value of tolerance was less than 0.2 and the value of VIF was 10 and greater, then the multicollinearity was considered problematic, and only one of the variables is included in the model.[28] However, none of the variables reached the threshold for elimination. Variables with $p < 0.10$ at the bivariate level and those that were contextually important were entered into a multivariate logistic regression model.[29–31] Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were computed using the stepwise approach for each of the two main outcomes ("Previous HIV counseling and testing" and "willingness to self-test for HIV"). Hosmer–Lemeshow statistic and Omnibus tests were conducted to determine model fitness, with a Hosmer–Lemeshow chi-squared yielding p-value of >0.05 indicating a good fit.[32]

Results

Socio-demographic and behavioral characteristics

Of 427 students recruited, 399 (93.4%) completed the questionnaires. Reasons for non-response included "*I am too busy*" ($n = 12$, 2.8%), "*I have other appointments* ($n = 7$, 1.7%)", and "*It would take too much time*" ($n = 9$, 2.1%). Participants were mostly young (mean age $\pm$ SD, 23.3 ± 0.18 years), male (60.0%, $n = 239$), and single (87.5%, $n = 349$). Majority were of Hausa/

Fulani ethnic group (84.5%, $n = 337$) and Muslim (96.0%, $n = 383$). Half of the respondents were in their fifth or sixth year of study and two-thirds resided off-campus. Over a quarter of participants were sexually active. Among those sexually active, a third had multiple sex partners, and 18.3% used condoms at their last sexual encounter (Table 1).

HIV counseling and testing, motivations, and reasons for not testing

Only 143 participants (35.8%) had previously been tested for HIV. Of these, 59.4% ($n = 85$) received HIV testing once. The most frequent motivations for HIV testing were to meet physical examination requirements for university admission (28.0%, $n = 40$), due to recommendations from a health provider (16.8%, $n = 24$), or in response to suggestions from a friend or family member (13.3%, $n = 19$). About a quarter (24.5%, $n = 35$) of the respondents last tested in the preceding 12 months. Testing was mostly at the university clinic (16.5%, $n = 66$) or a HTC center (10.3%, $n = 41$). The common reasons for not testing included: "*I don't think I have HIV*" (47.3%, $n = 121$), "*I would have liked to, but did not have the opportunity*" (20.0%, $n = 51$), and "*There is no reason for testing*" (16.8%, $n = 43$, Table 2). At the bivariate level, prior HTC was more prevalent among older, non-Hausa–Fulani students, and among first and final year students and those that were willing to self-test. Higher previous testing rates were observed among sexually active students engaged in risky behavior and campus residents ($p < 0.05$, Table 3).

Awareness and willingness to self-test for HIV

Slightly more than half (55.9%, $n = 223$) of the respondents had heard about HIVST prior to the study. Only 9.0% ($n = 36$) of respondents reported previous HIVST. The overwhelming majority of participants were willing to self-test (70.4%, $n = 281$) and to pay for the test kits (55.9%, $n = 223$). Over half (61.4%, $n = 245$) of the respondents were willing to self-test with a sexual partner. At the bivariate level, willingness to self-test was consistently high across gender, age, ethnic, religion, state, and marital categories ($p > 0.05$, Table 3).

Predictors of HTC

The independent predictors of previous HTC included level of study, residence, sexual activity, condom use, and willingness to self-test. Students in the second to sixth year of study were 72–74% less likely to have had HTC compared to first-year students. Compared to campus residents, students living off-campus were

Table 1. Socio-demographic characteristics of University students, Kano, Nigeria.

Characteristics	Frequency No. (%) $N = 399$
Gender	
Male	239 (60.0)
Female	160 (40.0)
Age group (years)	
<20	42 (10.5)
20–24	251 (62.9)
25–29	85 (21.3)
≥30	21 (5.3)
Ethnicity	
Hausa/Fulani	337 (84.5)
Others[a]	62 (15.5)
Religion	
Islam	383 (96.0)
Christianity	16 (4.0)
State of origin	
Kano	233 (58.4)
Jigawa	27 (6.8)
Katsina	17 (4.3)
Others[b]	122 (30.5)
Marital status	
Single	349 (87.5)
Ever married	50 (12.5)
Faculty/course of study	
Clinical sciences	134 (33.6)
Arts and Islamic studies	92 (23.1)
Law	86 (21.6)
Agriculture	47 (11.8)
Engineering	40 (10.0)
Level of study	
100	30 (7.5)
200	27 (6.8)
300	61 (15.3)
400	61 (15.3)
≥500	220 (55.1)
Place of residence	
On campus	132 (33.1)
Off campus	267 (66.9)
Sexual activity (preceding six months)	
Yes	115 (28.8)
No	284 (71.2)
Number of sexual partners[c]	
1	77 (67.0)
≥2	38 (33.0)
Condom use[c]	
Never	55 (47.8)
Occasional	44 (38.3)
Always	16 (13.9)
During the last sexual encounter	21 (18.3)
Previous HIV test	
Yes	143 (35.8)
No	256 (64.2)
Willingness to self-test for HIV	
Yes	281 (70.4)
No	118 (29.6)

[a]Others = Igbo, Yoruba, Tiv, Egbira, Kanuri, and Nupe.
[b]Others = Other Nigerian states.
[c]Only for sexually active respondents.

Table 2. HIV testing history and willingness to self-test among University students, Kano, Nigeria (N = 399).

	Frequency n (%)
HIV testing history	
Previously tested for HIV	
Yes	143 (35.8)
No	256 (64.2)
Motivations for HIV testing	
Medical examination for university admission	40 (10.0)
Advice from doctor/antenatal care	24 (6.0)
Encouraged by a friend or family member	19 (4.8)
Marriage requirement	16 (4.0)
Employment/travel requirement	13 (3.3)
Possible exposure to HIV	11 (2.8)
Illness or symptoms	7 (1.8)
Encouraged by sex partner	5 (1.3)
Others[a]	24 (6.0)
Reasons for not testing for HIV	
I do not think I have HIV	121 (30.3)
I would like to, but I have not had the opportunity	51 (12.8)
There is no reason for testing	43 (10.8)
It takes too much time/ I do not have that time	9 (2.3)
I do not like needles/the testing procedure	9 (2.3)
I am afraid of having a positive test	4 (1.0)
Others[b]	8 (2.0)
HIVST awareness	
Yes	223 (55.9)
No	176 (44.1)
Sources of Information about HIVST	
Health worker	66 (16.5)
Radio	56 (14.0)
Internet	46 (11.5)
Government Hospital/Clinic	30 (7.5)
Television	26 (6.5)
NGO/CBO/Faith-based Health facility	9 (2.3)
Others[b]	17 (4.3)
Prior HIVST	
Had prior self-test for HIV	36 (9.0)
No prior HIVST	363 (91.0)
Attitude toward HIVST	
Willingness to self-test for HIV	
Yes	281 (70.4)
No	118 (29.6)
Preference for types of HIVST	
Oral self-test	65 (16.3)
Blood self-test	291 (72.9)
Not sure	43 (10.8)
Willingness to buy HIVST test kits	
Yes	223 (55.9)
No	176 (44.1)

[a]Wet nurse requirement, NGO Health campaign, and as part of the practical course.
[b]Pharmacy shop/chemist shop, and private hospital/clinic.
HIVST: HIV self-testing.

55% less likely to have had prior HTC (AOR = 0.45 (95%CI: 0.28–0.73)). Similarly, students who were not sexually active were 61% less likely to have tested for HIV compared to their sexually active peers (AOR = 0.39, 95%CI: 0.24–0.64). Occasional and regular condom users were respectively six and four times as likely to have tested for HIV compared to never users. Respondents who were unwilling to self-test for

Table 3. Prior HIV testing and willingness to self-test by respondent characteristics, Kano, Nigeria (n = 399).

Characteristics	N	Previously tested for HIV	P-value	Willing to self-test for HIV	P-value
Gender			0.78		0.086
Male	239	87 (36.4)		176 (73.6)	
Female	160	56 (35.0)		105 (65.6)	
Age group (years)			0.022[a]		0.078
<20	42	13 (31.0)		26 (61.9)	
20–24	251	79 (31.5)		171 (68.1)	
25–29	85	40 (47.1)		69 (81.2)	
≥30	21	11 (52.4)		15 (71.4)	
Ethnicity			0.05[a]		0.055
Hausa/Fulani	337	114 (33.8)		231 (68.6)	
Others	62	29 (46.8)		50 (80.7)	
Religion			0.082		0.17
Islam	383	134 (35.0)		267 (69.7)	
Christianity	17	9 (56.3)		14 (87.5)	
State of origin			0.046		0.33
Kano	233	74 (31.8)		157 (67.4)	
Jigawa	27	7 (25.9)		22 (81.5)	
Katsina	17	5 (35.7)		11 (78.6)	
Others	122	57 (45.6)		91 (72.8)	
Marital status					
Ever married	349	119 (34.1)		245 (70.2)	
Single	50	24 (48.0)		36 (72.0)	
Faculty/course of study			0.006[a]		<0.001[a]
Clinical sciences	134	64 (47.8)		126 (94.0)	
Arts and Islamic studies	92	29 (31.5)		47 (51.1)	
Law	86	29 (33.7)		56 (65.1)	
Agriculture	47	12 (25.5)		30 (63.8)	
Engineering	40	9 (22.5)		22 (55.0)	
Level of study			0.017[a]		<0.001[a]
100	30	14 (46.7)		16 (53.3)	
200	27	5 (18.5)		10 (37.0)	
300	61	17 (27.9)		42 (68.9)	
400	61	16 (26.2)		29 (47.5)	
≥500	220	91 (41.4)		184 (83.6)	
Residence			0.009[a]		0.16
On campus	132	59 (44.7)		99 (75.0)	
Off campus	267	84 (31.5)		182 (68.2)	
Sexual activity (preceding six months)			0.001[a]		0.33
Yes	115	55 (47.8)		85 (73.9)	
No	284	88 (31.0)		196 (69.0)	
Sexual partners[a]			0.12		0.88
1	87	38 (43.7)		64 (73.6)	
≥2	28	17 (60.7)		21 (75.0)	
Condom use[a]			0.001[a]		0.87
Never	66	22 (33.3)		48 (72.7)	
Occasional	35	25 (71.4)		27 (77.1)	
Always	14	8 (57.1)		10 (71.4)	
Previous HIV test			–		<0.001[a]
Yes	143	–		119 (83.2)	
No	256	–		162 (63.3)	
Willingness to self-test			<0.001[a]		–
Yes	281	119 (42.4)		–	
No	118	24 (20.3)		–	

[b]Only for sexually active respondents.
[a] statistically significant at P<0.05

HIV were 62% less likely to have had HTC compared to those who were willing (AOR = 0.38, 95%CI: 0.22–0.66)). The logistic regression model was a good fit (Hosmer–Lemeshow Goodness-of-fit test $x^2 = 3.54$, $p = 0.90$).

Predictors of willingness to undergo HIVST

Willingness to self-test for HIV was predicted by respondents' gender, age, ethnicity, faculty/course of study, and level of study (Table 4). Females were 44% less likely to be willing to self-test for HIV compared to males (AOR = 0.56, 95% CI: 0.32–0.98). Similarly, older respondents (≥30 years) were 80% less likely to be willing to self-test for HIV compared to their younger counterparts, age <20 years (AOR = 0.20, 95%CI: 0.05–0.90). Non-Hausa–Fulani students were twice as likely to self-test for HIV compared to their Hausa–Fulani colleagues (AOR = 2.40, 95%CI: 1.11–5.19). Furthermore, students of the faculty of clinical science had nearly five-fold increased likelihood to be willing to self-test for HIV compared to those in the faculty of agriculture (AOR = 4.92, 95% CI: 1.51–16.05). Students in their fifth year of study or later were five times as likely to be willing to self-test for HIV relative to first-year students (AOR = 5.24, 95%CI: 1.85–14.84). Finally, students with no history of prior HTC were 57% less likely to be willing to self-test for HIV (AOR = 0.43, 95%CI: 0.24–0.79). The model was a good fit (Hosmer–Lemeshow Goodness-of-fit test $x^2 = 6.77$, $p = 0.56$).

Discussion

Recognizing the complementary role of HIVST in access to prevention, treatment, and care, the WHO encouraged countries to generate evidence for its adoption. It was against this background that we documented HTC uptake, willingness to self-test for HIV, and their correlates among undergraduates. We found low uptake of HTC, but most students were willing to self-test. HTC uptake was associated with level of study, residence, sexual activity, condom use, and willingness to self-test, whereas respondents' age, gender, ethnicity, faculty/course of study, and level of study predicted willingness to self-test.

The proportion of sexually active students in our sample (28.8%) was lower than reports from other Nigerian (48.6%),[33,34] and African (51.8–80.9%) institutions.[8,9] However, multiple sex partnership (33.0%) was similar to other Nigerian institutions,[33,34] and elsewhere in Africa (33.3% and 33.9%).[8,9] In contrast, reported condom use among our participants (18.3%) was lower than among their contemporaries in other Nigerian (68%)[33,35] and African institutions (33.5–

66.5%).[8,9] This finding suggests a lower prevalence of sexual risk behavior among our respondents. Cultural factors, the burden and intensity of HIV interventions, variations in study populations, methods, and measurements could explain these differences. For instance, early marriage, intergenerational marriage, and concurrent sexual partnerships are common in northern Nigeria, thereby increasing HIV transmission risk.[17] Similarly, comprehensive knowledge was found in only 43% of young women and 34% of young men aged 15–24 years.[36] In the referenced study, "comprehensive knowledge" was defined as knowledge that consistent use of condoms during sexual intercourse and having just one uninfected faithful partner could reduce the chance of getting HIV, that a healthy-looking person could have HIV, and rejection of the two most common local misconceptions about HIV transmission or prevention (i.e. HIV can be transmitted by mosquito bites and by sharing food with person who has HIV).[36] The figures could be lower in northern Nigeria considering disparities in education.[36] Furthermore, variations in measurement could occur between self-report and HTC records, as interviews are prone to social desirability bias.

The uptake of HTC documented in our study (35.8%) was higher than in some Nigerian institutions (16–30.4%),[34,37,38] but lower than in other institutions within the country (44.2–58.5%),[39–42] parts of Africa (43.3–98.5%),[8,10,43,44] and the rest of the world (41.9–87%).[21,45] In 2018, 67% of those living with HIV in Nigeria were aware of their status. Globally, HIV testing levels were lowest in the Middle East and North Africa (47%), and in west and central Africa (65%). Western Europe, Central Europe, and North America (88%) were closest to achieving 90% testing coverage, followed by East and Southern Africa (85%).[1] Apart from variations in the study population and study methods, disparities in HIV risk perception and access to voluntary counseling and testing services could also account for the differences.

The reasons given by our participants for avoiding HTC were similar to some previous reports,[42] but not others.[8,46] For instance, the proportion of respondents who did not perceive any risk of HIV acquisition (16.8%) was lower than in other African countries (22.7–23.5%).[8,42] Similarly, the proportion of our respondents who attributed inability to undergo HTC to lack of opportunity (20.0%) was two-fold higher than in Ethiopia (9.1%).[42] Furthermore, the proportion of participants who expressed anxiety regarding positive results (1.0%) was much lower than in other Nigerian universities (39.1–82.7%).[41,47,48]

Compared to our study population (55.9%), similar proportions (46.2–54.5%) of students in other African institutions knew about HIVST.[8,9] However, the

Table 4. Logistic regression model for predictors of previous HIV counseling and testing and willingness to self-test for HIV among University students, Kano, Nigeria ($n = 399$).

Characteristics	Previous HTC Adjusted odds ratio (95%CI)[a]	P-value	Willingness to self-test for HIV Adjusted odds ratio (95%CI)[b]	P-value
Gender				
Male	Referent		Referent	
Female	1.45 (0.87–2.43)	0.16	0.56 (0.32–0.98)[c]	0.042[c]
Age group (years)				
<20	Referent		Referent	
20–24	0.55 (0.14–2.17)	0.39	0.43 (0.17–1.05)	0.13
25–29	0.62 (0.22–1.81)	0.38	0.54 (0.18–1.64)	0.23
≥30	1.01 (0.39–2.57)	0.99	0.20 (0.05–0.90)[c]	0.035[c]
Ethnicity				
Hausa–Fulani	Referent		Referent	
Others	0.83 (0.39–1.77)	0.63	2.40 (1.11–5.19)[c]	0.026[c]
Religion				
Islam	Referent		Referent	
Christianity	1.30 (0.41–4.12)	0.66	1.57 (0.29–8.62)	0.60
Marital status				
Single	1.11 (0.53–2.34)	0.79	0.72 (0.30–1.69)	0.45
Ever married	Referent		Referent	
Faculty/course of study				
Agriculture	Referent		Referent	
Clinical sciences	0.99 (0.37–2.66)	0.98	4.92 (1.51–16.05)[c]	<0.001[c]
Engineering	0.56 (0.28–1.13)	0.10	0.52 (0.18–1.46)	0.74
Arts and science	0.72 (0.29–1.79)	0.48	0.72 (0.30–1.71)	0.71
Law	0.91 (0.31–2.63)	0.86	0.84 (0.31–2.26)	0.30
Level of study				
100	Referent		Referent	
200	0.26 (0.073–0.91)[c]	0.033[c]	0.73 (0.22–2.42)	0.53
300	0.28 (0.10–0.74)[c]	0.021[c]	3.88 (1.33–11.34)[c]	0.001[c]
400	0.28 (0.10–0.75)[c]	0.037[c]	1.70 (0.59–4.91)	0.19
≥500	0.44 (0.19–0.97)[c]	0.014[c]	5.24 (1.85–14.84)[c]	0.002[c]
Residence				
On-campus	Referent		Referent	
Off-campus	0.45 (0.28–0.73)[c]	0.04[c]	1.68 (0.91–3.10)	0.098
Sexual activity (preceding six months)				
Yes	Referent		Referent	
No	0.39 (0.24–0.64)[c]	0.001[c]	0.70 (0.37–1.29)	0.25
Condom use				
Never	Referent			
Occasional	6.18 (2.72–14.04)[c]	0.001[c]	Not included in model	
Always	4.45 (1.41–14.08)[c]	0.001[c]		
Previous HIV test				
Yes	Not applicable		Referent	
No			0.43 (0.24–0.79)[c]	0.01[c]
Willingness to self-test for HIV				
Yes	Referent		Not applicable	
No	0.38 (0.22–0.66)[c]	0.005[c]		

[a]Logistic model includes the following variables: gender, age group, ethnicity, religion, marital status, faculty/course of study, level of study, residence, sexual activity, condom use, and willingness to self-test.

[b]Logistic model includes the following variables: gender, age group, ethnicity, religion, marital status, faculty/course of study, level of study, residence, and sexual activity.

[c]Significant at $p < 0.05$.

CI: confidence interval.

acceptability of HIVST (70.0%) was lower than in other parts of Africa (81.4–87.1%)[8–14] and Canada (81%).[24] While the reasons for the high awareness and acceptability are consistent with other studies that identified convenience, confidentiality, and promptness as the main advantages of HIVST,[49] the lower acceptance of HIVST among our respondents could be due to variations in culture, the burden, and intensity of HIV interventions across Africa.[17]

Willingness to pay for test kits was higher among our participants (55.9%) than in other Nigerian institutions (50%), but lower than in other African institutions (72.8–78.4%)[8–10] and Canada (74%).[24] Other studies reported that the proportion of students willing to self-test could change if out-of-pocket costs were eliminated.[11,50] Furthermore, compared with our respondents (61.4%), a higher proportion (68.4–84%) of their peers in other African countries would self-test with their partners.[8,9] This could potentially double the uptake of self-testing, and facilitate protection and treatment of partners.

Most of the predictors of prior HTC except residence have been reported elsewhere.[8,11,12,28,44] The predictive role of sexual activity is not surprising, since sexual activity is the dominant route of HIV infection in sub-Saharan Africa. Sexually active and regular condom users are likely motivated by the need to protect themselves from contracting HIV. They are, therefore, more likely to test for HIV. The predictive effects of level of study on uptake of HTC have been reported in other studies,[44,51] where senior students were less likely to undergo HTC. Our finding could be explained by the inclusion of HTC as part of pre-admission medical examination in most Nigerian tertiary institutions. Pre-admission exams are an opportunity for new students to get tested, while senior students could have been admitted before the implementation of the policy. Likewise, campus residents have the advantage of easier access to HTC services in university clinics (can schedule visits more easily). Finally, it seems logical to expect those who had HTC to be willing to self-test.

The predictors of willingness to self-test in our study differs from previous studies.[8,9] The high acceptance of HIVST among senior students suggest increased risk perception among mature and sexually active students. It is conceivable that increased institutional efforts targeting freshmen with HIV/AIDS messages during orientation programs could partly explain the willingness of first year students to self-test. The reasons for disparity in attitudes among students in their second to fifth years is however, not as easily deduced. This finding should be explored in future studies using qualitative or mixed methods research.

On the differences by gender, another study in Africa found higher acceptance of HIVST among males.[20] This finding could be due to gender variations in risk behavior. Similarly, the effect of ethnicity on willingness to self-test could be related to cultural practices that increase the risk of HIV. The willingness of clinical students to self-test has been reported elsewhere[52] and could be due to better knowledge, skills,[53] and perception of risk of sexual exposure.

Given the large testing gap and the willingness of the participants to use self-testing as an alternative, policymakers should pilot HIVST adoption to facilitate diagnosis and access to prevention, care, and treatment among this sub-population. A critical mass of these young people should be trained and motivated to support their peers. In addition, test kits, counseling services, and linkage to campus health facilities are essential. Future studies could compare testing skills and interpretation among students and health care workers.

Our study has limitations. First, interviewing a cross-section of students in one university in northern Nigeria introduces selection bias, as our sample may not be representative of all Nigerian universities. Even within northern Nigeria, there are variations in cultural practices. It is therefore, necessary to exercise caution when extrapolating our findings to other institutions. The use of a probability sampling method, however, increases the likelihood of our participants being representative of students of other institutions. Second, responses were self-reported and subject to social desirability bias. However, detailed explanation about the study objectives, assurance of confidentiality, and self-completion of the questionnaires could have reduced this possibility. Finally, when confronted with the reality of HIV testing, some respondents who were keen on self-testing could change their minds. Nonetheless, this proportion is unlikely to be large enough to alter the programmatic utility of our results. The strengths of our study include the large sample size, high response rate (93.4%), the use of a validated questionnaire, and the application of multivariate regression analyses, which controlled for potential confounders.

Conclusion

We found HTC uptake to be low among a sample of university students in northern Nigeria, but the majority of university students were willing to self-test for HIV. We recommend measures that will enable increased uptake of HTC services, including training of peer educators, establishment of counseling hotlines, reliable supply of subsidized test kits, and strengthening of linkages with university health services.

Key messages

- Uptake of HTC services is low among university students in northern Nigeria, but the majority of university students were willing to self-test for HIV.
- Willingness to undergo HIV-self testing was associated with college seniority, age, ethnicity, and program of study.
- Our findings support the feasibility of scaling up HIVST among university students in northern Nigeria.

ORCID iD

Muktar H Aliyu https://orcid.org/0000-0001-9504-4679

References

1. www.unaids.org/en/resources/fact-sheet (2019, accessed 7 January 2020).
2. Nguyen VTT, Best S, Pham HT, et al. HIV point of care diagnosis: preventing misdiagnosis experience from a pilot of rapid test algorithm implementation in selected communes in Vietnam. *J Int AIDS Soc* 2017; 20: 21752.
3. Wood BR, Ballenger C and Stekler JD. Arguments for and against HIV self-testing. *HIV AIDS* 2014; 6: 117–126.
4. Johnson CC, Kennedy C, Fonner V, 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: 21594.
5. Tonen-Wolyec S, Batina-Agasa S, Muwonga J, et al. Acceptability, feasibility, and individual preferences of blood-based HIV self-testing in a population-based sample of adolescents in Kisangani, Democratic Republic of the Congo. *PLoS One* 2019; 14: e0218795.
6. Hector J, Davies MA, Dekker-Boersema J, et al. Acceptability and performance of a directly assisted oral HIV self-testing intervention in adolescents in rural Mozambique. *PLoS One* 2018; 13: e0195391.
7. Smith P, Wallace M and Bekker LG. Adolescents' experience of a rapid HIV self-testing device in youth-friendly clinic settings in Cape town South Africa: a cross-sectional community based usability study. *J Int AIDS Soc* 2016; 19: 21111.
8. Mokgatle MM and 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: e0169765.
9. Izizag BB, Situakibanza H, Mbutiwi T, et al. Factors associated with acceptability of HIV self-testing (HIVST) among university students in a Peri-Urban area of the Democratic Republic of Congo (DRC). *Pan Afr Med J* 2018; 31: 248.
10. Zanolini A, Chipungu J, Vinikoor MJ, et al. HIV self-testing in Lusaka Province, Zambia: acceptability, comprehension of testing instructions, and individual preferences for self-test kit distribution in a population-based sample of adolescents and adults. *AIDS Res Hum Retroviruses* 2018; 34: 254–260.
11. Kalibala S, Tun W and Cherutich P. Factors associated with acceptability of HIV self-testing among health care workers in Kenya. *AIDS Behav* 2014; 18: S405–S414.
12. Kebede B, Abate T and Mekonnen D. HIV self-testing practices among Health Care Workers: feasibility and options for accelerating HIV testing services in Ethiopia. *Pan Afr Med J* 2013; 15: 50.
13. Kumwenda M, Munthali A, Phiri M, et al. Factors shaping initial decision-making to self-test amongst cohabiting couples in urban Blantyre, Malawi. *AIDS Behav* 2014; 18: S396–S404.
14. Tonen-Wolyec S, Mbopi-Keou F, Batina-Agasa S, et al. Acceptability of HIV self-testing in African students: a cross-sectional survey in the Democratic Republic of Congo. *Pan Afr Med J* 2019; 33: 83.
15. UNAIDS. New survey results indicate that Nigeria has an HIV prevalence of 1·4%, www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2019/march/20190314_nigeria (2019, accessed 21 September 2019).
16. Shiferaw Y, Alemu A, Assefa A, et al. Perception of risk of HIV and sexual risk behaviors among University students: implication for planning interventions. *BMC Res Notes* 2014; 7: 162.
17. Obioha E. Exploring the cultural context of HIV/AIDS pandemic in a Nigerian community: implication for culture specific prevention programmes. *Anthropologist* 2008; 10: 269–276.
18. UNICEF. Global and Regional trends, https://data.unicef.org/topic/hivaids/global-regional-trends/ (2019, accessed 21 September 2019).
19. Consolidated Guidelines on HIV Testing Services: 5Cs: consent, confidentiality, counselling, correct results and connection 2015. Geneva, Switzerland: World Health Organization; 2015.
20. Harichund C and Moshabela M. Acceptability of HIV self-testing in Sub-Saharan Africa: scoping study. *AIDS Behav* 2018; 22: 560–568.
21. Pant Pai N, Bhargava M, Joseph L, et al. Will an unsupervised self-testing strategy be feasible to operationalize in Canada? Results from a pilot study in students of a large Canadian university. *AIDS Res Treat* 2014; 2014: 747619.

22. Bayero University, Kano, www.buk.edu.ng/ (2019, accessed 14 June 2019).

23. Lwanga SK and Lemeshow S. Sample size determination in health studies: a practical manual. Geneva, Switzerland: *World Health Organization*, 1991, pp.29–32.

24. Brown B, Folayan MO, Imosilic A, et al. HIV self-testing in Nigeria: public opinions and perspectives. *Global Public Health* 2015; 10: 354–365.

25. Mugo PM, Micheni M, Shangala J, et al. Uptake and acceptability of oral HIV self-testing among community pharmacy clients in Kenya: a feasibility study. *PLoS One* 2017; 12: e0170868.

26. IBM Corp. Released 2013. IBM SPSS statistics for windows, version 22.0. Armonk, NY: IBM Corp.

27. Kim H. Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. *Restor Dent Endod* 2017; 42: 152–155.

28. Salmerón GR, García PJ, López MDM, et al. Collinearity diagnostic applied in ridge estimation through the variance inflation factor. *J Appl Stat* 2016; 43: 1831–1849.

29. Anthony OK, Adetayo T, Folajinmi O, et al. Gender and HIV testing service uptake: trend in Northern Nigeria. *J AIDS Clin Res* 2016; 7: 638.

30. Staveteig S, Shanxiao W, Head SK, et al. 2013. Demographic patterns of HIV testing uptake in Sub-Saharan Africa. DHS comparative reports no. 30. Calverton, MD: ICF International.

31. Katz MH. Multivariable analysis– a practical guide for clinicians and public health researchers. Cambridge, UK: Cambridge University Press, 2011.

32. Hosmer DW and Lemeshow S. Applied logistic regression. New York, NY: Wiley, 2013.

33. Imaledo JA, Peter-Kio OB and Asuquo EO. Pattern of risky sexual behavior and associated factors among undergraduate students of the University of Port Harcourt, Rivers State, Nigeria. *Pan Afr Med J* 2012; 12: 97.

34. Uzochukwu B, Uguru N, Ezeoke U, et al. Voluntary counseling and testing (VCT) for HIV/AIDS: a study of the knowledge, awareness and willingness to pay for VCT among students in tertiary institutions in Enugu State Nigeria. *Health Policy* 2011; 99: 277–284.

35. Ajuwon AJ, Titiloye M, Oshiname F, et al. Knowledge and use of HIV counseling and testing services among young persons in Ibadan, Nigeria. *Int Q Community Health Educ* 2010–2011; 31: 33–50.

36. National Population Commission (NPC) [Nigeria] and ICF. Nigeria demographic and health survey 2018. Abuja, Nigeria, and Rockville, MD: NPC and ICF, 2019.

37. Abiodun O, Sotunsa J, Ani F, et al. Knowledge of HIV/AIDS and predictors of uptake of HIV counseling and testing among undergraduate students of a privately owned university in Nigeria. *BMC Res Notes* 2014; 7: 1.

38. Wusu O and Okoukoni S. The role of HIV counselling and testing in sexual health behaviour change among undergraduates in Lagos. *Tanzan J Health Res* 2011; 13: 27–32.

39. Onyeonoro UU, Emelumadu OF, Chuku A, et al. Knowledge and utilization of HIV counseling and testing services among students of a tertiary institution in Abia State, South East Nigeria. *J HIV Hum Reprod* 2014; 2: 8–14.

40. Asante KO. HIV/AIDS knowledge and uptake of HIV counselling and testing among undergraduate private university students in Accra. *Ghana Reprod Health* 2013; 10: 17.

41. Ogaji DS, Oyeyemi AS and Ibrahim I. Awareness, willingness and use of Voluntary HIV testing and counseling services by students of a university in south-south Nigeria. *J Comm Med Prim Health Care* 2013; 25: 36–44.

42. Tsegay G, Edris M and Meseret S. Assessment of voluntary counseling and testing service utilization and associated factors among Debre Markos University Students, North West Ethiopia: a cross-sectional survey in 2011. *BMC Public Health* 2013; 13: 243.

43. Vermeer W, Bos AER, Mbwambo J, et al. Social and cognitive variables predicting voluntary HIV counseling and testing among Tanzanian medical students. *Patient Educ Couns* 2009; 75: 135–140.

44. Caldeira KM, Singer BJ, O'Grady KE, et al. HIV testing in recent college students: prevalence and correlates. *AIDS Educ Prev* 2012; 24: 363–376.

45. Hurt CB, Soni K, Miller WC, et al. HIV testing practices and interest in self-testing options among young, Black men who have sex with men in North Carolina. *Sex Transm Dis* 2016; 43: 587–593.

46. Djibuti M, Zurashvili T, Kasrashvili T, et al. Factors associated with HIV counseling and testing behavior among undergraduates of universities and vocational technical training schools in Tbilisi, Georgia. *BMC Public Health* 2015; 15: 427.

47. Bibiana NE, Emmanuel PO, Amos D, et al. Knowledge, attitude and factors affecting voluntary HIV counseling and testing services among women of reproductive age group in an Abuja Suburb community, Nigeria. *Med J Zambia* 2018; 45: 13–22.

48. Choko AT, Desmond N, Webb EL, 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: e1001102.

49. Pal K, Ngin C, Tuot S, et al. Acceptability study on HIV self-testing among transgender women, men who have sex with men, and female entertainment workers in Cambodia: a qualitative analysis. *PLoS One* 2016; 11: e0166129.

50. Ng OT, Chow AL, Lee VJ, et al. Accuracy and user-acceptability of HIV self-testing using an oral fluid-based HIV rapid test. *PLoS One* 2012; 7: e45168.

51. Xu H, Xie J, Xiao Z, et al. Sexual attitudes, sexual behaviors, and use of HIV prevention services among male undergraduate students in Hunan, China: a cross-sectional survey. *BMC Public Health* 2019; 19: 250.

52. Onadeko MO, Balogun MO, Onigbogi OO, et al. Occupational exposure, attitude to HIV-positive patients and uptake of HIV counselling and testing among health care workers in a tertiary hospital in Nigeria. *Sahara J* 2017; 14: 193–201.

53. Kuecuekbalaban P, Rostalski T, Schmidt S, et al. Psychological, situational and application-related determinants of the intention to self-test: a factorial survey among students. *BMC Health Serv Res* 2017; 17: 468.