'I will choose when to test, where I want to test': investigating young people's preferences for HIV self-testing in Malawi and Zimbabwe

Pitchaya P. Indravudh[a], Euphemia L. Sibanda[b,c], Marc d'Elbée[d], Moses K. Kumwenda[a], Beate Ringwald[c], Galven Maringwa[b], Musonda Simwinga[e], Lot J. Nyirenda[c], Cheryl C. Johnson[f], Karin Hatzold[g], Fern Terris-Prestholt[d] and Miriam Taegtmeyer[c]

Objectives: The current study identifies young people's preferences for HIV self-testing (HIVST) delivery, determines the relative strength of preferences and explores underlying behaviors and perceptions to inform youth-friendly services in southern Africa.

Design: A mixed methods design was adopted in Malawi and Zimbabwe and includes focus group discussions, in-depth interviews and discrete choice experiments.

Methods: The current study was conducted during the formative phase of cluster-randomized trials of oral-fluid HIVST distribution. Young people aged 16–25 years were purposively selected for in-depth interviews ($n = 15$) in Malawi and 12 focus group discussions ($n = 107$) across countries. Representative samples of young people in both countries ($n = 341$) were administered discrete choice experiments on HIVST delivery, with data analyzed to estimate relative preferences. The qualitative results provided additional depth and were triangulated with the quantitative findings.

Results: There was strong concordance across methods and countries based on the three triangulation parameters: product, provider and service characteristics. HIVST was highly accepted by young people, if provided at no or very low cost. Young people expressed mixed views on oral-fluid tests, weighing perceived benefits with accuracy concerns. There was an expressed lack of trust in health providers and preference for lay community distributors. HIVST addressed youth-specific barriers to standard HIV testing, with home-based distribution considered convenient. Issues of autonomy, control, respect and confidentiality emerged as key qualitative themes.

Conclusion: HIVST services can be optimized to reach young people if products are provided through home-based distribution and at low prices, with respect for them as autonomous individuals.

[a]Malawi-Liverpool-Wellcome Trust Clinical Research Programme, Blantyre, Malawi, [b]Centre for Sexual Health and HIV AIDS Research Zimbabwe, Harare, Zimbabwe, [c]Department of International Public Health, Liverpool School of Tropical Medicine, Liverpool, [d]Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, UK, [e]Zambart, Lusaka, Zambia, [f]Department of HIV/AIDS, World Health Organization, Geneva, Switzerland, and [g]Population Services International, Washington, District of Columbia, USA.

Correspondence to Fern Terris-Prestholt, Department of Global Health and Development, Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, UK.

E-mail: Fern.Terris-Prestholt@lshtm.ac.uk

Introduction

Young people aged 15–24 years account for a third of people with HIV in sub-Saharan Africa and a third of new infections worldwide [1]. HIV testing among this population remains disproportionately low compared with adults, with coverage even lower among adolescents aged 15–19 years [2,3]. Late HIV diagnosis, delays in antiretroviral therapy initiation and poor adherence to treatment have resulted in poor clinical outcomes among this age group [4–7].

Young people experience unique barriers to standard HIV testing services (HTS) that contribute to low uptake of HIV testing. Individual and household-level barriers include perceptions of low risk of HIV infection, emotional burden of dealing with a positive test result and absence of support from family and friends [8,9]. On a community and health-systems level, stigma around HIV testing in communities, fear of disrespect by healthcare providers, concerns over confidentiality and issues of parental or guardian consent can prevent young people from accessing HTS [8–12]. Young people are also rarely financially independent and therefore disproportionately affected by actual and perceived costs of accessing services [8,11].

HIV self-testing (HIVST), the process in which a person collects his or her own specimen, performs the test and interprets the results, is now recommended as an additional approach by the WHO [13]. This approach has potential for reaching young people and overcoming some of the barriers associated with HTS [14]. Key motivations for young people in sub-Saharan Africa to self-test include greater confidentiality, privacy, convenience and the perception that oral-fluid self-test kits are easy to use [15–18]. Compared with other age groups, adolescents aged 16–19 years old had the highest uptake of HIVST when delivered to communities in urban Malawi [19]. Although young people appear to have an interest in HIVST, research on their preferences for HIVST delivery – specifically around product, provider and service characteristics – is limited. A greater understanding of young people's preferences is needed to inform and develop optimal youth-friendly HIVST strategies that will facilitate uptake of testing and linkage to prevention and treatment.

Methods

A mixed methods design was used to identify young people's preferences for how HIVST should be delivered, to determine the relative strength of preferences, and to explore behaviors and perceptions that may underlie preferences. Figure 1 details the design, data collection and data analysis process and how the methods supported and built on each other and ultimately provided a comprehensive framework for understanding preferences. Focus group discussions (FGD) explored group perceptions and in-depth interviews (IDI) aimed to gain more insight into sensitive issues and create an environment for people to disclose previous testing and HIV status. Discrete choice experiments (DCE), a method for measuring stated preferences for goods or services, were informed by the qualitative research and provided a quantitative estimate of preferences [20–22]. By asking people to choose between alternative bundles of HIVST delivery characteristics, choice data can be analyzed to understand key drivers of demand.

Data collection

The current research was nested within the formative phase of a series of parallel cluster-randomized trials of community distribution of oral-fluid self-test kits (OraQuick HIV Self-Test) under UNITAID/PSI Self-Testing Africa (STAR) (refer to hivstar.lshtm.ac.uk). The formative studies and trials aimed to inform and evaluate country-specific programing, resulting in different research designs and sampling methods. Studies were guided by intercountry research questions, which enabled analyses to be conducted across contexts despite differences in designs. The qualitative studies and DCEs were conducted between April and September 2016 in Malawi (Blantyre, Machinga, Mwanza and Neno districts) and Zimbabwe (Mazowe district). Ethical approvals were obtained from the College of Medicine Research Ethics Committee in Malawi, the Medical Research Council of Zimbabwe and the Research Ethics Committee of the London School of Hygiene and Tropical Medicine.

For the FGDs and IDIs, topic guides across the two countries aimed to elicit views on barriers and facilitators to HIV testing, values and preferences for HIVST and perceptions around social impacts from HIVST. Participants, aged 16–25 years, were recruited from communities undergoing pilot HIVST implementation. In Malawi, residents who had self-tested were purposively sampled to ensure representation by women and men and whether or not they had previously tested for HIV. Participants in Zimbabwe were similarly sampled by sex as well as whether or not they had self-tested. In total, 15 IDIs and three FGDs ($n = 23$) were conducted in Malawi and nine FGDs ($n = 84$) were administered in Zimbabwe. FGDs and IDIs were conducted in local languages, audio-recorded, and transcribed and translated into English.

Emerging themes from the qualitative data, as well as findings from a literature review and ranking exercise with qualitative participants on HIV testing characteristics relevant to each country, informed the DCE design process (Fig. 1), which adhered to standard guidelines [23]. The DCEs consisted of a set of scenarios, each comprising two alternative approaches for delivering HIV testing (Appendix 1, http://links.lww.com/QAD/B96).
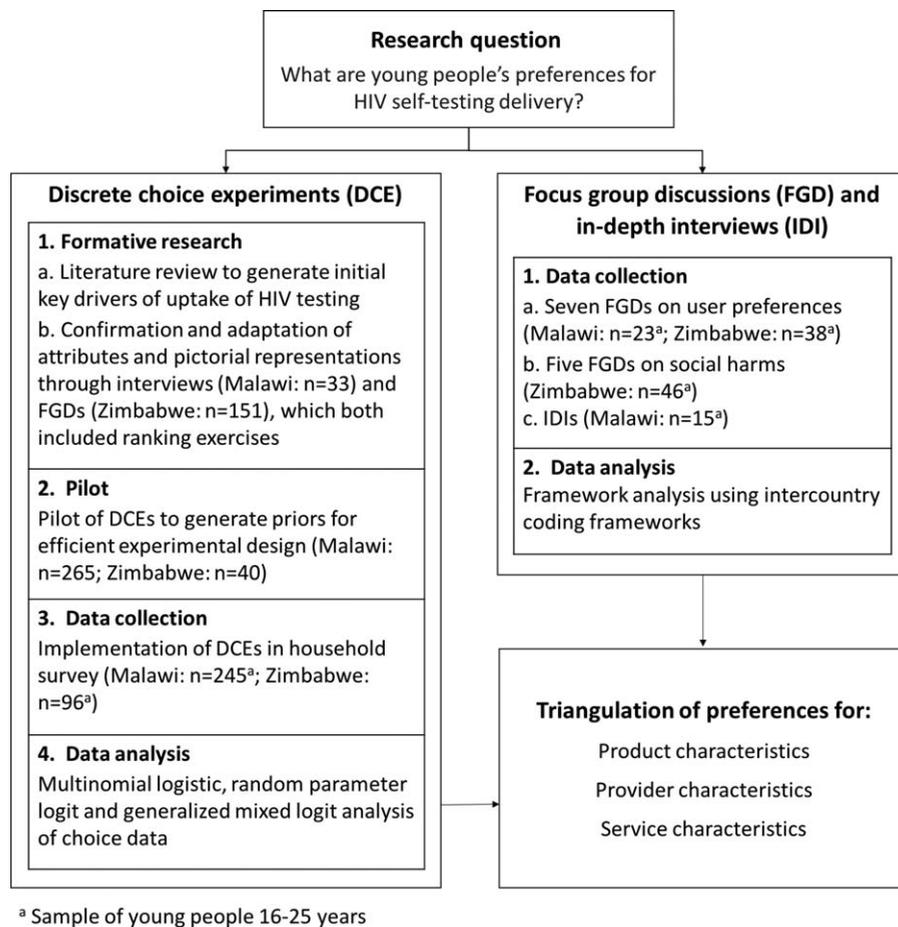
Fig. 1. Overview of mixed methods.

The Malawi DCE also included the option to select the status quo. Pictorial representations of these scenarios were developed to facilitate comprehension of the alternative services. Using prior parameters generated from a pilot, we created an unlabeled d-efficient design, considered leading practice [24], in *Ngene* (version 1.21.1; ChoiceMetrics Pty Ltd, Sydney, New South Wales, Australia) to identify the fewest number of choice sets for estimating all parameters [25].

The DCEs were nested within larger population-based household surveys conducted at baseline in Malawi and after pilot distribution in Zimbabwe under the respective cluster-randomized trials. We employed a two-stage sampling design. Households from enumeration areas in both countries were first randomly selected for the survey; household members aged 16 years or older were eligible. Next, eligible participants in Malawi who had a recent negative test or did not know their HIV status were randomly allocated the DCE. In contrast, the first 300 eligible participants in Zimbabwe were given the DCE regardless of HIV status. Participants were randomly assigned to one of 40 sets of six choice scenarios using an electronic tablet-based questionnaire in Malawi and one of two sets of nine choice scenarios using a paper-based

questionnaire in Zimbabwe. Interviewers explained the attribute levels (Table 1) and illustrations and provided a demonstration of the oral-fluid self-test before participants were asked to select their preferred service for each scenario. Sample size was calculated using the rule of thumb by Johnson and Orme [26], suggesting a minimum sample size of 170 in Malawi and 110 in Zimbabwe. Given our focus on young people, we only analyzed choice data from participants aged 16−25 years. Although this sample ($n = 245$ in Malawi and $n = 96$ in Zimbabwe) was sufficient for estimating strength of preference for the attribute levels, it did not allow for robust estimation of variation in preferences between subgroups of young people.

Data management and analysis
The qualitative data, while informing the DCE design, were analyzed as an independent data source to provide additional depth in understanding preferences and reflect the breadth of enquiry. A framework analysis was used to deductively generate themes around user preferences, including product, provider and service characteristics, and inductively construct themes that arose frequently from the data in both countries [27]. Intercountry coding frameworks were developed, and emerging themes were

Table 1. Attributes and levels for discrete choice experiments.

Preference by domain	Malawi		Zimbabwe	
	Attribute	Levels	Attribute	Levels
Product characteristics	Test price	Free, 50 Malawian kwacha (US$ 0.07), 150 Malawian kwacha (US$ 0.21)	Test price	Free, US$ 0.50, US$ 1
	Sample collection method	Oral-fluid self-test, blood-based self-test, provider-delivered blood-based test		
Provider characteristics	Type of provider	Healthcare worker, lay distributor, intimate partner	Provider age	≤30 years old, >30 years old
			Provider residence	Same community, outside of community
Service delivery characteristics	Location	Health facility, mobile clinic, home, home of provider	Location	Health facility, mobile clinic, home
	Pretest support	Instruction leaflet, hotline, in-person, hotline and in-person	Pretest support	Instruction leaflet, hotline, in-person
	Posttest support	Instruction leaflet, hotline, in-person, hotline and in-person	Opening hours	Regular hours, regular hours and evenings and weekends
			Batched or individual distribution	Batch distribution, individual distribution

Italicized headings represent HIV self-testing attributes. Attribute levels follow.

identified through collaborative analysis of the field notes and collected data and in-person discussions of researchers and implementers. Transcripts were coded in *NVivo* (version 10; QSR International, Burlington, Massachusetts, USA) by one researcher in each country, with an independent coder checking 10 percentage of transcripts for intercoder reliability. Data were analyzed to ensure that commonalities or differences between individuals and groups as units were visible.

DCE data were cleaned using *Stata Statistical Software* (version 14; StataCorp, College Station, Texas, USA). Utilities (U), representing the strength of relative preferences, were estimated for each country using discrete choice models in *Nlogit*. Choice data, elicited from the choice made between the service alternatives, were first analyzed using a multinomial logistic (MNL) model as a basic model. Random parameter logit (RPL) and generalized mixed logit (GMXL) models were then introduced to respectively allow for unobserved preference heterogeneity in addition to scale heterogeneity [28]. Effects coding was used for attribute levels, which were categorical except for price. Three common attributes were included across countries that could be directly compared: price of kit, location of distribution and level of pretest support.

Key preferences elicited from the DCE and qualitative data were categorized into the following domains: product features such as price and specimen collection method; provider characteristics including the type of provider; and service attributes for example the location of distribution. Findings within each of these categories were triangulated across methods and classified as

consistent, complementary (if providing more depth or a different perspective) or contradictory.

Results

Background characteristics of DCE and qualitative participants are detailed in Table 2 and reflect representation among young people across sex, education, employment status, marital status and prior HIV testing. Most participants were women and had previously tested for HIV. In comparison with Malawi, more young people in Zimbabwe had higher education levels, were employed with a regular salary or were unmarried.

In this section, we present the DCE and qualitative results around preferences for product, provider and service delivery attributes followed by the triangulation results. Estimates generated from the MNL, RPL and GMXL models were largely robust across models (Appendix 2, http://links.lww.com/QAD/B96). The gamma and tau parameters, which test for unobserved and scale heterogeneity, were highly insignificant for the GMXL model ($P = 0.94$ in Malawi and $P = 0.78$ in Zimbabwe for both parameters), meaning we can revert to the basic model that does not account for heterogeneity. In Table 3, we present the MNL estimates in detail. The results from the method triangulation are shown in Table 4, with the qualitative analysis providing additional depth in explaining the strength of preference as well as identifying important divergent views and concerns among young people.

Table 2. Background characteristics for participants aged 16–25 years old.

	In-depth interviews	Focus group discussions		Discrete choice experiments	
	Malawi	Malawi	Zimbabwe	Malawi	Zimbabwe
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Sex					
Male	7 (46.7)	10 (43.5)	37 (44.0)	90 (36.7)	48 (50.0)
Female	8 (53.5)	13 (56.5)	47 (56.0)	155 (63.3)	48 (50.0)
Age [median (IQR)]	20 (18, 21)	20 (19, 23)	21 (19, 23)	20 (18, 23)	20 (17, 22)
Education					
No formal schooling	2 (13.3)	0 (0.0)	0 (0.0)	21 (8.6)	1 (1.0)
Started or completed primary school	11 (73.3)	13 (56.5)	6 (7.1)	168 (68.6)	22 (22.9)
Started or completed secondary school	2 (13.3)	10 (43.5)	78 (92.9)	54 (22)	71 (74.0)
Tertiary	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.8)	2 (2.1)
Employed with regular salary	2 (13.3)	10 (43.5)	N/A	3 (1.2)	12 (12.5)
Married	7 (46.7)	12 (52.5)	35 (41.7)	134 (54.7)	37 (38.5)
Ever tested for HIV	7 (46.7)	14 (60.9)	N/A	190 (77.6)	69 (71.9)
Total	15 (100.0)	23 (100.0)	84 (100.0)	245 (100.0)	96 (100.0)

IQR, interquartile range.

Product characteristics

For the DCE, price had a very strong influence on testing choices in both Malawi ($U = -4.874$, $P < 0.01$) and Zimbabwe ($U = -1.691$, $P < 0.01$). The strength of these preferences can be interpreted relative to changes in other attribute levels. For example an increased price of US\$ 0.10 in Malawi would lead to a utility loss of -0.487. Including another attribute level with an equally large, but positive utility could compensate for the effect of such a price increase. In Malawi, the DCE did not identify any significant preferences between the specimen collection methods (e.g. oral fluid self-test, blood-based self-test and provider-delivered blood-based test).

The FGD and IDI results in both countries revealed that HIVST kits should be no to very low cost, with price acting as a barrier to testing. In Malawi, this was seen to be particularly important for those who were not working or financially dependent on their families. In terms of the self-testing product, young people across countries saw it as an innovative technology and appreciated the ability to control the testing and disclosure process.

I will choose when to test, where I want to test, and I can determine how private the place of testing is . . . 19-year-old man, FGD, Zimbabwe

Although there was strong consensus in FGDs around self-testing, views around performance and accuracy of the different specimen collection methods diverged. Participants expressed that they were more accepting of oral–fluid tests than older people and talked about benefits such as ease–of–use and painless specimen collection compared with finger prick for blood-based testing. There was, however, the perception that blood-based tests were more accurate, a view held more strongly in FGDs in Zimbabwe than Malawi as expressed here:

Many said [oral-fluid tests were not] reliable because . . . the virus is in the blood. So many were not satisfied with this self-testing. 16-year-old woman, FGD, Zimbabwe

When the results were triangulated across the DCE and qualitative methods, preferences for product characteristics were found to be consistent, with participants desiring for HIVST kits to be free of charge or very low cost. Preference between the different specimen collection methods was also similar: no strong preferences were revealed in the DCEs and the FGD and IDI findings were mixed, with stated benefits of oral–fluid self-tests offset by concerns around accuracy.

Provider characteristics

In Malawi, young people in the DCEs preferred to obtain an HIVST kit from a minimally trained community distributor ($U = 0.085$, $P < 0.10$) to a trained healthcare worker (HCW) ($U = 0.037$, $P \geq 0.10$) or intimate partner ($U = -0.122$, $P < 0.10$). Meanwhile, participants in Zimbabwe were indifferent to the age group of providers and whether they came from the same community. Each of these provider attributes was country-specific and could therefore not be compared across settings.

FGD and IDI participants in both countries felt that HIVST would motivate young people to test in settings characterized by distrust in HCWs to convey the correct results and keep information confidential. There was a stated preference for lay community distributors, though there were some concerns raised in the Malawi FGDs around their counseling qualifications. In the Malawi FGDs and IDIs, peer groups were also suggested as important conduits for supporting young people. Further, participants in Zimbabwe expressed desire to have distributors residing in the same village, as this facilitated availability of support and assistance if needed:

Table 3. Estimation of young people's preferences for HIV self-testing delivery using multinomial logistic regressions.

	(A) Model I (Malawi)				(B) Model II (Zimbabwe)		
	Coefficient		St. Err.		Coefficient		St. Err.
Product characteristics				Product characteristics			
Test price	−4.874	*	0.440	*Test price*	−1.691	*	0.480
Sample collection method							
Oral-fluid self-test	0.082		0.062				
Blood-based self-test	−0.025		0.057				
Provider-delivered blood-based test	−0.057		0.096				
Provider characteristics				Provider characteristics			
Type of provider				*Provider age*			
Healthcare worker	0.037		0.053	≤30 years	0.012		0.036
Lay distributor	0.085	**	0.050	>30 years	−0.012		0.036
Intimate partner	−0.122	**	0.068	*Residence of provider*			
				Same community	0.070		0.054
				Outside of the community	−0.070		0.054
Service delivery characteristics				Service delivery characteristics			
Location of distribution				*Location of distribution*			
Health facility	−0.140	**	0.081	Health facility	−0.030		0.078
Mobile clinic	−0.170	*	0.065	Mobile clinic	−0.669	***	0.275
Home	0.350	*	0.080	Home	0.699	***	0.301
Home of distributor	−0.040		0.065				
Pretest support				*Pretest support*			
Instruction leaflet	−0.096		0.064	Instruction leaflet	−0.049		0.105
Hotline	0.024		0.068	Hotline	0.039		0.110
In-person	−0.024		0.064	In-person	0.010		0.067
Hotline and in-person	0.096		0.080	*Hours of operation*			
Posttest support				Regular hours	0.078		0.070
Instruction leaflet	−0.141	***	0.068	Regular hours and evenings and weekends	−0.078		0.070
Hotline	0.014		0.060	*Batch or individual distribution*			
In-person	0.126	***	0.062	Individual distribution	−0.018		0.036
Hotline and in-person	0.002		0.075	Batch distribution	0.018		0.036
Neither[a]	−1.760	*	0.111				
Neither[a] *never tested*	−0.013		0.098				
AIC	2706.7			AIC	1149.30		
LLF	−1337.4			LLF	−565.63		
N	245			*N*	96		

Effects coding used for categorical variables.
Italicized headings represent HIV self-testing attributes. Attribute levels follow.
AIC, Akaike information criterion; LLF, Log likelihood function.
[a]Neither represents the status quo alternative.
*Is significant at *P* value < 0.01.
**Is significant at *P* value < 0.10.
***Is significant at *P* value < 0.05.

[The distributor] could give the kit ... and must come back again to provide support, which is easier if he is from our community. *20-year-old man, FGD, Zimbabwe.*

The DCEs and qualitative results provided complimentary insights on preferences for provider characteristics. Young people preferred distribution of HIVST kits by lay community distributors across methods, with the FGDs and IDIs also revealing a lack of trust of HCWs. The Zimbabwe DCE did not reveal any strong preferences regarding the residence of distributors, which departed from some of the findings from the FGD results.

Service delivery characteristics

In terms of location of distribution, the DCE results revealed that access at home was favored in Malawi ($U = 0.350$, $P < 0.01$) and Zimbabwe ($U = 0.699$, $P < 0.05$). This was preferred over mobile clinics (Malawi: $U = −0.170$, $P < 0.01$; Zimbabwe: $U = −0.669$, $P < 0.05$) and health facilities (Malawi: $U = −0.140$, $P < 0.10$; Zimbabwe: $U = −0.030$, $P \geq 0.10$). Compared to others these attribute levels were some of the most important drivers of demand for young people. Participants across countries were indifferent to the level of pretest assistance, which included instruction leaflets, telephone hotlines and in-person support. Other attributes relating to service delivery were explored separately in each country. In contrast to being indifferent to approaches for pretest support, participants in Malawi preferred in-person assistance following self-testing ($U = 0.126$, $P < 0.05$) rather than just the instruction leaflet ($U = −0.141$, $P < 0.05$). In Zimbabwe, participants did not have strong

Table 4. Key findings on preferences and triangulation of methods.

Preferences by domain	Key qualitative results (Malawi: 3 FGDs, 15 IDIs Zimbabwe: 9 FGDs)	DCE results (Malawi: $n = 245$ Zimbabwe: $n = 96$)	Triangulation results
Product characteristics	There were strong preferences for HIVST kits to be offered free of charge across methods and countries	Setting the price of HIVST kits as low as US$0.10 would reduce uptake among users in both countries. Compared with other attributes, price mattered most in Malawi	Consistent
	FGD participants in both countries often mentioned the benefits of oral-fluid testing compared with blood-based testing, though with some skepticism around accuracy. Self-testing in general was viewed very positively in the FGDs and IDIs across contexts	Young people in both countries revealed no strong preferences regarding the sample collection method	Complementary
Provider characteristics	In both methods and countries, there was an expressed lack of trust in healthcare providers and a preference for lay community distributors. Young people in the Malawi FGDs and IDIs also mentioned preferring peer distributors. In Zimbabwe, participants preferred distributors that were from the same communities	In Malawi, there was a preference for lay community distributors and dislike for distribution through intimate partners. In Zimbabwe, participants had no strong preferences regarding the age and residence of providers	Complementary
Service delivery characteristics	Young people in the FGDs and IDIs in both settings were in favor of home-based distribution of HIVST kits for reasons of convenience	Location was one of the strongest drivers of demand in both countries, with access to HIV testing at home highly valued	Consistent
	FGD and IDI participants in Malawi seemed more open to collecting HIVST kits from local clinics, mobile clinics or community gatherings. Some young men in the Zimbabwe FGD also wanted the choice of picking up kits at these locations	Distribution of HIVST kits through mobile clinics was strongly disliked in both countries. In Malawi, health facilities were almost as strongly disliked as the mobile clinic model. This was NS in Zimbabwe	Contradictory
	Young people across methods and contexts were motivated by the confidentiality and control afforded by HIVST. They also mentioned liking the availability of in-person support as long as they could conduct the tests themselves	Participants in both countries were indifferent to the level of pretest support given by providers. However, in terms of posttest support, in-person assistance was preferred in Malawi	Complementary
	There were mixed views regarding batch distribution of kits to the household in the Malawi and Zimbabwe FGDs. Some young people were concerned that acceptance of an HIVST kit in front of family members would reveal that they were sexually active, while others found it as a way to discreetly take a test	Young people in Zimbabwe were indifferent to batch distribution of HIVST kits to the entire household	Complementary

DCE, discrete choice experiment; FGD, focus group discussion; HIVST, HIV self-testing; IDI, in-depth interviews; NS, not significant.

preferences for other service delivery characteristics, including hours of operation and distribution of batches of HIVST kits to the entire household.

In the FGDs and IDIs, young people appreciated the convenience and savings in time and transportation costs associated with home distribution of HIVST kits.

I thought it wise to go for [self-testing] when ... introduced in this community, so I decided to test because I had access .... I was not supposed to walk a distance for testing. 23-year-old man, IDI, Malawi

Accessing HIVST and taking the test at home was also seen to provide greater privacy and encourage action among those who had procrastinated over testing. In both countries, where HIV testing and treatment services were often offered in the same location within health facilities, some participants felt young people were afraid of being seen as expressed in this quote:

People can't be going to the hospital for an HIV test ... Once I go there today, the news is going to spread everywhere and people will know that so and so is HIV positive. 22-year-old woman, FGD with female youth peer group, Malawi

Compared with Zimbabwe, FGD and IDI participants in Malawi were more open to collecting kits from local clinics, mobile clinics or even community gatherings. There was also the view that hospitals ensured better safe-keeping of testing devices. In Zimbabwe, a minority of young men in one FGD reported wanting the autonomy of collecting the HIVST kit from a mobile or local clinic as this gave them more control over when to test, illustrated here:

I say no to a fixed date that they decide to come; I won't want [the test kit] at that time. So if I collect at the clinic it is good; I will go and collect from the clinic when I want to. 19-year-old man, FGD, Zimbabwe

Despite some concerns about confidentiality, availability of in-person support was highly favored by participants from both countries and balanced this conflict by suggesting, 'The counselor must be there but not during the entire process' (22-year-old woman, FGD, Malawi). Providers were viewed as important in offering information and preparing users for dealing with HIV-positive results. Most FGD and IDI participants in both countries were against using a hotline, citing the value attached to in-person dialog especially for posttest support.

Young people across both methods and countries expressed that they were starting to become more independent, make decisions for themselves and, at the same time, were exploring their sexuality and boundaries, leading to some clashes in household dynamics, including decision-making about testing. In one FGD in Zimbabwe, young people said they disliked when community distributors spoke to their parents without consulting them directly despite being above the age of consent. Further, there were mixed views in the FGDs in both countries on whether kits should be given individually or distributed in 'batches' to the household. Although some young people worried that parents could deduce whether they were sexually active by their decision to accept a kit, others found it better if kits were offered to the whole household, so no attention was placed on the young person's choice. The reverse was also brought up with participants, mentioning that coercion of young people to test may be more likely to occur in situations where distribution was batched.

Evaluating the results from the DCE with the qualitative results, home access of HIVST was consistently preferred across methods. In contrast, FGD and IDI participants in Malawi were open to distribution through health facilities and mobile clinics, which differed from the DCE results. DCE participants in Malawi preferred more comprehensive support beyond the instruction leaflet after self-testing. This was also reflected in the FGDs and IDIs, where young people wanted the option of accessing in-person support if needed. In the Zimbabwe DCE, there were no strong preferences for batched distribution of HIVST kits, which complemented the mixed findings from the qualitative research.

Discussion

This is the first study to explore young people's preferences for HIVST in Malawi and Zimbabwe and comes at a time when many countries are starting to scale-up HIVST as an additional approach to reach untested populations [13]. We found that HIVST is highly acceptable to young people in these countries as it empowers them to choose the location and timing of the test and control disclosure around their results. Young people were attracted by the innovative new technology and appreciated the decision-making autonomy and control it gave them at a time of life when they were becoming more independent from their parents and more sexually active. Young people liked the convenience, confidentiality and perceived ease-of-use. Across methods, young people felt strongly that HIVST should be free and distributed at home, with some form of in-person support available if needed.

The high acceptability of HIVST has been described among young people in other settings in sub-Saharan Africa [15,29,30]; however, these studies provide limited information on young people's preferences around HIVST delivery characteristics. Previous studies have largely reported that oral-fluid tests were appealing because they were easy to use, painless and did not require a blood sample [15,16,31]; although a study in Tanzania reported dislike for this method due to lack of familiarity [32]. Our study pointed to concerns by young people around accuracy of oral-fluid tests, a finding that has previously been cited in the United States [17,18]. HIVST programs promoting oral-fluid tests will need information about their functioning and performance to address these concerns. Given young people's low access to financial resources and strong aversion to price, the findings also show that uptake of HIVST may be limited if kits are not provided for free or at extremely low prices.

Young people's strong preferences for home delivery of self-test kits and some in-person support by providers contrasted with the desire for total privacy. Home-based testing offered a way for young people to overcome issues of access and visibility associated with facility-based HTS [8,9,11,33–35]. Meanwhile, availability of in-person support was reported as being important if additional information or assistance was required in the case of a positive test. In Kenya, preference for posttest support was found to be more pronounced among young people than adults [15]. This may be particularly important for young people, as studies suggest that linkage to care for this population has been suboptimal in the contexts of community-based HIV testing in Kenya and South Africa [36,37].

Being empowered to control one's own HIV testing process seems to be particularly appealing to young people [38]. As they transition from childhood to adulthood, they are given or demand greater autonomy and independence. Being responsible and taking charge of one's own life and health motivates young people to test for HIV [8,11,39], which resonates with our findings that empowerment and control act as motivators for young people to test.

Confidentiality was one of the main reasons why young people preferred HIVST [15,16]. Young people's lack of trust of health workers and desire for confidentiality has

been described elsewhere [11,33,40,41] and motivated young people's preference for HIVST in this study. Our study also shows preference for lay community distributors, with pilot studies under the STAR Consortium confirming this in practice [42,43]. In Kenya, where home-based HIV testing by lay counselors has been successful [39,44], the integration of HIVST onto existing community-health platforms could become a model for HIVST in the future. In the context of a gap between biological and psychosocial maturity, as well as discrepancies in cultural, social and legal definitions of maturity, promoting HIVST in young people may not be without conflicts, including denied or forced testing. Appropriate training of distributors and sensitization of parents and the wider community would therefore be needed.

There were a number of limitations to our study. The DCE and qualitative research were nested within country-specific cluster-randomized trials of community-based HIVST implementation, resulting in distinctive research designs and sampling methods in each country. Despite this, results were largely consistent and complementary. Sample size calculations for the DCE were based on the total population and did not provide enough degrees of freedom to robustly examine differences in preferences among subgroups of young people. Although participants were asked about preferences for oral–fluid and blood-based self-tests, none had seen a blood-based self-test, which may have influenced stated preferences for oral–fluid tests.

Our study adds to the evidence on preferences for HIVST delivery among young people, with potential implications for reducing current testing gaps among this hard-to-reach age group. Uptake of HIVST among young people is most promising if distribution of test kits is convenient, which is provided through home-based distribution at no cost, with respect for them as autonomous individuals.

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Conflicts of interest

There are no conflicts of interest.

References

1. UNAIDS. *AIDS by the numbers.* Geneva, Switzerland: Joint United Nations Programme on HIV/AIDS (UNAIDS); 2016.
2. National Statistical Office (NSO); ICF Macro. *Malawi Demographic and Health Survey 2010.* Zomba, Malawi, and Calverton, Maryland, USA: NSO and ICF Macro; 2011.
3. Zimbabwe National Statistics Agency; ICF International. *Zimbabwe demographic and health survey 2015: final report.* Rockville, Maryland, USA: Zimbabwe National Statistics Agency (ZIMSTAT) and ICF International; 2016.
4. Bygrave H, Mtangirwa J, Ncube K, Ford N, Kranzer K, Munyaradzi D. **Antiretroviral therapy outcomes among adolescents and youth in rural Zimbabwe.** *PLoS One* 2012; **7**:e52856.
5. Nachega J, Hislop M, Nguyen H, Dowdy D, Chaisson R, Regensberg L, *et al.* **Antiretroviral therapy adherence, virologic and immunologic outcomes in adolescents compared with adults in Southern Africa.** *J Acquir Immune Defic Syndr* 2009; **51**:65–71.
6. Wandeler G, Keiser O, Pfeiffer K, Pestilli S, Fritz C, Labhardt N, *et al.* **Outcomes of antiretroviral treatment programs in rural Southern Africa.** *J Acquir Immune Defic Syndr* 2012; **59**: e9–e16.
7. Weigel R, Estill J, Egger M, Harries A, Makombe S, Tweya H, *et al.* **Mortality and loss to follow-up in the first year of ART: Malawi National ART Programme.** *AIDS* 2012; **26**:365–373.
8. Armstrong A, Baggaley R, Ferguson J, van der Kwaak A, Wolmarans L. *The voices, values and preference of adolescents on HIV testing and counselling.* Geneva, Switzerland: World Health Organization (WHO); 2013.
9. Strauss M, Rhodes B, George G. **A qualitative analysis of the barriers and facilitators of HIV counselling and testing perceived by adolescents in South Africa.** *BMC Health Serv Res* 2015; **15**:250.
10. MacPhail CL, Pettifor A, Coates T, Rees H. **You must do the test to know your status': attitudes to HIV voluntary counseling and testing for adolescents among South African youth and parents.** *Health Educ Behav* 2008; **35**:87–104.
11. Ferrand RA, Trigg C, Bandason T, Ndhlovu CE, Mungofa S, Nathoo K, *et al.* **Perception of risk of vertically acquired HIV infection and acceptability of provider-initiated testing and counseling among adolescents in Zimbabwe.** *Am J Public Health Res* 2011; **101**:2325–2332.
12. Kurth AE, Lally MA, Choko AT, Inwani IW, Fortenberry JD. **HIV testing and linkage to services for youth.** *J Int AIDS Soc* 2015; **18** **(2 Suppl 1)**:19433–119433.

13. WHO. *Guidelines on HIV self-testing and partner notification: supplement to consolidated guidelines on HIV testing services.* Geneva, Switzerland: World Health Organization (WHO); 2016.

14. Johnson C, Baggaley R, Forsythe S, van Rooyen H, Ford N, Napierala Mavedzenge S, *et al.* **Realizing the potential for HIV self-testing.** *AIDS Behav* 2014; **18 (Suppl 4)**:S391–S395.

15. Ochako R, Vu L, Peterson K. *Insights into potential users and messaging for HIV oral self-test kits in Kenya, 3ie grantee final report.* Washington, DC: International Initiative for Impact Evaluation (3ie); 2014.

16. Pant Pai N, Bhargava M, Joseph L, Sharma J, Pillay S, Balram B, *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**:8.

17. Catania JA, Dolcini MM, Harper GW, Dowhower DP, Dolcini-Catania LG, Towner SL, *et al.* **Bridging barriers to clinic-based HIV testing with new technology: translating self-implemented testing for African American youth.** *Transl Behav Med* 2015; **5**:372–383.

18. Brown W, Carballo-Diéguez A, John R, Schnall R. **Information, motivation, and behavioral skills of high-risk young adults to use the HIV self-test.** *AIDS Behav* 2016; **20**:2000–2009.

19. Choko AT, MacPherson P, Webb EL, Willey BA, Feasy H, Sambakunsi R, *et al.* **Uptake, accuracy, safety, and linkage into care over two years of promoting annual self-testing for HIV in Blantyre, Malawi: a community-based prospective study.** *PLoS Med* 2015; **12**:e1001873.

20. Lancsar E, Louviere J. **Conducting discrete choice experiments to inform healthcare decision making: a user's guide.** *Pharmacoeconom* 2008; **26**:661–677.

21. Louviere J, Lancsar E. **Choice experiments in health: the good, the bad, the ugly and toward a brighter future.** *Health Econ Policy Law* 2009; **4 (Pt 4)**:527–546.

22. Lancsar E, Swait J. **Reconceptualising the external validity of discrete choice experiments.** *Pharmacoeconom* 2014; **32**:951–965.

23. Mangham LJ, Hanson K, McPake B. **How to do (or not to do) ... designing a discrete choice experiment for application in a low-income country.** *Health Policy Plan* 2009; **24**:151–158.

24. Zwerina K, Huber J, Kuhfeld W. *A general method for constructing efficient choice designs.* Durham, NC: Fuqua School of Business, Duke University; 1996.

25. Reed Johnson F, Lancsar E, Marshall D, Kilambi V, Muhlbacher A, Regier DA, *et al.* **Constructing experimental designs for discrete-choice experiments: report of the ISPOR Conjoint Analysis Experimental Design Good Research Practices Task Force.** *Value Health* 2013; **16**:3–13.

26. Orme B. *Getting started with conjoint analysis: strategies for product design and pricing research.* Madison, WI: Research Publishers; 2010.

27. Gale N, Heath G, Cameron E, Rashid S, Redwood S. **Using the framework method for the analysis of qualitative data in multidisciplinary health research.** *BMC Med Res Methodol* 2013; **13**:117.

28. Hensher DA, Rose JM, Greene WH. *Applied choice analysis.* 2nd ed. Cambridge: Cambridge University Press; 2015.

29. Choko AT, Desmond N, Webb EL, Chavula K, Napierala-Mavedzenge S, Gaydos CA, *et al.* **The uptake and accuracy of oral kits for HIV self-testing in high HIV prevalence setting: a cross-sectional feasibility study in Blantyre, Malawi.** *PLoS Med* 2011; **8**:e1001102.

30. Nkuna E, Nyazema NZ. **HIV self-testing, self-stigma and HAART treatment at the University of Limpopo: health sciences students' opinion and perspectives.** *Open AIDS J* 2016; **10**:78–82.

31. Figueroa C, Johnson C, Verster A, Baggaley R. **Attitudes and acceptability on HIV self-testing among key populations: a literature review.** *AIDS Behav* 2015; **19**:1949–1965.

32. Ostermann J, Njau B, Brown DS, Muhlbacher A, Thielman N. **Heterogeneous HIV testing preferences in an urban setting in Tanzania: results from a discrete choice experiment.** *PLoS One* 2014; **9**:e92100.

33. Bhoobun S, Jetty A, Koroma MA, Kamara MJ, Kabia M, Coulson R, *et al.* **Facilitators and barriers related to voluntary counseling and testing for HIV among young adults in Bo, Sierra Leone.** *J Community Health* 2014; **39**:514–520.

34. Matseke G, Peltzer K, Mohlabane N. **Clients' perceptions and satisfaction with HIV counselling and testing: a cross-sectional study in 56 HCT sites in South Africa.** *Afr J Prim Healthcare Fam Med* 2016; **8**:1173.

35. Michaels-Igbokwe C, Terris-Prestholt F, Lagarde M, Chipeta E, Cairns J. **Young people's preferences for family planning service providers in rural Malawi: a discrete choice experiment.** *PLoS One* 2015; **10**:e0143287.

36. Naik R, Doherty T, Jackson D, Tabana H, Swanevelder S, Thea DM, *et al.* **Linkage to care following a home-based HIV counselling and testing intervention in rural South Africa.** *J Int AIDS Soc* 2015; **18**:19843.

37. Hatcher AM, Turan JM, Leslie HH, Kanya LW, Kwena Z, Johnson MO, *et al.* **Predictors of linkage to care following community-based HIV counseling and testing in rural Kenya.** *AIDS Behav* 2012; **16**:1295–1307.

38. Frye V, Wilton L, Hirshfield S, Chiasson MA, Usher D, Lucy D, *et al.* **"Just because it's out there, people aren't going to use It." HIV self-testing among young, Black MSM, and transgender women.** *AIDS Patient Care STDS* 2015; **29**:617–624.

39. Dalal W, Feikin DR, Amolloh M, Ransom R, Burke H, Lugalia F, *et al.* **Home-based HIV testing and counseling in rural and urban Kenyan communities.** *J Acquir Immune Defic Syndr* 2013; **62**:e47–e54.

40. Hampanda K, Ybarra M, Bull S. **Perceptions of healthcare services and HIV-related health-seeking behavior among Uganda adolescents.** *AIDS Care* 2014; **26**:1209–1217.

41. Michaels-Igbokwe C, Lagarde M, Cairns J, Terris-Prestholt F. **Designing a package of sexual and reproductive health and HIV outreach services to meet the heterogeneous preferences of young people in Malawi: results from a discrete choice experiment.** *Health Econ Rev* 2015; **5**:9.

42. Sibanda EL, Mutseta M, Hatzold K, Gudukeya S, Dhliwayo A, Lopez C, *et al.* Community-based distribution of HIV self-test kits: results from a pilot of door-to-door distribution of HIV self-test kits in one rural Zimbabwean community. In: Abstract Book AIDS 2016-21st International AIDS Conference – 18–22 July 2016 – Durban, South Africa. Geneva, Switzerland: International AIDS Society; 2016. p. 785.

43. Indravudh P, Kumwenda M, Neuman M, Chisunkha B, Hatzold K, Nkhoma C, *et al.* Providing user support for HIV self-testing beyond instructions-for-use in Malawi. In: Conference on Retroviruses and Opportunistic Infections (CROI 2017) Seattle, Washington, February 13–16, 2017. San Francisco, California: CROI Foundation/ International Antiretroviral Society – USA; 2017. p. 389.

44. Otiso L, McCollum R, Mireku M, Karuga R, de Koning K, Taegtmeyer M. **Decentralising and integrating HIV services in community-based health systems: a qualitative study of perceptions at macro, meso and micro levels of the health system.** *BMJ Glob Health* 2017; **2**:e000107.