Uptake of HIV testing services through novel community-based sexual and reproductive health services: An analysis of the pilot implementation phase of the Yathu Yathu intervention for adolescents and young people aged 15-24 in Lusaka, Zambia

Abstract: Adolescents and young people aged 15-24 are underserved by available HIV-testing services (HTS). Delivering HTS through community-based, peer-led, hubs may prove acceptable and accessible to adolescents and young people, thus increasing HIV-testing coverage. We used data from the pilot phase of a cluster-randomised trial of community-based sexual and reproductive health services for adolescents and young people in Lusaka, Zambia, between September 2019 and January 2020, to explore factors associated with uptake of HTS through community-based hubs. 5,757 adolescents and young people attended the hubs (63% female), among whom 75% tested for HIV (76% of females, 75% of males). Community-based hubs provided HTS to 80% of adolescents and young people with no history of HIV-testing. Among females, uptake of HTS was lower among married/cohabiting females; among males, uptake was lower among unmarried males and among individuals at risk of hazardous alcohol use. The high number of adolescents and young people accessing hubs for HIV testing suggests they are acceptable. Enhanced targeting of HTS to groups who may not perceive their HIV risk needs to be implemented.

Across sub-Saharan Africa, adolescents and young people aged 15-24 are at high risk of HIV infection, accounting for approximately one-third of new HIV infections globally in 2019.(1) In 2017, over 90% of deaths due to AIDS-related illness among adolescents occurred in sub-Saharan Africa, a consequence of unknown HIV status or difficulties with accessing and adhering to antiretroviral therapy.(2) Adolescent girls and young women aged 15-24 in sub-Saharan Africa are at particularly high risk of HIV infection, accounting for 20% of new infections globally in 2017.(2) Preventing HIV infection and supporting entry into the HIV care continuum requires comprehensive knowledge of HIV and access to HIV testing services (HTS). Despite this need, adolescents and young people continue to be underserved by available HTS, which continues to be delivered largely through healthcare facilities. In Zambia, according to the 2016 Population-based HIV Impact Assessment, among adolescents and young people, 45% of males and 66% of females had ever-tested for HIV; a recent test in the 12 months prior to the survey was reported by 25% of males and 40% of females.(3)

Globally, there are multiple challenges to accessing and accepting HIV testing and care services among adolescents and young people including: a lack of adolescent-friendly services, age of consent for HIV testing, distance to services and socio-cultural views about pre-marital sex.(4–9) A systematic review of strategies to reach adolescents with HTS identified community-based strategies as having the potential to increase uptake of HTS, yet there was a lack of rigorous evidence of effectiveness.(10) The authors also highlight the lack of evidence of the effectiveness of incentives in increasing HTS uptake among adolescents.(10) Between 2013-2017, the HPTN-071 (PopART) and nested PopART for Youth (P-ART-Y) study delivered combination HIV prevention, including HTS, door-to-door in eight communities in Zambia.(11,12) Findings show that these strategies increased knowledge of HIV status among adolescents and young people, but reaching adolescents aged 15-17 and young men aged <25 remained a challenge.(12–14) Increasing HIV testing coverage among

adolescents and young people requires delivery of youth-focussed services that are acceptable and accessible, and responsive to their needs.

Based on experiences and learning from implementation of HPTN 071 (PopART) and P-ART-Y in the same communities, we conducted a formative study to co-design, with adolescents and young people, a strategy to deliver community-based, peer-led sexual and reproductive health (SRH) services, called Yathu Yathu.(15) The co-designed strategy includes the delivery of comprehensive SRH services, including HTS, through community-based spaces (called hubs) by a team of peer support workers, a supervisor, and nurse. To increase service uptake, an incentivised delivery system, called the prevention points card (PPC) system, allows adolescents and young people to earn points when accessing services and to use these points to redeem rewards, such as soap, toothbrush, toothpaste and face cloths. The system also allows for the collection of data on service access to measure coverage and uptake, and to adapt implementation.

Yathu Yathu was piloted over five-months, during which time implementation research was intended to adapt the intervention in response to adolescents and young people's use of services. Using PPC data collected during the pilot phase, we investigated who self-reported ever-testing for HIV among adolescents and young people accessing the hubs, who opted to HIV test at the hub and the characteristics of adolescents and young people choosing to HIV self-test at the hub. The aim of this study was to understand who accessed HTS through community-based, peer-led services to inform how such interventions might be delivered to increase HIV testing uptake amongst this group.

Methods

Study location and population

The pilot implementation phase was from September 2019 to January 2020 in 10 geographical areas within two study communities in Lusaka, Zambia. Each of the 10 geographical areas has a population

of ~2,350 individuals aged 15-24. Prior to implementation of Yathu Yathu, all households in the 10 geographical areas were enumerated and all adolescents and young people offered a PPC. Those accepting a PPC were informed of the availability of SRH services through the Yathu Yathu hubs and that, using their PPC, they could gain points and redeem rewards for accessing services.

Yathu Yathu

Yathu Yathu consists of the delivery of comprehensive SRH services, including HTS, condoms and other contraceptives, and comprehensive sexuality education, through community-based hubs, with referrals to the local government health facility for other services, including voluntary medical male circumcision and antiretroviral therapy. The rewards available through the integrated incentivised PPC system are primarily health-related, including soap, menstrual hygiene products and deodorant. The number of points earned per service accessed was discussed with adolescents and young people during a formative research phase and is dependent on the psychological difficulty of accessing the services,(15) and the points required per reward dependent on cost of the rewards; the exception being menstrual hygiene products. The additional advantage of the PPC was to enable the capture of data on services accessed by that individual.

At their first visit to a Yathu Yathu hub, adolescents and young people are asked whether they have ever tested for HIV and when they last tested for HIV. At the hub, AYP can choose to have an HIV test on a finger-prick blood sample, performed by a member of the hub team, or to use an oral HIV self-testing (HIVST) kit. The HIVST kit can be used at the hub or elsewhere, with points offered for return of the used HIVST kit. All HIV testing is conducted in line with the WHO 5-Cs (informed consent, counselling, confidentiality, correct result and linkage to care) and in accordance with Zambian National HIV testing guidelines.(16) For individuals opting for finger-prick HIV testing, the Alere Determine HIV-1/2 rapid test was the first test. A reactive result was confirmed using a second rapid HIV test (SD BioLine). For individuals opting to self-test, the OraQuick (OraSure) was the screening test, and a reactive result confirmed with Determine HIV-1/2 and SD Bioline rapid tests

performed in parallel by a trained member of staff. For all individuals testing positive for HIV, support, confidential counselling and active linkage to the health care facility to initiate ART was offered.

Data sources

For this analysis, we used data routinely collected from the PPC. This system collects data on HIV testing history as reported at an individual's first visit to the hub and on services accessed during each visit to the hub. For HIV testing, data is collected on whether the individual opted to self-test or for finger-prick HIV testing. The result of the HIV test is recorded, alongside any other services accessed during a single visit to the hub.

Outcomes and explanatory variables of interest

This analysis included four binary outcomes. The first was self-reporting ever-testing for HIV among all adolescents and young people reporting their history of ever-testing at their first visit to a Yathu Yathu hub. The second was any uptake of HTS at the hub among all AYP attending the hubs (excluding individuals self-reporting their HIV-positive status), including finger-prick HIV testing at the hub and HIVST; the third outcome is uptake of HTS among individuals who self-reported never testing for HIV. The fourth outcome was the type of HIV test chosen (finger-prick HIV testing or HIVST) among all individuals choosing to HIV test. Factors explored for their association with the outcomes included: sex, and age, educational attainment, and marital status, all reported at enumeration. At their first visit, individuals were asked the three Alcohol Use Disorders Identification Test-Concise (AUDIT-C) screening questions regarding their frequency of alcohol intake to determine their risk of hazardous alcohol use.(17) We also explored the association between being at risk of hazardous alcohol use and the outcomes, and between whether adolescents and young people visited the hub once or more than once and uptake of HTS and type of HIV test individuals opted for at the hub.

Data analysis

Analyses are restricted to adolescents and young people who attended a hub. We first describe the age, sex, marital status and educational attainment of individuals attending the hubs. We describe our first outcome, self-reported history of HIV testing, and explore factors associated with previously testing for HIV. Next, we describe uptake of HTS at the hubs and explore factors, including age, sex, and a self-report of ever-testing for HIV, associated with HIV testing at the hub. Next, we restricted this outcome to adolescents and young people who reported never testing for HIV. Finally, we describe, among individuals choosing to HIV test, their preference for finger-prick HIV testing or self-testing and explored factors associated with preference for self-testing relative to finger-prick HIV testing. We used logistic regression, with a fixed effect to account for clustering by enumeration zone and adjusted for age , to assess the association between the explanatory variables and the outcomes of interest. In the subgroup analysis of uptake of HIV testing among the smaller number of individuals who reported never-testing, we included a fixed effect to account for clustering by community. Analyses were done separately for males and females. Variables associated with the outcomes at the $p<0.10$-level were included in adjusted analyses. Adjustment was dependent on the hypothesised relationship between the variables Figure 1, with distal variables not adjusted for those more proximal to the outcome. For example, marital status was not adjusted for being at risk of hazardous alcohol use, which was measured at the time of the hub visit thus unlikely to influence marital status and act as a potential confounder of the association between marital status and the outcomes.

Ethical considerations

The University of Zambia Biomedical Research Ethics Committee (007-04-19) and the London School of Hygiene and Tropical Medicine (17104) approved the study. Individuals aged 18 to 24 provided written informed consent to participate. For adolescents aged 15-17, parents/guardians provided written informed consent and adolescents written informed assent.

Results

Self-reported history of ever testing for HIV

Of the 5757 adolescents and young people attending the hubs, 63.3% (n=3646) were female and 37.8% (n=2174) attended the hub once during the study period. Half of the attendees were aged 15-17 (females: 44.6%, n=1625/3646; males: 50.0%, n=1055/2111).

Of the 5552 adolescents and young people who self-reported their history of HIV-testing, 67.7% (n=3760) had ever HIV-tested (70.6% of females and 62.7% of males; Figure 2 & Table 1). Among ever-testers reporting the date of their last test, 66.6% (n=1519/2282) of females and 54.8% (n=630/1150) of males reported testing within the last 12 months. Among adolescents and young people who ever-tested, 2.6% of females (n=64/2480) and 1.7% (n=22/1280) of males reported a previous HIV positive test result, among whom 81 (94.2%) reported being registered for HIV care and on ART.

Self-reported ever HIV-testing was lower among adolescents aged 15-17 and individuals with no/primary education (females: 58.8%, n=529/900; males: 44.0% n=210/477) compared to those with some/complete secondary education (females: 74.7%, n=1951/2611; adjOR=0.71 95%CI 0.59, 0.86; males: 68.4%, n=1070/1564; adjOR=0.54 95%CI 0.43, 0.68). Among males, 90.0% (n=36/40) of the small number of married men ever-tested compared to 62.2% (n=1244/2001) of single/never married adolescent boys and young men (adjOR= 2.64 95%CI 0.90, 7.71).

Uptake of HIV testing services at Yathu Yathu hubs

A similar proportion of females (76.2%, n=2730/3582) and males (n=75.0%, n=1567/2089) HIV tested at the hubs. Among adolescents and young people choosing not to test, 28.8% (n=263) of females and 35.8% (n=194) of males had *not* reported ever-testing for HIV. In adjusted analyses (Table 2), there were few individual-level characteristics associated with HIV testing at the hubs. Uptake was lower among married/cohabiting females (66.7%, n=383/574 vs 78.0%, n=2347/3008

single/never married females; adjOR=0.66 95%CI 0.52, 0.84); conversely, uptake was higher among married males relative to single/never married males (83.0%, n=39/47 vs 74.8%, n=1528/2042; adjOR=2.16 95%CI 0.97, 4.81). Among males, uptake was lower among individuals at risk of alcohol abuse (59.6%, n=65/109 vs 76.8%, n=1410/1837 males not at risk; adjOR=0.48 95%CI 0.30, 0.75). Although most adolescents and young people who tested for HIV at the hubs tested at their first visit to the hubs (females: 86.4%, n=2358/2730; males: 88.6%, n=1389/1567), uptake of HTS was higher among individuals attending the hub more than once (Table 2). Among the individuals testing for HIV at the hubs, 1.0% (n=27/2730) of females and 0.3% (n=4/1567) of males tested HIV positive. All were referred for ART services at the local health facility.

Uptake of HIV testing services among adolescents and young people self-reporting never testing

Findings were similar when restricted to adolescents and young people who had never tested for HIV (Suppl Table 1); there was evidence that uptake was also lower among the small number of married/cohabiting females (72.2%, n=39/54 vs 80.7%, n=788/977; adjOR=0.49 95%CI 0.23, 1.03) and evidence that uptake was higher among the small number of men aged 20-24 (88.9% vs 76.9% boys aged 15-17; adjOR=2.38 95%CI 1.19, 4.74).

Choice of HIV test among adolescents and young people HIV testing at the hubs

The majority of adolescents and young people testing at the hub opted for finger-prick HTS (76.2%, n=3276). There was little evidence that opting to HIV self-test was associated with individual-level characteristics (Table 3). Adolescent girls and young women aged 18-19 were more likely to self-test than adolescent girls aged 15-17 (29.0%, n=184/635, vs 23.5% n=299/1270, adjOR=1.31 95%CI 1.05, 1.63). HIV self-testing was higher among females who had previously tested for HIV, and among males visiting the hub more than once (Table 3).

Discussion

Almost 6000 adolescents and young people aged 15 to 24 attended community-based, peer-led hubs during a five-month pilot implementation phase. The majority of attendees were adolescent girls and young women and over half had previously tested for HIV, with adolescents aged 15-17, unmarried males and individuals with no or primary education reporting the lowest levels of ever-testing for HIV. Offering HTS through community-based, peer-led hubs reached a large number of adolescents and young people with HTS. Uptake of HIV testing differed by marital status, with married females less likely and some evidence that married males were more likely to HIV test at the hubs. Males at risk of alcohol abuse had lower levels of HIV testing uptake, and, among adolescent boys and men who had never tested, uptake was higher among men aged 20-24. We found that most adolescents and young people preferred finger-prick HIV testing, with preference for HIV self-testing higher among those who had experience with HIV testing or visiting hubs more frequently.

Our study is subject to limitations. Our data reflect history of ever-testing among the approximately 40% of enumerated adolescents and young people choosing to attend the hubs, not a random sample of adolescents and young people from the underlying study population. As such, our estimates of self-reported history of HIV testing may not reflect levels of HIV testing among all adolescents and young people in the study communities. Furthermore, this outcome may be subject to further bias if adolescents and young people reported HIV testing if they thought this would avoid an offer of HTS. Our study aimed to understand service use at the hubs during the pilot phase of the intervention. As such, we cannot confirm whether Yathu Yathu services increase HIV testing coverage among adolescents and young people. This outcome will be measured as part of an ongoing cluster-randomised trial to evaluate the impact of the Yathu Yathu intervention on knowledge of HIV status among adolescents and young people. Despite limitations, our study uses data routinely collected through a novel PPC system to understand use of HTS during a pilot implementation phase with a view to improve targeted delivery of HTS.

Overall, two-thirds of individuals attending the hubs reported ever-testing for HIV. According to the 2018 Zambian DHS, 76% of adolescent girls and young women and 62% of adolescent boys and young men ever-tested for HIV in 2018.(18) Although not a random sample, our analysis shows similar results. With the 2013/14 DHS reporting that 67% of adolescent girls and young women and 46% of adolescent boys and young men ever-tested,(19) progress has been made in providing HTS to adolescents and young people. In these communities, this progress is attributable, in part, to the delivery of the PopART intervention over three-years.(13,14) Nonetheless, there remain gaps, with the majority of hub attendees being female and adolescents aged 15-17, unmarried males and individuals with lower educational attainment less likely to report ever-testing. Although adolescents aged 15-17 are less likely to be in need of HIV testing, with 61% of adolescent girls and young women and 50% of adolescent boys and young men reporting sexual intercourse before age 18,(18) more needs to be done to reach adolescents with HIV testing and related services, with testing for HIV providing an opportunity to offer information on prevention of HIV and other STIs. Provision of comprehensive SRH services through Yathu Yathu community-based, peer-led hubs may prove effective at reaching this age group. Educational attainment and marital status are known to be associated with HIV-testing among older adults.(20–22) With little evidence that education was associated with uptake of HTS at the hubs, Yathu Yathu may facilitate more equitable access to HTS.

Despite attending the hubs, one-fifth of adolescents and young people with no history of HIV testing chose not to test for HIV. Data on sexual behaviours was not collected. It is likely that some adolescents and young people choosing not to test were at low risk of HIV as they have not yet had sex. As a key gateway to prevention services, offering HTS to younger adolescents remains important for maintaining sexual health. Uptake of HTS was lower among the small percentage of men at risk of alcohol abuse. With evidence that alcohol use is associated with incident HIV infection,(23) AUDIT-C score data need to be used to more effectively encourage uptake of HTS among adolescents and young people at potentially higher risk of HIV infection. Married adolescent girls

and young women were less likely to HIV test; in agreement with the published literature, this suggests that women may need their partner's permission to HIV test but likely also reflects high uptake of HTS in antenatal clinics.(18,24,25) With adolescent girls and young women at disproportionately high risk of HIV, there remains a need to support adolescent girls and young women and their partners access to HTS. Promoting couples testing and providing adolescent girls and young women with an invitation for their partner to attend the hub may increase uptake of HTS among adolescent girls and young women and their partners.(26)

Although most adolescents and young people choosing to HIV test did so at their first visit, uptake of HTS was higher among adolescents and young people visiting the hub more than once, particularly among males who had never tested for HIV. Fear is commonly cited as a barrier to HIV testing, including fear of: lack of confidentiality,(27) stigma and discrimination,(25,28) a positive test result,(29) and the finger-prick required for rapid HIV testing. Community-based spaces may overcome some of these fears and prove acceptable places for men to test, as suggested by the high percentage of men aged 20-24 who reported never-testing choosing to test at the hubs. Encouraging frequent visits to spaces where HTS are provided may develop adolescents and young people's trust in the services being offered and the individuals providing the services thus overcoming some of the fears associated with HIV testing.

Distribution of HIVST kits has been proposed as a strategy to reach adolescents and young people. Studies show that HIVST is acceptable to adolescents and young people, providing autonomy over when and where to test,(30) and that, when offered, HIVST among adolescents is high, (31) and that home-based distribution of HIVST kits, alongside finger-prick HTS as an option for how to test for HIV, can increase knowledge of HIV status among adolescents and young people aged 16-29.(32) Our analysis suggests that, once at a youth-friendly space that provided SRH services, adolescents and young people prefer finger-prick HIV testing. This preference may be reflective of lower knowledge of HIVST, a relatively new "technology" in these communities and nationally,(33) greater confidence

in the accuracy of results from blood-based HIV testing or of how the hub staff offer HTS. Alternatively, these findings may underscore that lack of acceptable and accessible services are key barriers to HIV testing among adolescents and young people and that, once addressed, they are willing to HIV test. Despite lower uptake of HIVST relative to finger-prick HIV testing, a quarter of adolescents and young people learnt their HIV status due to the availability of HIVST kits. HIVST is therefore critical in providing options for how to test and support reaching all adolescents and young people through community-based services.

Our study used data routinely collected during the pilot phase of implementation. Availability of these monitoring data provides a critical opportunity to adapt delivery to maximise effectiveness. Our findings suggest that additional efforts were required to reach adolescents and young people with no history of HIV-testing. As such, we implemented a peer outreach approach, with members of the adolescent community advisory boards (established during PopART and P-ART-Y with new members recruited prior to the Yathu Yathu formative phase) in each community asked to encourage adolescents and young people who had not yet been to the hub to attend. This approach may prove supportive to reaching adolescents and young people who have never accessed clinical services, including HTS.

In Zambia, door-to-door delivery of services in PopART and P-ART-Y increased knowledge of HIV among adolescents (34) and additional home-based distribution of HIVST kits as an option for HIV testing reached young adults, particularly men.(35) Yet there remained gaps, particularly in reaching adolescent boys and young men,(12,36) meaning adolescents and young people were left behind with respect to the UNAIDS 90-90-90 targets.(14) Peer-led interventions have been shown to connect adolescents and young people to HIV services(37) and community-based strategies that create a structure for service delivery have shown moderate positive effects on HIV-related knowledge and sexual behaviours.(38) With high numbers of individuals attending the hubs and high uptake of HTS at the hub, including among adolescents and young men with no history of ever-

testing, hubs may prove acceptable to adolescents and young people. As such, the provision of HTS through community-based, peer-led hubs, supported by a reward system designed with adolescents and young people may reach those underserved by available HTS and for whom home-based HIV testing is not acceptable. Evaluation of Yathu Yathu through a cluster-randomised trial will generate rigorous evidence of the effectiveness of this strategy on increasing HIV testing coverage, with enhanced targeting of HTS to groups who may not perceive their HIV risk likely required to maximise impact.

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Table 1. Characteristics of adolescents and young people aged 15 to 24 attending the hubs and their association with reporting ever testing for HIV

Characteristic	Number (%) of individuals	Number (%) ever-tested	Age- & community adjusted OR (95%CI)	Adjusted OR (95%CI)	p-value§
Adolescent girls and young women (N=3511)[1]					
Overall	3511 (100)	2480 (70.6)	-	-	
Age					
15-17	1564 (44.6)	823 (52.6)	1.0	1.0	<0.001
18-19	804 (22.9)	621 (77.2)	3.16 (2.59, 3.85)	3.16 (2.59, 3.85)	
20-24	1143 (32.6)	1036 (90.6)	8.61 (6.87, 10.80)	8.61 (6.87, 10.80)	
Marital[+]					
Single/never married	2941 (83.8)	1964 (66.8)	1.0	1.0	0.35
Married/living as married	570 (16.2)	516 (90.5)	1.10 (0.78, 1.54)	1.18 (0.83, 1.66)	
Educational attainment					
No/primary education	900 (25.6)	529 (58.8)	0.71 (0.59, 0.86)	0.71 (0.59, 0.86)	<0.001
Some/complete secondary education	2611 (74.4)	1951 (74.7)	1.0	1.0	
At risk of hazardous alcohol use (N=3305)[+]					
No	3184 (96.3)	2210 (69.4)	1.0	1.0	0.18
Yes	121 (3.7)	102 (84.3)	1.43 (0.83, 2.47)	1.45 (0.84, 2.50)	
Adolescent boys and young men (N=2041)[2]					
Overall	2041 (100)	1280 (62.7)	-	-	
Age					
15-17	1023 (50.1)	504 (49.3)	1.0	1.0	<0.001
18-19	499 (24.5)	347 (69.5)	2.33 (1.85, 2.93)	2.33 (1.85, 2.93)	
20-24	519 (25.4)	429 (82.7)	4.81 (3.71, 6.25)	4.81 (3.71, 6.25)	
Marital status[+]					

Single/never married	2001 (98.0)	1244 (62.2)	1.0	1.0	0.08
Married/living as married	40 (2.0)	36 (90.0)	2.67 (0.91, 7.82)	2.64 (0.90, 7.71)	
Educational attainment*					
No/primary education	477 (23.4)	210 (44.0)	0.54 (0.43, 0.68)	0.54 (0.43, 0.68)	<0.001
Some/complete secondary education	1564 (76.6)	1070 (68.4)	1.0	1.0	
At risk of hazardous alcohol use (N=1937)**					
No	1833 (94.6)	1119 (61.1)	1.0	1.0	0.15
Yes	104 (5.4)	88 (84.6)	1.53 (0.85, 2.76)	1.54 (0.86, 2.79)	

[1] 135 missing data/refused to respond, [2] 70 missing data/refused to respond; OR – odds ratio; 95%CI – 95% Confidence interval; All models adjusted for age and for clustering by zone. § From Wald test; [+]Further adjusted for educational attainment; *Further adjusted for marital status; **Further adjusted for marital status and educational attainment

Table 2. Uptake of HIV testing services among all adolescents and young aged 15 to 24 attending the hubs

Adolescent girls and young women (N=3582)[1]					
Characteristic	**Number (%) of individuals**	**Number (%) tested at hubs**	**Age- & community adjusted OR (95%CI)**	**Adjusted OR (95%CI)**	**p-value§**
Overall	3582 (100)	2730 (76.2)	-		
Age					
15-17	1617 (45.1)	1268 (78.4)	1.0	1.0	0.06
18-19	824 (23.0)	635 (77.1)	0.95 (0.77, 1.17)	0.95 (0.77, 1.17)	
20-24	1141 (31.9)	827 (72.5)	0.80 (0.67, 0.97)	0.80 (0.67, 0.97)	
Marital status					
Single/never married	3008 (84.0)	2347 (78.0)	1.0	1.0	<0.001
Married/living as married	574 (16.0)	383 (66.7)	0.66 (0.52, 0.84)	0.66 (0.52, 0.84)	
Educational attainment[+]					
No/primary education	922 (25.7)	695 (75.4)	1.01 (0.84, 1.22)	1.05 (0.86, 1.26)	0.65
Some/complete secondary education	2660 (74.3)	2035 (76.5)	1.0	1.0	
At risk of hazardous alcohol use (N=3314)[+]					
No	3198 (96.5)	2458 (76.9)	1.0	1.0	0.88
Yes	116 (3.5)	81 (69.8)	1.08 (0.70, 1.66)	1.03 (0.67, 1.59)	
Reported ever-testing for HIV[+]					
Never-tested/did not respond	1166 (32.6)	903 (77.4)	1.0	1.0	0.26
Yes, ever-tested for HIV	2416 (67.4)	1827 (75.6)	1.12 (0.92, 1.35)	1.12 (0.92, 1.35)	
Number of visits to the hub[+]					
One	1278 (35.7)	848 (66.4)	1.0	1.0	<0.001
More than one	2304 (64.3)	1882 (81.7)	2.40 (2.03, 2.83)	2.38 (2.01, 2.81)	
Adolescent boys and young men aged (N=2089)[1]					

Overall	2089 (100)	1567 (75.0)	-	-	-
Age					
15-17	1044 (50.0)	772 (74.0)	1.0	1.0	0.27
18-19	507 (24.3)	381 (75.2)	1.08 (0.84, 1.39)	1.08 (0.84, 1.39)	
20-24	538 (25.8)	414 (77.0)	1.23 (0.96, 1.59)	1.23 (0.96, 1.59)	
Marital					
Single/never married	2042 (97.8)	1528 (74.8)	1.0	1.0	0.06
Married/living as married	47 (2.2)	39 (83.0)	2.16 (0.97, 4.81)	2.16 (0.97, 4.81)	
Educational attainment [+]					
No/primary education	485 (23.2)	362 (74.6)	1.08 (0.84, 1.40)	1.08 (0.84, 1.40)	0.54
Some/complete secondary education	1604 (76.8)	1205 (75.1)	1.0	1.0	
At risk of hazardous alcohol use (N=1946) [+]					
No	1837 (94.4)	1410 (76.8)	1.0	1.0	0.001
Yes	109 (5.6)	65 (59.6)	0.49 (0.31, 0.77)	0.48 (0.30, 0.75)	
Reported ever-testing for HIV ^					
Never-tested/did not respond	831 (39.8)	637 (76.7)	1.0	1.0	0.06
Yes, ever-tested for HIV	1258 (60.2)	930 (73.9)	0.84 (0.67, 1.06)	0.80 (0.64, 1.01)	
Whether visited the hub more than once ^^					
Yes - once	862 (41.3)	562 (65.2)	1.0	1.0	<0.001
No - more than once	1227 (58.7)	1005 (81.9)	2.74 (2.21, 3.40)	2.62 (2.09, 3.29)	

1. Excludes AYP self-reporting knowing their HIV positive status (n=86). OR – odds ratio; 95%CI – 95% Confidence interval; All models adjusted for age and clustering by zone; § From Wald test; +Further adjusted for marital status; ++Further adjusted for marital status and at risk of hazardous alcohol use; ^Further adjusted for marital status, at risk of hazardous alcohol use and number of hub visits; ^^Further adjusted for marital status, at risk of hazardous alcohol use and reported ever-testing for HIV

Table 3. Uptake of HIV self-testing among the adolescents and young people aged 15-24 attending hubs and HIV testing at the hubs

	Number (%) of individuals	Number (%) self-testing	Age- & community adjusted OR (95%CI)	Adjusted OR (95%CI)	p-value§
Adolescent girls and young women aged 15-24 (N=2730)					
Overall	2730 (100)	678 (24.8)	-		
Age					
15-17	1268 (46.5)	297 (23.4)	1.0	1.0	0.02
18-19	635 (23.3)	184 (29.0)	1.31 (1.05, 1.63)	1.31 (1.05, 1.63)	
20-24	827 (30.3)	195 (23.6)	0.95 (0.77, 1.17)	0.95 (0.77, 1.17)	
Marital status					
Single/never married	2347 (86.0)	585 (24.9)	1.0	1.0	0.16
Married/living as married	383 (14.0)	91 (23.8)	0.81 (0.60, 1.08)	0.81 (0.60, 1.08)	
Educational attainment					
No/primary education	695 (25.5)	165 (23.7)	0.95 (0.77, 1.17)	0.95 (0.77, 1.17)	0.62
Some/complete secondary education	2035 (74.5)	511 (25.1)	1.0	1.0	
At risk of hazardous alcohol use					
No	2458 (96.8)	586 (23.8)	1.0	1.0	0.54
Yes	81 (3.0)	25 (30.9)	1.17 (0.71, 1.92)	1.17 (0.71, 1.92)	
Reported ever-testing for HIV [+]					
Never-tested/did not respond	903 (33.1)	181 (20.0)	1.0	1.0	0.002
Yes, ever tested	1827 (66.9)	497 (27.1)	1.41 (1.14, 1.74)	1.40 (1.13, 1.72)	
Whether visited the hub once [++]					
Yes - once	848 (31.1)	194 (22.9)	1.0	1.0	0.07
No - more than once	1882 (68.9)	482 (25.6)	1.22 (1.00, 1.48)	1.20 (0.99, 1.46)	
Adolescent boys and young men (N=1567)					

Overall	1567 (100)	346 (22.1)	-		
Age					
15-17	772 (49.3)	185 (24.0)	1.0	1.0	0.16
18-19	382 (24.3)	81 (21.3)	0.85 (0.63, 1.15)	0.85 (0.63, 1.15)	
20-24	414 (26.4)	80 (19.3)	0.75 (0.55, 1.02)	0.75 (0.55, 1.02)	
Marital status					
Single/never married	1528 (97.5)	337 (22.1)	1.0	1.0	0.12
Married/living as married	39 (2.5)	9 (23.1)	1.91 (0.84, 4.38)	1.91 (0.84, 4.38)	
Educational attainment*					
No/primary education	362 (23.1)	93 (25.7)	1.03 (0.76, 1.41)	1.04 (0.76, 1.41)	0.82
Some/complete secondary education	1205 (76.9)	253 (21.0)	1.0	1.0	
At risk of hazardous alcohol use*					
No	1410 (95.6)	314 (22.3)	1.0	1.0	0.46
Yes	65 (4.4)	16 (24.6)	1.27 (0.66, 2.42)	1.28 (0.67, 2.44)	
Reported ever-testing for HIV**					
Never-tested/did not respond	637 (40.7)	132 (20.7)	1.0	1.0	0.11
Yes, ever tested	930 (59.3)	217 (23.0)	1.27 (0.97, 1.66)	1.25 (0.95, 1.63)	
Whether visited the hub once^					
Yes - once	562 (35.9)	96 (17.1)	1.0	1.0	<0.001
No - more than once	1005 (64.1)	250 (24.9)	1.64 (1.24, 2.16)	1.63 (1.24, 2.15)	

OR – odds ratio; HIVST – HIV self-testing; All models adjusted for age and for clustering by zone; § From Wald test; +Further adjusted for whether visited the hub more than once; ++Further adjusted for self-reported history of HIV testing; *Further adjusted for marital status; **Further adjusted for marital status and for whether visited the hub more than once; ^Further adjusted for marital status and for reported history of HIV testing