**TITLE PAGE**

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Effect of prices, distribution strategies, and marketing factors on demand for HIV self-tests in Zimbabwe: A randomized clinical trial

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**KEY POINTS**

**Question:** How is demand for HIV self-tests influenced by pricing and distribution strategies?

**Findings:** In a randomized trial among 4,000 adults in Zimbabwe, where HIV prevalence is 13%, HIV self-test demand declined substantially from 32.5% among those offered free self-tests to 6.9% among those offered self-tests for US$0.50 and below 3% at prices exceeding US$1. Price sensitivity was higher among rural residents, men, and those who never tested before. In urban areas, demand was higher with pharmacy- than clinic-based distribution.

**Meaning:** Demand for HIV self-tests is highly price-sensitive in low-income settings. Free distribution of self-tests may help promote testing in high priority population segments.

**ABSTRACT**

**Importance:** HIV self-testing (HIVST) is a promising approach for increasing awareness of HIV status in sub-Saharan Africa, but evidence is lacking on optimal pricing policies and delivery strategies for maximizing the impact of HIVST.

**Objective**: Assess demand for HIV self-tests among adults and priority population subgroups under alternative pricing and distribution strategies.

**Design**: Randomized trial between February 15, 2018 and May 25, 2018. A factorial design was used to randomly assign participants to a combination of self-test price, distribution site, and promotion message.

**Setting**: Urban and rural communities in Zimbabwe

**Participants**: Individuals aged ≥16 years

**Intervention**: Participants were given a voucher enabling them to redeem an HIV self-test within 1 month at varying prices (US$0-US$3) and distribution sites (clinics or pharmacies in urban areas, retail stores or community health workers in rural areas). Vouchers included randomly assigned promotion messages that emphasized benefits of HIV testing.

**Main Outcome and Measure**: Proportion of participants who obtained self-tests in each trial arm, measured by distributor records.

**Results:** Among 4,787 individuals assessed for eligibility, 4,000 were enrolled. Participants’ average age was 35 years, 71% were female, and 66% were married. Self-test demand was highly price-sensitive; 260 participants (32.5%) offered free self-tests redeemed vouchers compared with 55 (6.9%) participants offered self-tests for US$ 0.5 (odds ratio, OR, 0.14, 95% CI 0.10-0.19), a reduction in demand of >25%. Demand was below 3% in the $1, $2, and $3 groups, significantly lower than the free distribution group. In pooled analyses, demand was considerably lower among participants in groups with price >$0 compared to the free distribution group (2.8% vs. 32.5%, OR 0.05, 95% CI 0.04-0.07). In urban areas, demand was significantly higher with pharmacy-based distribution versus clinic-based distribution (6.8% vs. 2.9%, adjusted odds ratio, 2.78, 95% CI 1.74–4.45). Price sensitivity was significantly higher among rural residents, men, and those who had never tested before. Promotion messages did not influence demand.

**Conclusions and Relevance:** Demand for HIV self-tests in Zimbabwe is highly price-sensitive. Free distribution may be essential for promoting testing among high priority population groups. Pharmacy-based distribution is preferable to clinic-based distribution in urban areas.

**Trial Registration: NCT03559959**

**BACKGROUND**

Greater awareness of HIV status and more frequent testing in high-risk populations is essential for achieving the UNAIDS 90-90-90 targets and realizing the promise of treatment as prevention. Yet in sub-Saharan Africa (SSA), nearly 20% of people living with HIV were unaware of their status in 2017.1 Despite the scale-up of clinic- and community-based models of providing HIV testing services, testing coverage remains sub-optimal particularly among men and key populations.2 To close the testing gap and advance HIV prevention objectives, innovative approaches are needed to increase uptake of HIV testing in SSA.

HIV self-testing (HIVST) allows individuals to collect their own sample and perform a simple rapid HIV antibody test in the absence of a provider.3 Several oral fluid-based or blood-based HIV tests have received WHO pre-qualification, with high sensitivity and specificity among lay users.3 Existing research shows there is high interest in and acceptability of HIVST across a wide range of populations.4–11 Following the recent World Health Organization guidelines that recommended large-scale implementation of HIVST, self-tests are becoming more widely available in government health facilities and retail outlets in several high HIV prevalence countries in SSA.3

Donor agencies and governments have heavily subsidized self-tests for distribution in some countries while private sector availability is emerging in parallel.12 However, the cost of self-tests and the price faced by consumers represent important obstacles to large-scale implementation of HIVST. As countries seek to scale-up HIVST for priority populations, there is limited evidence on how self-test demand is affected by alternative pricing and marketing strategies. A growing body of evidence from low-income countries shows that demand for prevention technologies such as antimalarial bednets and water filtration solutions is highly price sensitive.13–18 Knowing the self-test demand at various prices in the general population and key subgroups is important for setting appropriate subsidy levels for self-tests and understanding demand for HIV prevention technologies more generally. Moreover, with HIVST, there is also limited information about optimal distribution approaches for self-tests that will help reach untested individuals as well as messaging strategies that may promote uptake of such new technologies. Estimating how demand is affected not only by prices but also by various distribution approaches and different types of information provided to consumers can further inform HIVST scale-up efforts.

We conducted a randomized trial to examine the optimal pricing policies and distribution strategies for HIVST in a large community-based study in Zimbabwe.

**METHODS**

**Study Design, Setting, and Participants**

The study assessed demand for HIV self-tests using a randomized trial in which participants were given vouchers to obtain HIV self-tests at varying prices. After providing written informed consent, participants completed a brief questionnaire. Participants and their household members then received vouchers that specified a randomly selected price and distribution point where self-tests could be obtained. Some vouchers also included messages designed to promote HIV testing. Redemption of vouchers for self-tests was monitored during the following month.

The study was conducted in rural and urban communities in Zimbabwe, where adult HIV prevalence is 13%. Communities included a rural area in Mashonaland East Province and a high-density urban area in Mashonaland Central Province. PSI Zimbabwe, which provides HIV testing and counselling services in the study communities and leads a national HIVST program, was the main implementing partner for the study.

Ethics approval was obtained from the Medical Research Council of Zimbabwe, the Liverpool School of Tropical Medicine, the University of Pennsylvania, and the University of North Carolina at Chapel Hill. Between February 15 and April 25, 2018, research assistants recruited participants by visiting a random sample of households in study communities. In households that consented to screening, research assistants listed all eligible household members and randomly selected 1 member using a computer-generated randomization scheme. Eligible participants were ≥16 years old, owned a mobile phone or had access to a household member’s mobile phone, and planned to stay in the study area for at least 12 months. Written informed consent was obtained from individuals who met eligibility criteria and agreed to participate in the study.

**Randomization Procedures**

Research assistants gave participants a sealed envelope containing a voucher that revealed the study group assignment to both the participant and the research assistant. The price, distribution point, and promotion message in each voucher were determined using a computer-generated randomization scheme. A factorial design was used to form study groups, with vouchers containing 1 of 5 prices, 2 distribution points, and 4 messaging strategies (Figure 1). Randomization was stratified by urban and rural sites.

**Study Interventions**

Participants received a brief verbal description of HIVST during enrollment. The vouchers enabled them to obtain an oral fluid-based HIV test (OraQuick Rapid HIV-1/2 antibody tests, OraSure Technologies, Bethlehem, PA, USA) in their community within 1 month. Research assistants explained how to redeem vouchers for self-tests and wrote down the expiration date on the vouchers. Although the study’s primary objective was to assess demand among study participants, vouchers were also given to study participants’ household members aged ≥16 years so they could obtain self-tests as well. Household members were not required to be present to receive vouchers. Vouchers for each participant and their household members had the same price, distributor, and promotion message. Each voucher included a unique number that could be linked to an individual in the participant’s household.

*Prices*

The out-of-pocket price participants had to pay for self-tests ranged from US $0 (full subsidy) to US $3 (partial subsidy), with three intermediate prices of US$ 0.5, US$ 1, US$ 2. These prices were selected after consultations with key stakeholders in Zimbabwe and consideration of prevailing retail prices that were US$3 or higher.

*Self-test distribution strategies*

In rural communities, 2 relevant self-test distribution strategies were tested: provision by 48 CHWs and at 22 retail stores. In urban communities, self-tests were made available at 8 pharmacies and 12 government clinics. All distributors were equipped with sufficient self-tests to meet demand from participants.

*Promotion messages*

Two messages to promote HIV testing were tested in the vouchers (Figure 1). One message highlighted the greater privacy and confidentiality of HIVST.19 Another message sought to motivate testing by emphasizing that immediate HIV treatment was available for those who received a reactive result. This message was designed to mitigate perceived burden of living with HIV.20 Messages were translated to Shona and pre-tested. Vouchers were randomly assigned to 1 of 4 messaging strategies: no message, privacy message, early treatment message, or both messages.

*Self-test distributor compensation and monitoring*

Distributors were asked to collect all vouchers brought by participants and to enter voucher numbers on paper forms and computer tablets. Distributors were compensated US$30 at the end of the study for their efforts. They were also monitored every 2 weeks to ensure fidelity to study procedures. Research assistants verified if voucher redemptions were reconciled with the inventory of self-tests. Distributors received an additional US$5 per compliant monitoring visit, up to $20 if compliance was assured at 4 monitoring visits.

Self-tests included easy-to-use instructions that had been developed in prior HIVST studies in Zimbabwe.19 Additionally, distributors were asked to show participants a brief instructional video about HIVST on tablet computers at the time of voucher redemption.

**Data Collection**

Baseline questionnaire data were collected using Audio Computer-Assisted Self-Interview Software on a tablet with headphones. The questionnaire asked about demographic characteristics, prior HIV testing history, and self-reported sexual behavior.

Uptake of HIVST was monitored at the distribution sites where vouchers were redeemed in exchange for self-tests. The distribution sites collected the vouchers, dispensed HIV self-tests at the specified prices, and recorded the transaction date on the voucher. Voucher numbers were used to link self-test uptake to individual participants.

**Study Outcomes**

The primary pre-specified outcome was self-test demand among participants, defined as a binary indicator of whether a participant obtained a self-test within 1 month. A secondary outcome was self-test demand among participants’ household members.

**Statistical Analyses**

To estimate the effect of price on demand, the primary analysis used unadjusted and adjusted logistic regression models to compare demand in each of the 4 non-zero price groups to the free distribution group. The stratification factor of rural vs. urban residence was controlled for in all models, and participants’ sex was included in adjusted models. Logistic regression models adjusting for price and participants’ sex were used to estimate the effect of distribution strategies and promotion messages on self-test demand. For promotion messages, we compared demand for HIV self-tests in the privacy alone, early treatment alone, and privacy plus early treatment group to the no message group.

In secondary analyses, we compared demand in the combination of groups with prices >$0 to the free distribution group. Subgroup analyses were performed to determine the effects of non-zero prices by pre-specified socioeconomic characteristics and behavioral factors, including income, self-reported HIV testing history, number of sexual partners, and condom use. In addition, we performed post-hoc subgroup analyses based on residence (urban vs. rural), sex, and age given the policy relevance of studying demand in these particular sub-groups. To test whether price sensitivity varied by demographic sub-groups, a subgroup-price interaction term was included in linear probability models. We chose linear models because logistic regression models do not provide an odds ratio interpretation for interaction terms and the standard errors of these interaction terms are not equal to those of average marginal effects in the linear models.21,22 In addition to the pre-specified main analysis, we conducted post-hoc analyses to evaluate the effect of prices on demand among participants’ household members. All statistical tests were 2-sided and significance was set at P<0.05. For the analyses of household members, standard errors were clustered at the household level to account for the correlation within a household. Analyses were performed using Stata version 15.1.

Power calculations focused on estimating the price sensitivity of self-test demand. Given limited prior data, we assumed 15% of participants would obtain self-tests at the highest price. A sample of 270 participants per price group was required to have 80% power to detect a difference of ≥10 percentage points in demand between price groups (alpha=0.05). With 2,000 participants in rural sites and 2,000 in urban sites, the final selection of 5 price points in each site resulted in a sample of 400 per price group and 80% power to detect between-group differences in demand of ≥8 percentage points. We followed the CONSORT reporting guidelines for randomized controlled trials.23

**RESULTS**

Among 4,787 individuals assessed for eligibility, 4,000 were enrolled and randomized (Figure 1). Major reasons for non-enrolment included not interested or too busy (281), already on treatment (94), feeling too old to participate in an HIV testing study (54), and recently tested (51). Four participants were excluded from analyses due to missing questionnaire data, resulting in an analytical sample of 3,996 participants.

Participants in the 5 price groups had largely similar characteristics except for sex (Table 1). Participants’ average age was 35 years, 71% were female, and 66% were married. The vast majority (82%) reported having tested for HIV at least once previously but only 45% had tested in the past 12 months. Among those who had ever tested, 8% self-reported being HIV-positive. Most participants (71%) reported having a regular sexual partner and 5% of participants reported >1 sexual partner in the past month. Among those with at least 1 sexual partner in the past month, most participants reported consistent condom use (87%).

*Price-sensitivity of demand*

Self-test demand was higher in rural sites than urban sites, but in both sites it was very sensitive to price (Table 2 & eFigure 1). Overall, 32.5% of participants offered free self-tests redeemed vouchers whereas 6.9% of those offered self-tests for $0.5 redeemed vouchers (odds ratio, OR, 0.14, 95% CI 0.10-0.19), a reduction in demand of over 25 percentage points (Table 2). Demand was also significantly lower in the $1, $2, and $3 groups than the free distribution group. In adjusted logistic regression analysis, demand remained strongly associated with price. Results were similar after excluding participants who self-reported having previously tested HIV-positive (not shown).

Demand was considerably lower in the combination of groups with prices >$0 (2.8%) than the free distribution group (32.5%, OR 0.05, 95% CI 0.04-0.07). When examining rural and urban sites separately, demand remained strongly associated with price. In rural sites demand was highest in the free distribution group (47.3%) and significantly lower at higher prices, with 9.5% of participants obtaining self-tests in the $0.5 group (AOR 0.12, 95% CI 0.08-0.17) and 4.0% obtaining self-tests in the $1 group (AOR 0.05, 95% CI 0.03-0.08). In urban sites 17.8% of participants in the free distribution group redeemed vouchers and demand also declined significantly at higher prices.

Demand among 4,923 household members was also highly sensitive to price in logistic regression models that adjusted for sex and age (eTable 1). Effect sizes were similar to those found among study participants.

*Demand by self-test distribution strategy and promotion message*

In rural sites, demand was higher with CHW distribution (14.0%) than retail store distribution (11.7%), but this difference was not significant in logistic regression analyses that adjusted for self-test price offered to participants and sex of participants (AOR 0.77, 95% CI 0.56-1.05) (Table 3). In urban areas, demand was significantly higher with pharmacy-based distribution versus clinic-based distribution (6.8% vs. 2.9%, AOR 2.78, 95% CI 1.74–4.45).

Promotion messages included with vouchers did not influence demand. Overall, participants who received vouchers with no added messages to promote HIV testing were most likely to obtain self-tests (10.2%) whereas those with messages promoting privacy of self-tests, immediate ART for those obtaining a reactive result, or both had demand between 8.0%-8.5%. Demand did not differ significantly between these groups.

*Subgroup analyses for price sensitivity of demand*

Self-test demand varied considerably between various participant subgroups but demand remained highly sensitive to price in all subgroups (Table 4). Demand declined more steeply with higher prices in rural areas than urban areas and the difference in price-sensitivity was statistically significant (p<0.01). Men had higher demand than women at low prices but not at higher prices, indicating a higher price-sensitivity that was statistically significant (p=0.04). Price sensitivity was also higher among younger participants aged ≤25 years than older participants (p<0.01). Demand and price sensitivity did not differ much between those with below median vs. above median incomes, and similarly between those with low-risk vs. high-risk sexual behaviors. However, due to the magnitude of missingness in income and number of sexual partners (Table 1), these results should be interpreted with caution. Participants reporting never having tested before displayed greater price-sensitivity than those who tested before (p=0.03).

**DISCUSSION**

In high HIV prevalence areas of Zimbabwe where there is a significant need to increase coverage of HIV testing, demand for HIV self-tests was highly sensitive to price. Compared to offering self-tests free-of-charge, charging prices as low as US$0.5 led to strikingly large reductions in demand from 32.5% to 6.9%. Demand was even lower at higher prices of $1-$3. Demand was highly sensitive to price across many population subgroups, but importantly, price sensitivity was highest in priority subgroups such as rural residents, men, and those who had never tested before. Additionally, pharmacy-based distribution resulted in the highest uptake of self-tests in urban areas, whereas in rural areas demand did not differ between distribution by community health workers and retail outlets.

This study provides evidence that can be used to develop optimal pricing policies and distribution strategies for self-tests. While the market for HIV self-tests is still developing, prices in low- and middle-income countries presently range from US$3-6 per test in the public sector and are even higher in the private sector.24 A recent initiative of the Bill and Melinda Gates Foundation lowered the price of a widely-used oral fluid-based self-test (OraQuick) to US$2 in high prevalence countries.12 As HIVST receives consideration as part of intensified HIV elimination efforts, this study’s findings suggest that further subsidies will be needed to achieve desired increases in testing coverage. The higher price sensitivity in priority populations that have lower rates of prior testing underscores the need for subsidization of self-tests.

This study also contributes to a growing literature that uses field experiments to assess demand for health products and services in low-income settings. Even at very low prices, demand for diagnostics and life-saving health technologies is remarkably sensitive to price. The large reduction in demand at prices >$0 is consistent with studies showing that small price increases lead to large declines in demand for antimalarial bednets, water disinfectant solutions, and treatments for acute diseases.13–18 To our knowledge, no prior studies have studied the price sensitivity of self-test demand using experimental methods and revealed preferences. Studies using stated preferences have shown that prices do influence demand for HIV and malaria testing,11,25–29 but a key distinction is that observed demand at prices >$0 in our study was considerably lower than what would be expected given stated willingness to pay in other studies conducted in eastern and southern Africa. While differences between study populations may explain this, it is plausible that stated willingness to pay exaggerates actual demand.

It is notable that demand was not even higher when participants were offered self-tests free-of-charge, particularly in urban areas. About half of rural participants and one-fifth of urban participants obtained self-tests when offered them free-of-charge. The higher uptake in rural areas could be due to lower rates of prior testing and lack of confidential, private, or convenient testing options. In urban areas, on the other hand, prior testing rates were higher and people could obtain anonymous testing at nearby locations. While studies of demand for other health products have observed much higher uptake under free distribution,13,16 self-test demand at similar prices may be lower due to psychological distress about obtaining an HIV-positive result and greater stigma associated with HIV than diseases like malaria.20

It is puzzling that promotion messages emphasizing benefits of HIVST did not increase demand. In fact, not including any message in vouchers generated the highest demand among the 4 messaging strategies we tested. This might be because short 1-sentence promotion messages were not salient enough to highlight positive attributes of self-tests or address anticipated emotional burdens.27 On the other hand, participants may have already been familiar with some information conveyed in the messages. More than 80% of participants had tested for HIV previously and could have heard about the benefits of early treatment. Future work that tests messages designed to address other perceived limitations of HIVST, such as concerns over pre- and post-test counseling or accuracy of results,30 might reveal new ways to promote uptake of self-tests.

This study has several limitations. First, the majority of participants were female because men were less likely to be home during recruitment. However, demand and price sensitivity among household members, who were 57% male, were similar to what was found among study participants. Second, demand for HIV self-tests was indicated by voucher redemption but use of self-tests was not measured. However, studies have shown that people who obtained self-tests also use them and experiments of demand for other health products have generally refuted the notion that paying for a health product increases the likelihood of usage.13,14,16,31 Third, we did not collect data on test results and thereby cannot determine whether the “yield” of HIV-positive individuals varied by price or distribution strategy.17 Fourth, we did not assess the effect of spillover effects across households. Spillover effects may heighten price sensitivity if individuals in the non-zero price groups chose not to pay for a test kit after knowing that their neighbor received a free voucher. Alternatively, social learing from those who tried the self-test kits first may lead to higher uptake in the non-zero price study groups. Finally, we did not assess linkage to care by individuals tested positive, which was beyond the scope of the study but is important for future research to address.

**CONCLUSION**

Demand for HIV self-tests is extremely price sensitive in Zimbabwe, even at relatively low prices and especially in rural areas. Free distribution of self-tests is likely to be necessary for increasing HIV testing coverage among high priority groups such as men and those who have never tested before.

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manuscript; and decision to submit the manuscript for publication.

**Access to Data and Data Analysis:** Chang and Thirumurthy had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Author Contributions:**

*Concept and design:* Cowan, Hatzold, Thirumurthy.

*Acquisition, analysis, or interpretation of data:* Chang, Matambanadzo, Takaruza, Thirumurthy.

*Drafting of the manuscript:* Chang, Matambanadzo, Thirumurthy.

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*Administrative, technical, or material support:* Chang, Matambanadzo, Takaruza, Hatzold, Cowan, Sibanda, Thirumurthy.

*Supervision:* Chang, Matambanadzo, Cowan, Sibanda, Thirumurthy.

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**Figure Legends**

Figure 1. CONSORT flow diagram

Table 1. Participant characteristics

|  |  |  |  |
| --- | --- | --- | --- |
|  | **N** | **Full Sample** | **Study Group** |
|  |  |  | **$0** | **$0.5** | **$1** | **$2** | **$3** | **p-value** |
| N | 3996 | 3996 | 800 | 798 | 799 | 799 | 800 |  |
| Age, mean (SD), year | 3996 | 35.1 (14.7) | 35.0 (14.6) | 34.8 (15.1) | 35.3 (14.7) | 35.5 (14.6) | 35.2 (14.7) | 0.89 |
| Monthly income, median (IQR), US$ | 1951 | 60.0 (20.0, 150.0) | 55.0 (20.0, 150.0) | 50.0 (20.0, 140.0) | 60.0 (20.0, 175.0) | 60.0 (22.0, 150.0) | 50.0 (20.0, 150.0) | 0.80 |
| Female, N (%) | 3996 | 2841 (71.1%) | 573 (71.6%) | 597 (74.8%) | 577 (72.2%) | 543 (68.0%) | 551 (68.9%) | 0.02 |
| Married, N (%) | 3909 | 2568 (65.7%) | 524 (66.9%) | 526 (67.0%) | 529 (67.6%) | 491 (63.2%) | 498 (63.7%) | 0.20 |
| Education, N (%) | 3996 |  |  |  |  |  |  | 0.77 |
|  No or some primary schooling |  | 409 (10.2%) | 79 (9.9%) | 85 (10.7%) | 84 (10.5%) | 90 (11.3%) | 71 (8.9%) |  |
|  Completed primary schooling |  | 419 (10.5%) | 85 (10.6%) | 78 (9.8%) | 81 (10.1%) | 88 (11.0%) | 87 (10.9%) |  |
|  Some secondary schooling |  | 857 (21.4%) | 174 (21.8%) | 174 (21.8%) | 175 (21.9%) | 160 (20.0%) | 174 (21.8%) |  |
|  Completed O level |  | 1971 (49.3%) | 391 (48.9%) | 408 (51.1%) | 382 (47.8%) | 385 (48.2%) | 405 (50.6%) |  |
|  Completed A level or higher |  | 340 (8.5%) | 71 (8.9%) | 53 (6.6%) | 77 (9.6%) | 76 (9.5%) | 63 (7.9%) |  |
| Location, N (%) | 3996 |  |  |  |  |  |  | 1.00 |
|  Rural |  | 2000 (50.1%) | 400 (50.0%) | 400 (50.1%) | 400 (50.1%) | 400 (50.1%) | 400 (50.0%) |  |
|  Urban |  | 1996 (49.9%) | 400 (50.0%) | 398 (49.9%) | 399 (49.9%) | 399 (49.9%) | 400 (50.0%) |  |
| Ever tested for HIV, N (%) | 3960 | 3237 (81.7%) | 645 (81.9%) | 654 (82.2%) | 652 (82.6%) | 640 (80.8%) | 646 (81.3%) | 0.89 |
| Tested in the past 12 months, N (%) | 3996 | 1813 (45.4%) | 371 (46.4%) | 370 (46.4%) | 347 (43.4%) | 355 (44.4%) | 370 (46.2%) | 0.66 |
| Tested positive in most recent HIV test, N (%) | 3156 | 259 (8.2%) | 59 (9.4%) | 50 (7.8%) | 49 (7.7%) | 56 (8.9%) | 45 (7.2%) | 0.59 |
| Have a regular sexual partner, N (%) | 3996 | 2836 (71.0%) | 577 (72.1%) | 579 (72.6%) | 581 (72.7%) | 540 (67.6%) | 559 (69.9%) | 0.11 |
| Partner ever tested for HIV, N (%) | 2484 | 2128 (85.7%) | 420 (84.5%) | 443 (86.5%) | 432 (84.9%) | 409 (85.0%) | 424 (87.4%) | 0.65 |
| Partner tested positive in most recent HIV positive, N (%)  | 2058 | 155 (7.5%) | 31 (7.7%) | 30 (7.0%) | 30 (7.3%) | 33 (8.2%) | 31 (7.6%) | 0.98 |
| Age of first sex, median (IQR) | 2528 | 20.0 (18.0, 22.0) | 20.0 (18.0, 22.0) | 20.0 (18.0, 22.0) | 20.0 (18.0, 23.0) | 19.0 (18.0, 23.0) | 20.0 (18.0, 22.0) | 0.16 |
| No. partners last month | 3557 |  |  |  |  |  |  | 0.82 |
|  0 partner, N (%) |  | 1333 (37.5%) | 267 (37.3%) | 255 (36.7%) | 258 (36.0%) | 286 (39.6%) | 267 (37.8%) |  |
|  1 partner, N (%) |  | 2046 (57.5%) | 414 (57.8%) | 409 (58.8%) | 415 (58.0%) | 405 (56.0%) | 403 (57.0%) |  |
|  >1 partner, N (%) |  | 178 (5.0%) | 35 (4.9%) | 31 (4.5%) | 43 (6.0%) | 32 (4.4%) | 37 (5.2%) |  |
| Always used condom last month (among those with at least 1 partner), N (%) | 2250 | 1948 (86.6%) | 395 (87.4%) | 389 (87.4%) | 395 (85.1%) | 384 (86.5%) | 385 (86.5%) | 0.85 |

Abbreviations: SD, standard deviation; IQR, interquartile range; HTC, HIV testing and counseling

Table 2. Demand for HIV self-tests by price

|  |  |  |  |
| --- | --- | --- | --- |
|  | Full Sample | Rural | Urban |
|  | Participants, No. | Obtainedself-test, No. | ObtainedSelf-test,% | Unadjusted OR(95% CI)a | Adjusted OR(95% CI)b | Obtained self-test,% | Adjusted OR(95% CI)c | Obtained self-test,% | Adjusted OR(95% CI)c |
| Price Group |  |  |  |  |  |  |  |  |  |
|  $0 (free) | 800 | 260 | 32.5% | Reference | Reference | 47.3% | Reference | 17.8% | Reference |
|  $0.5 | 798 | 55 | 6.9% | 0.14 (0.10 – 0.19) | 0.14 (0.10 – 0.19) | 9.5% | 0.12 (0.08 – 0.17) | 4.3% | 0.21 (0.12 – 0.36) |
|  $1 | 799 | 21 | 2.6% | 0.05 (0.03 – 0.08) | 0.05 (0.03 – 0.08) | 4.0% | 0.05 (0.03 – 0.08) | 1.3% | 0.06 (0.02 – 0.15) |
|  $2 | 799 | 9 | 1.1% | 0.02 (0.01 – 0.04) | 0.02 (0.01 – 0.04) | 2.0% | 0.02 (0.01 – 0.05) | 0.3% | 0.01 (0 – 0.08) |
|  $3 | 800 | 6 | 0.8% | 0.01 (0.01 – 0.03) | 0.01 (0.01 – 0.03) | 1.0% | 0.01 (0 – 0.03) | 0.5% | 0.02 (0.01 – 0.09) |
| Site |  |  |  |  |  |  |  |  |  |
|  Rural | 2000 | 255 | 12.8% | Reference | Reference | -- | -- | -- | -- |
|  Urban | 1996 | 96 | 4.8% | 0.27 (0.21 – 0.36) | 0.28 (0.21 – 0.36) | -- | -- | -- | -- |
| Sex |  |  |  |  |  |  |  |  |  |
|  Male | 1155 | 116 | 10.0% | -- | Reference | 12.8% | Reference | 6.0% | Reference |
|  Female | 2841 | 235 | 8.3% | -- | 0.84 (0.64 – 1.11) | 12.7% | 0.94 (0.68 – 1.31) | 4.4% | 0.65 (0.4 – 1.05) |
| Pooled Price |  |  |  |  |  |  |  |  |  |
|  $0 (free) | 800 | 260 | 32.5% | Reference | Reference | 47.3% | Reference | 17.8% | Reference |
|  Price>$0 | 3196 | 91 | 2.8% | 0.05 (0.04 – 0.07) | 0.05 (0.04 – 0.07) | 4.1% | 0.05 (0.04 – 0.07) | 1.6% | 0.07 (0.05 – 0.12) |
| Site |  |  |  |  |  |  |  |  |  |
|  Rural | 2000 | 255 | 12.8% | Reference | Reference | -- | -- | -- | -- |
|  Urban | 1996 | 96 | 4.8% | 0.27 (0.21 – 0.36) | 0.28 (0.21 – 0.37) | -- | -- | -- | -- |
| Sex |  |  |  |  |  |  |  |  |  |
|  Male | 1155 | 116 | 10.0% | -- | Reference | 12.8% | Reference | 6.0% | Reference |
|  Female | 2841 | 235 | 8.3% | -- | 0.88 (0.67 – 1.15) | 12.7% | 0.98 (0.71 – 1.35) | 4.4% | 0.68 (0.42 – 1.1) |

Abbreviations: OR, odds ratio; CI, confidence interval

a Logistic regression model that adjusted for the stratification factor only (i.e., rural or urban site)

b Logistic regression model that adjusted for the stratification factor and any covariate not balanced at baseline (i.e., sex)

c Logistic regression model that adjusted for any covariate not balanced at baseline (i.e., sex)

Table 3. Demand for HIV self-tests by distribution strategy and promotion message

|  |  |
| --- | --- |
|  | **Study Group by Distribution Strategy** |
|  | Rural | Urban |
|  | CHW | Retail Store | Clinic | Pharmacy |
| No. of Participants | 1000 | 1000 | 997 | 999 |
| Obtained self-test, No. | 138 | 117 | 28 | 68 |
| Obtained self-test, % | 14.0% | 11.7% | 2.9% | 6.8% |
| AOR (95% CI), adjusted for pricea | Reference | 0.77 (0.56 – 1.05) | Reference | 2.78 (1.74 – 4.45) |
| AOR (95% CI), adjusted for price and sexa | Reference | 0.77 (0.57 – 1.05) | Reference | 2.79 (1.74 – 4.48) |
|  | **Study Group by Promotion Message** |
|  | No Message | Privacyb alone | Early treatmentc alone | Privacyb & Early treatmentc |
| No. of Participants | 998 | 999 | 999 | 1000 |
| Obtained self-test, No. | 102 | 85 | 84 | 80 |
| Obtained self-test, % | 10.2% | 8.5% | 8.4% | 8.0% |
| AOR (95% CI), adjusted for pricea | Reference | 0.78 (0.56 – 1.09) | 0.77 (0.55 – 1.07) | 0.72 (0.51 – 1.01) |
| AOR (95% CI), adjusted for price and sexa | Reference | 0.79 (0.56 – 1.11) | 0.77 (0.55 – 1.08) | 0.74 (0.53 – 1.04) |

Abbreviations: AOR, adjusted odds ratio; 95% CI, confidence interval; CHW, community health worker

a Results are from logistic regression models.

b "Privacy” message: Be the first to know your status and take the right action.

c “Early treatment” message: Positive or negative, life is full of hope. If you test HIV-positive, you can immediately access treatment and continue to lead a healthy life.

Table 4. Demand for HIV self-tests and price sensitivity in participant sub-groups

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Obtained Self-Tests**No. / Total No. (%) | **Effect of price >$0a** | **Subgroup – Price interactionb** |
|  | **US $0** | **US $0.5** | **US $1** | **US $2** | **US $3** | **AOR** (95% CI) | ***P* Value** | ***P* Value**  |
| Obtained HIV self-test | 260/800 (32.5%) | 55/798 (6.9%) | 21/799 (2.6%) | 9/799 (1.1%) | 6/800 (0.8%) | 0.06 (0.05 – 0.08) | <.01 | -- |
| Urban | 71/400 (17.8%) | 17/398 (4.3%) | 5/399 (1.3%) | 1/399 (0.3%) | 2/400 (0.5%) | 0.07 (0.05 – 0.12) | <.01 | <.01 |
| Rural | 189/400 (47.3%) | 38/400 (9.5%) | 16/400 (4%) | 8/400 (2%) | 4/400 (1%) | 0.05 (0.04 – 0.07) | <.01 |
| Female | 173/573 (30.2%) | 34/597 (5.7%) | 17/577 (2.9%) | 6/543 (1.1%) | 5/551 (0.9%) | 0.06 (0.05 – 0.09) | <.01 | .04 |
| Male | 87/227 (38.3%) | 21/201 (10.4%) | 4/222 (1.8%) | 3/256 (1.2%) | 1/249 (0.4%) | 0.05 (0.03 – 0.08) | <.01 |
| Age > 25 years | 195/549 (35.5%) | 48/524 (9.2%) | 17/551 (3.1%) | 7/564 (1.2%) | 5/564 (0.9%) | 0.07 (0.05 – 0.09) | <.01 | <.01 |
| Age ≤ 25 years | 65/251 (25.9%) | 7/274 (2.6%) | 4/248 (1.6%) | 2/235 (0.9%) | 1/236 (0.4%) | 0.04 (0.02 – 0.07) | <.01 |
| Income ≤ median | 65/219 (29.7%) | 12/248 (4.8%) | 6/203 (3%) | 4/235 (1.7%) | 1/225 (0.4%) | 0.06 (0.04 – 0.1) | <.01 | .22 |
| Income > median | 55/162 (34%) | 16/159 (10.1%) | 3/169 (1.8%) | 3/173 (1.7%) | 3/158 (1.9%) | 0.07 (0.04 – 0.12) | <.01 |
| Never tested before | 41/143 (28.7%) | 8/142 (5.6%) | 2/137 (1.5%) | 2/152 (1.3%) | 0/149 (0%) | 0.05 (0.03 – 0.1) | <.01 | .03 |
| Tested before | 217/645 (33.6%) | 47/654 (7.2%) | 19/652 (2.9%) | 7/640 (1.1%) | 6/646 (0.9%) | 0.06 (0.05 – 0.08) | <.01 |
| ≤1 sexual partners in past month | 202/564 (35.8%) | 37/536 (6.9%) | 9/550 (1.6%) | 9/555 (1.6%) | 5/527 (0.9%) | 0.05 (0.04 – 0.07) | <.01 | .98 |
| >1 sexual partners in past month | 14/46 (30.4%) | 2/38 (5.3%) | 3/52 (5.8%) | 0/41 (0%) | 1/44 (2.3%) | 0.08 (0.03 – 0.22) | <.01 |
| Always used condoms last month | 150/395 (38%) | 28/389 (7.2%) | 7/395 (1.8%) | 7/384 (1.8%) | 4/385 (1%) | 0.05 (0.03 – 0.07) | <.01 | .54 |
| Not always used condoms last month | 12/57 (21.1%) | 4/56 (7.1%) | 3/69 (4.3%) | 0/60 (0%) | 0/60 (0%) | 0.11 (0.04 – 0.3) | <.01 |

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval

a Results are from logistic regression models of HIV self-test demand with indicator of the price >$0 group ($0 price group as the reference) and controls for participant’s sex. Each AOR is for price >$0 group compared to free distribution group when sample is restricted to the specific subgroup defined in the first column.

b *P* value is for the interaction between the subgroup (first row of each subgroup as the reference) and the prize >$0 group in linear probability models, which includes all observations with non-missing values for the subgroup variable defined in the first column and controls for sex.