

Improving the Efficiency and Effectiveness of Assisted Partner Services for HIV
in Western Kenya

Unmesha Roy Paladhi

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Reading Committee:

Carey Farquhar, Chair

David Katz

Renee Heffron

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Unmesha Roy Paladhi

University of Washington

Abstract

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Unmesha Roy Paladhi

Chair of the Supervisory Committee:

Carey Farquhar

Department of Epidemiology

To control the HIV epidemic in Sub-Saharan Africa, it is crucial to increase the proportion of people who know their serostatus. In Kenya, approximately 1.6 million people are living with HIV (PLWH), of whom it is estimated that 21% are unaware of their status. Assisted partner services (APS) are programs that help to identify and locate sexual and injecting partners of individuals diagnosed with HIV, and provide these partners with testing options, connection to care, and counseling. The World Health Organization (WHO) has recommended that APS be broadened as a HIV tracing mechanism to locate hard to reach populations. Furthermore, the onset of the COVID-19 pandemic has highlighted the need to increase HIV testing services (HTS) that are successfully offered remotely. While the WHO and Centers for Disease Control and Prevention (CDC) encourage offering HIV self-testing (HIVST) as part of comprehensive HTS, there is a significant gap in knowledge including the effectiveness of HIVST in low-resource APS programs, like Kenya. In this dissertation, we proposed three distinct aims to investigate the effectiveness of HIVST compared to provider-delivered testing alone in increasing partners tested within an APS program, using behavioral economics theory on utilizing non-financial incentives to increase HIVST uptake. We determined whether offering HIVST during APS as an option for partner testing increases HIV testing, first-time testing, new HIV diagnoses, and linkage to HIV care among partners of index clients compared to Standard APS (Aim 1). We also examined the effectiveness of offering multiple HIV self-test kits as an incentive to increase HIVST uptake among sexual partners of PLWH participating in APS (Aim 2). Finally, we compared characteristics of sexual partners successfully contacted in-person versus via phone in an APS

program (Aim 3). In an established APS program in Western Kenya, we found no statistically significant differences in HIV testing, first-time testing, new HIV diagnoses, and linkage to care among partners offered a choice of HIVST or provider-delivered testing versus provider-delivered testing alone (Aim 1). In the same setting, we found that offering two HIVSTs as an incentive compared to a single HIVST did not increase HIV testing, first-time testing, new diagnosis, or linkage to care. However, it did reach and test people at risk for HIV beyond the scope of more typical APS approaches, mostly sexual partners of the named partners (Aim 2). Lastly, we found that those who were contacted in-person for APS were more likely to receive a new HIV diagnosis, compared to those reached via phone and those who were contacted by phone were more likely to be male and have completed higher education levels (Aim 3). These studies provide strong evidence for integration of HIVST into APS in Kenya to increase uptake for this method of HIV testing in this region.

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Chapter 1: Introduction

Assisted partner services (APS) have been successful in promoting testing of individuals at high risk for acquiring HIV by tracing and notifying sexual and injecting partners of individuals diagnosed with HIV and offering testing and linkage to care. However, as new challenges associated with conducting provider-delivered and clinic-based testing emerge and we attempt to efficiently reach a wider network of partners of people living with HIV (PLWH) in resource-limited settings, it is important to explore remote testing methods like HIV self-testing (HIVST), contact tracing modalities like phone-based vs. in-person partner notification, and novel strategies like non-monetary incentives to maintain consistently high testing rates.

To improve upon the established APS program in the Kisumu and Homa Bay counties of Western Kenya, a new study was conducted that randomized 24 healthcare facilities to offer HIVST as a testing option for partners of index clients versus provider-delivered HIV testing alone (Aim 1). A single crossover study was nested within Aim 1 to offer a second HIVST kit as a non-financial incentive to HIV testing (Aim 2). Lastly, data from an implementation science study was used to determine the characteristics of individuals being captured by phone-based contact-tracing (Aim 3).

Summary of Aims and Results

Aim 1. Determine whether offering HIVST as an option for partner testing when providing APS increases HIV testing, first-time testing, new HIV diagnoses, and linkage to HIV care among partners of index clients compared to Standard APS.

In an established APS program in Western Kenya, we found no statistically significant differences in HIV testing, first-time testing, new HIV diagnoses, and linkage to care among partners offered a choice of HIVST or provider-delivered testing versus provider-delivered testing alone.

Aim 2. Determine the effectiveness of offering two HIVST kits as an incentive to increase HIV self-testing uptake among partners of PLWH participating in APS in Western Kenya.

This nested single crossover study conducted in 24 health facilities in Western Kenya found that offering two HIVSTs as an incentive compared to a single HIVST, within a successful established APS program, did not increase HIV testing, first-time testing, new diagnosis, or linkage to care. However, it did reach and test people at risk for HIV beyond the scope of more typical APS approaches, mostly sexual partners of the named partners.

Aim 3. Compare characteristics of sexual partners successfully contacted in-person versus via phone in an APS program in Western Kenya.

We found that those who were contacted by phone were more likely to be male and have completed higher education levels. When looking at overall HIV testing outcomes, there was no association between being contacted by phone and HIV testing, first-time testing, or linkage to care. However, compared to those contacted via phone, those who were contacted in-person were more likely to receive a new HIV diagnosis.

Chapter 2: Effectiveness of HIV Self-Testing when offered within Assisted Partner Services in Western Kenya (APS-HIVST Study): A Cluster Randomized Controlled Trial

Unmesha Roy Paladhi^{1,2}; David A. Katz²; George Otieno³; James P. Hughes⁴; Harison Lagat⁵; Sarah Masyuko^{2,6}; Monisha Sharma²; Paul Macharia²; Rose Bosire⁷; Mary Mugambi⁸; Edward Kariithi^{3*}; Carey Farquhar^{1,2,8*}

1. Department of Epidemiology, School of Public Health, University of Washington, Seattle, WA, USA
2. Department of Global Health, University of Washington, Seattle, USA
3. PATH-Kenya, Kisumu, Kenya
4. Department of Biostatistics, University of Washington, Seattle, USA
5. School of Nursing, University of Washington, Seattle, USA
6. Ministry of Health, Nairobi, Kenya
7. Centre for Clinical Research, Kenya Medical Research Institute (KEMRI), Nairobi, Kenya
8. Department of Medicine, University of Washington, Seattle, USA

*co-senior authors

Abstract

Introduction: Assisted partner services (APS) is an effective strategy for increasing HIV testing, new diagnosis, and linkage to care among sexual partners of people living with HIV (PLWH). APS can be resource intensive as it requires community tracing to locate each partner named and offer them testing. There is limited evidence for the effectiveness of offering HIV self-testing (HIVST) as an option for partner testing within APS.

Methods: We conducted a cluster randomized controlled trial comparing provider-delivered HIV testing (Standard APS) versus offering partners the option of provider-delivered testing or HIVST (APS+HIVST) at 24 health facilities in Western Kenya. Facilities were randomized 1:1 and we conducted intent-to-treat analyses using Poisson generalized linear mixed models to estimate intervention impact on HIV testing, new HIV diagnoses, and linkage to care. All models accounted for clustering at the clinic level and new diagnoses and linkage models were adjusted for individual-level age, sex, and income *a priori*.

Results: From March-December 2021, 755 index clients received APS and named 5054 unique partners. Among these, 1408 partners reporting a prior HIV diagnosis were not eligible for HIV testing and excluded from analyses. Of the remaining 3646 partners, 96.9% were successfully contacted for APS and tested for HIV: 2111 (97.9%) of 2157 in the APS+HIVST arm and 1422 (95.5%) of 1489 in the Standard APS arm. In the APS+HIVST arm, 84.6% (1785/2111) tested via HIVST and 15.4% (326/2111) received provider-delivered testing. Overall, 16.7% of the 3533 who tested were newly diagnosed with HIV [APS+HIVST=357/2111 (16.9%); Standard APS=232/1422 (16.3%)]. Of the 589 partners who were newly diagnosed, 90.7% were linked to care [APS+HIVST=309/357 (86.6%); Standard APS=225/232 (97.0%)]. There were no significant differences between the two arms in HIV testing [relative risk (RR):1.02, 95%CI:0.96-1.10], new HIV diagnoses [adjusted RR (aRR):1.03, 95%CI:0.76-1.39], or linkage to care [aRR:0.88, 95%CI:0.74-1.06].

Conclusions: This APS program successfully reached and HIV tested >95% of elicited partners, and 1 in 6 of those tested was newly diagnosed with HIV, >90% of whom were linked to care. There were no differences between APS+HIVST and Standard APS, demonstrating that integrating HIVST into APS is an effective strategy for identifying PLWH.

Clinical Trial Number: NCT04774835

Introduction

The 95-95-95 targets set by the Joint United Nations Programme on HIV/AIDS (UNAIDS) to diagnose 95% of all people living with HIV (PLWH), have 95% of those with an HIV diagnosis on antiretroviral therapy (ART), and 95% of those on ART be virally suppressed requires robust testing programs worldwide (1). One effective strategy for identifying people with undiagnosed HIV is assisted partner services (APS), a longstanding component of control programs for sexually transmitted infections (STI), including HIV. Following the release of World Health Organization (WHO) guidelines in 2016 recommending offering these services to all people living with HIV, APS has been widely adopted and scaled-up globally (2–4). The primary goals of APS are to ensure that partners are notified of their exposure, tested, and linked to appropriate care.

In Western Kenya, our team has worked in collaboration with the Ministry of Health to implement APS in 31 health facilities by training existing staff (APS Scale-up Study) (5). Consenting females testing HIV positive (index clients) were asked to name all sexual partners in the last 3 years. Staff notified these partners of their potential HIV exposure and encouraged them to get tested for HIV with provider-delivered testing either in clinic settings or at the individual's home. While APS is shown to be an effective and cost-effective method of identifying people with undiagnosed HIV, it is resource-intensive and barriers exist to effective implementation, including limitations of staff, infrastructure, and potentially future funding (5–7). Strategies for reducing resources needed to implement these programs while increasing the proportion of partners reached via these services are needed.

The WHO recommends HIV self-testing (HIVST) to increase access to HIV testing services (HTS) among those at risk (8), and promoted HIVST as a strategy for providing HTS during the COVID-19 pandemic including for APS due to social distancing restrictions (4,9–11). HIVST is currently promoted in Kenya with data showing high acceptance across many populations including men, pregnant women, and sex workers (12–14). HIVST kits are offered in community settings, through online platforms, pharmacies, and in some healthcare facilities (12,15). However, HIVST is not routinely being used as part of APS in Kenya, despite its potential to identify PLWH and link them to care, improve reach, reduce providers' time and transport in tracing clients in the community, and increase partner control over their health.

The APS-HIVST Study was developed as an extension of the APS Scale-up Study (5,16). We aimed to evaluate the effectiveness of HIVST as a testing option (APS+HIVST) compared to routine provider-based testing (Standard APS) for partners of index clients identified via APS. We assessed the outcomes of partner testing, first-time testing, new HIV diagnoses, and linkage to care.

Methods

Study Design

The APS-HIVST Study was a parallel cluster randomized controlled trial (cRCT) conducted in the Kisumu and Homa Bay counties of Western Kenya with enrollment completed from March-December 2021. The trial was implemented in 24 healthcare facilities (i.e. clusters) in the two counties, including a mix of low- and high-volume facilities in both urban and rural settings. The study received ethical approval from the University of Washington Human Subjects Division (STUDY00002420) and the Kenyatta National Hospital Ethics and Research Committee (P465/052017) and was registered on clinicaltrials.gov (NCT04774835).

Participants

People (index clients) who tested HIV-positive at the 24 study sites were offered APS and study participation. While all index clients and partners were offered and encouraged to enroll in this study, enrollment was not necessary to receive HIV testing or APS at any stage. Index clients were eligible for APS if they were ≥ 18 years old, not currently in HIV care, and willing to provide informed consent and locator information for sexual partners. Partners of index clients were traced and offered APS and study enrollment. Partners were eligible if they were ≥ 18 years old and able and willing to provide informed consent. Both index and partner participants were excluded if they were pregnant or had reported intimate partner violence (IPV) during the last month. Those excluded for recent IPV were connected to appropriate resources.

Randomization

Facilities were randomized in a 1:1 allocation ratio to offer partners only provider-delivered testing within APS (Standard APS) versus HIV self-testing or provider-delivered testing within APS (APS+HIVST). Randomization was stratified by county, previous APS performance, HIV testing volume, and urbanicity (Appendix Table 1). There was no masking as randomization occurred at a facility level and health advisors (HAs) and HTS providers were trained to offer either Standard APS or APS+HIVST as per their facility's randomization. While index clients received care at these randomized sites, they only received provider-delivered testing and their site determined what testing options their partner(s) would be offered.

Procedures

After receiving a new HIV diagnosis at a study site, index clients learned of APS, provided informed consent, and enrolled into the program, where they provided the names and contact information for all sexual partners in the past 3 years to a HTS provider. HTS providers are employed by the Kenyan Ministry of Health (MoH) at their assigned health facility. Our study employed two nurse HAs that worked and assisted with study activities conducted by the HTS providers for our study. The HTS providers or HAs contacted the sexual partners over the phone. After three attempts or if no phone number was available, providers made at least three attempts to reach partners in-person in the community. Upon reaching them, HTS providers confidentially notified partners of their potential exposure to HIV and encouraged HIV testing. Partners testing HIV-positive were then recruited into the study and APS, after obtaining verbal consent via phone, unless reached in-person, in which case they provided written consent.

Control Arm: Standard APS

After obtaining consent, HTS providers at control sites offered provider-delivered testing, either at the clinic or in the community. Partners who reported having been previously diagnosed with HIV were also enrolled and offered APS for their sexual partners. If they were not already in care, they were referred to their local comprehensive care center (CCC), which is a clinic providing HIV care. Partners who tested and received a new HIV diagnosis were also asked to name their partners for APS. Those who tested negative were counselled to consider pre-exposure prophylaxis (PrEP) and/or condoms, if appropriate based on self-reported risk factors.

After the initial contact, HTS providers conducted 6-week follow-up calls (or in-person visits for those unreachable by phone) to reiterate HIV test results and referred those who tested HIV-positive to their local CCC, if not already enrolled in care.

Intervention Arm: APS+HIVST

HTS providers at intervention sites offered partners the choice of picking up a HIVST at a study facility or pharmacy in the community, or provider-delivered testing at the clinic or in the community. Participants choosing HIVST were verbally provided with a list of locations where they could pick up a free HIVST and sent a text message with a unique alpha-numeric code to show the pharmacist or study site staff when picking up an HIVST. Partners were encouraged to pick up a kit as soon as possible and informed they would be contacted again to share their test results. Participating pharmacies provided Oraquick® In-Home HIV Test and offered to assist with testing. The kits also contained standard (not study-specific) testing instructions in English and Kiswahili and a phone number for remote assistance or questions.

After the initial contact, HTS providers conducted 6-week follow-up calls (or in-person visits for those unreachable by phone) as described in the control arm. Those who reported testing positive for HIV via HIVST were encouraged to come to the clinic for confirmatory testing. Individuals who selected HIVST were also asked questions about their HIVST experiences.

Partners who tested positive were then offered APS for their sexual partners and linkage to care information was collected for those who reported starting antiretroviral therapy (ART). Study data were collected on tablets using the open-source Open Data Kit (ODK) platform (17). Pharmacists kept a record of participants collecting HIVST kits and codes used for data reconciliation.

Outcomes

We evaluated the following outcomes with denominators in parentheses: HIV testing (named partners who were eligible for testing, i.e. without a prior HIV diagnosis), new HIV diagnosis (partners tested for HIV), first-time testing (named partners who were eligible for testing), and linkage to care (partners newly diagnosed with HIV). Of those who tested using HIVST, only those who received a positive result on a confirmatory test were defined as receiving a new HIV diagnosis. Linkage to care was defined as those who had been connected to a CCC by a HTS provider during the follow-up visit or on their own, confirmed by collecting their CCC number. We also present the breakdown of those accepting HIVST when offered the option in the intervention sites.

Additional questions about the HIVST experience in the Intervention arm included: ease of using the HIVST kit overall and reading the result, confidence in using the HIVST kit correctly, help or emotional support from friends or family when using the HIVST kit, and receipt of any pre- or post-test counseling.

Statistical Analysis

We conducted intent-to-treat analyses using Poisson generalized linear mixed models (GLMM) with log link functions, exchangeable correlation structure, and model-based standard errors to evaluate associations between the intervention and the four outcomes. Models accounted for clustering at the clinic level. Models for new HIV diagnoses and linkage to care were adjusted for age, sex, and income *a priori*. Models for HIV testing and first-time testing were unadjusted as demographic information was unavailable for partners who did not test. Two-sided p-values <0.05 were considered statistically significant. Analyses were conducted using R software v.4.2.2 (2022-10-31) (18).

Results

From March to December 2021, 16,724 people (index clients) were tested for HIV at the 24 study sites, of whom 779 (4.7%) were diagnosed with HIV (Figure 1). Index client demographic characteristics were similar in both arms (Appendix Table 2). Of these 779, 755 (96.9%) enrolled in the study, all of whom linked to care. HTS providers elicited a total of 5263 partners from the 755 index clients enrolled in APS (elicitation ratio:7.0 partners per index). Of elicited partners, 209 (3.9%) were original index clients and not eligible for APS, and an additional 1408 (26.8%) reported a prior HIV diagnosis and were not offered HIV testing. The remaining 3646 partners (69.3%) were eligible for HTS as part of APS and included in analyses. Of these partners, 113 (3.1%) were either unreachable or declined to participate, and 3533 (96.9%) enrolled in the study and were tested for HIV.

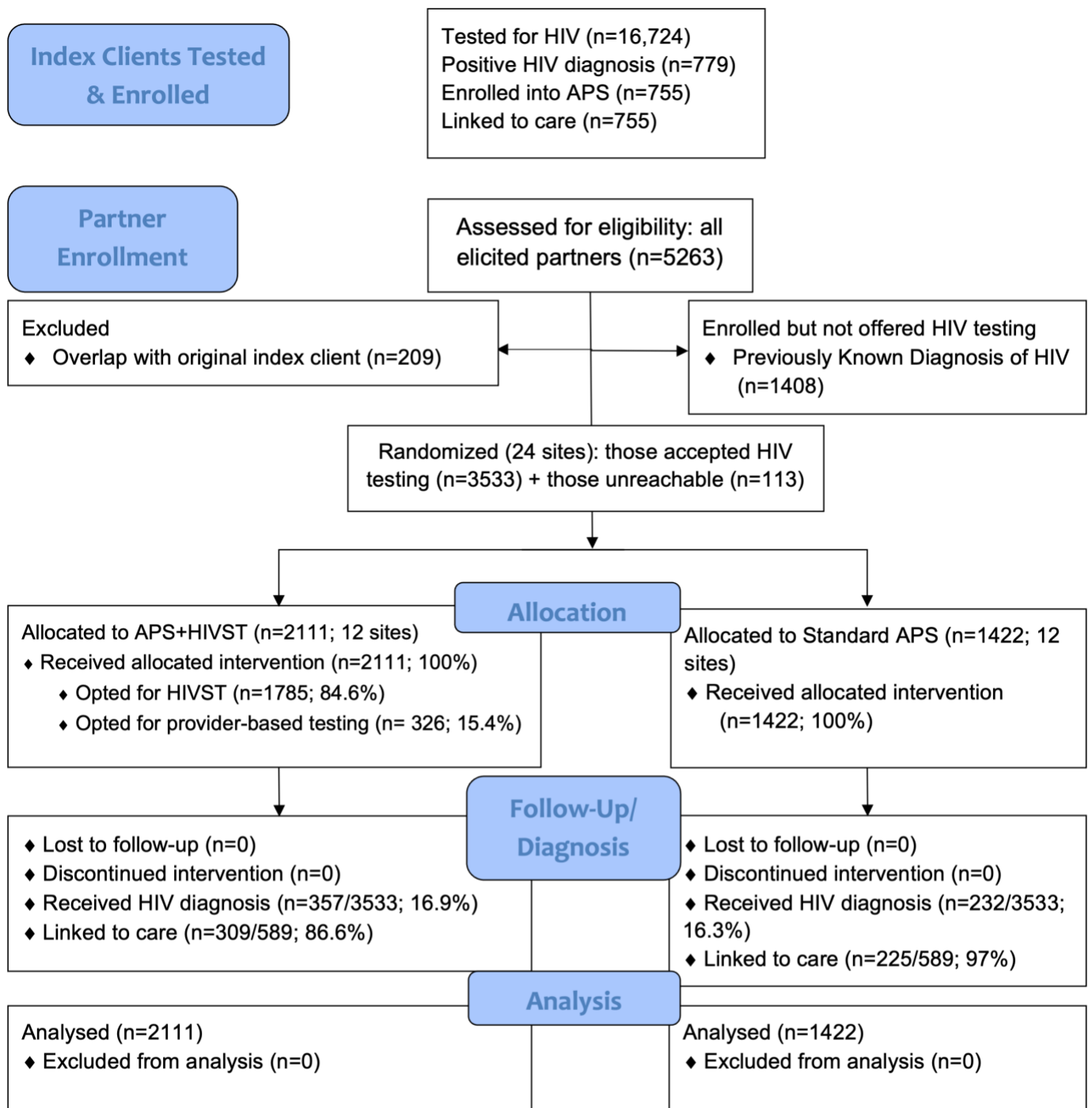


Figure 1. Consort Flow Diagram. Progress of participants through the APS-HIVST Study.

Abbreviations: APS, assisted partner services

Overall, the median age of enrolled partners was 35 years (inter-quartile range 31-41), 57.7% were men, 62.2% from Homa Bay, 83.5% married, 32.2% had completed secondary school, and 64.0% had a monthly income <10,000 KSh (~77 USD) (Table 1). The most common risk behaviors reported for the last twelve months were inconsistent condom use (50.2%), no condom used during last sexual contact (48.9%), and having multiple sexual partners (36.0%). More partners (57.6%) were in high HIV testing volume clinics. Partner characteristics were similar across study arms.

Table 1. Demographic characteristics of partners elicited from index clients who were eligible and offered HIV testing.

	APS+HIVST N=2157 Median (IQR) or N (%)	Standard APS N=1489 Median (IQR) or N (%)	Overall N=3646 Median (IQR) or N (%)
Age (in years)	35 [31, 41]	35 [31, 41]	35.0 [31, 41]
Sex			
Female	882 (41.8)	614 (43.2)	1496 (42.3)
Male	1229 (58.2)	808 (56.8)	2037 (57.7)
County			
Homa Bay	1436 (68.0)	761 (53.5)	2197 (62.2)
Kisumu	675 (32.0)	661 (46.5)	1336 (37.8)
Marital Status			
Cohabiting	2 (0.1)	3 (0.2)	5 (0.1)
Divorced or separated	48 (2.3)	27 (1.9)	75 (2.1)
Married, monogamous	1684 (79.8)	1122 (78.9)	2806 (79.4)
Married, polygamous	80 (3.8)	65 (4.6)	145 (4.1)
Single or never married	284 (13.5)	186 (13.1)	470 (13.3)
Widow(er)	13 (0.6)	19 (1.3)	32 (0.9)
Highest Level of Education Completed			
Never attended school	3 (0.1)	21 (1.5)	24 (0.7)
Some primary school	210 (9.9)	162 (11.4)	372 (10.5)
Primary school	354 (16.8)	278 (19.5)	632 (17.9)
Some secondary school	513 (24.3)	337 (23.7)	850 (24.1)
Secondary school	698 (33.1)	438 (30.8)	1136 (32.2)
Post-secondary school	333 (15.8)	186 (13.1)	519 (14.7)
Monthly Income (1 USD = ~123 KSh)			
0 to 10,000 KSh	1493 (70.7)	768 (54.0)	2261 (64.0)
10,000 to 50,000 KSh	606 (28.7)	622 (43.7)	1228 (34.8)
50,000 and higher KSh	12 (0.6)	32 (2.3)	44 (1.2)

Risk Behavior(s)[†]			
Inconsistent condom use	1022 (47.4)	808 (54.3)	1830 (50.2)
No condom in last sex	1105 (51.2)	678 (45.5)	1783 (48.9)
Multiple sexual partners	825 (38.2)	489 (32.8)	1314 (36.0)
HIV positive sexual partner	276 (12.8)	152 (10.2)	428 (11.7)
Transactional sex	16 (0.7)	139 (9.3)	155 (4.3)
Recurrent PEP use	123 (5.7)	13 (0.9)	136 (3.7)
Ever used PrEP	98 (4.5)	22 (1.5)	120 (3.3)
Recent STI	106 (4.9)	14 (0.9)	120 (3.3)
Sex under influence of drugs	20 (0.9)	46 (3.1)	66 (1.8)
High HIV risk sexual partners	13 (0.6)	8 (0.5)	21 (0.58)
Ongoing IPV	2 (0.1)	1 (0.1)	3 (0.08)
None	492 (22.8)	248 (16.7)	740 (20.3)
Clinic HIV testing volume			
Low	857 (39.7)	688 (46.2)	1545 (42.4)
High	1300 (60.3)	801 (53.8)	2101 (57.6)

[†]Not mutually exclusive with other risk behaviors. 113 missing from all characteristics from those unreachable/refusals.

Abbreviations: APS, assisted partner services; HIVST, HIV self-testing; IQR, inter-quartile range; USD, United States Dollars; KSh, Kenyan Shillings; PEP, post-exposure prophylaxis; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection; IPV, intimate partner violence.

HIV Testing & New HIV Diagnosis

Of the 3646 partners without a prior HIV diagnosis, almost all (96.9%) were contacted and enrolled, all of whom tested for HIV. The proportion who tested for HIV was similar across study arms: 97.9% (2111/2157) vs. 95.5% (1422/1489) in the APS+HIVST and Standard APS arms, respectively (Relative Risk [RR]: 1.02, 95% Confidence Interval [CI]: 0.96-1.10) (Table 2).

Table 2. Proportions and relative risks (RR) of the effectiveness of offering HIVST as a testing option within APS to partners on HIV testing uptake, successful diagnosis, and linkage to care.

Outcome	N	Intervention Group		Overall (N, %)	Unadjusted RR (95% CI)	Adjusted [†] RR (95% CI)
		APS+HIVST (n, %)	Standard APS (n, %)			
HIV Tested	3646					
Yes		2111 (97.87)	1422 (95.50)	3533 (96.9)	1.02	N/A
No		46 (2.13)	67 (4.50)	113 (3.1)	(0.96-1.10); p=0.48	
First-time Tested	3646					
Yes		83 (3.85)	210 (14.1)	293 (8.0)	0.33	N/A
No		2074 (96.15)	1279 (85.90)	3353 (92.0)	(0.07-1.46); p=0.142	
New HIV diagnosis	3533					
Yes		357 (16.9)	232 (16.3)	589 (16.7)	0.99	1.03
No		1754 (83.1)	1190 (83.7)	2944 (83.3)	(0.72-1.36); p=0.949	(0.76-1.39); p=0.843
Linked to HIV Care	589					
Yes		309 (86.6)	225 (97.0)	534 (90.7)	0.89	0.88
No		48 (13.4)	7 (3.0)	55 (9.3)	(0.75-1.06); p=0.194	(0.74-1.06); p=0.174

†Adjusted for age, sex, and income. All models accounted for clustering by study site and excludes partners with a previously known HIV diagnosis at initial contact, as not eligible for HIV testing and consequently other outcomes. Abbreviations: APS, assisted partner services; HIVST, HIV self-testing; RR, relative risk; CI, confidence interval.

Among 2157 partners at intervention sites, 84.6% (1785/2111) were tested via HIVST while 15.4% (326/2111) received provider-delivered testing. Age, sex, and income were similarly distributed for those who completed HIVST versus those who completed provider-delivered testing: median age was 35 years in both groups, 41.9% of those who completed HIVST were female (748/1785) vs. 41.1% of those who completed provider-delivered testing (134/326), and 70.7% of those who completed HIVST earned 0-10,000KSh annually (1262/1785) vs. 70.9% of those who completed provider-delivered testing (231/326).

Among the 3533 partners who tested for HIV, 589 (16.7%) were newly diagnosed with HIV (Table 2) with similar proportions in the two arms: 16.9% in the intervention arm vs. 16.3% in the control. Adjusting for age, sex, and income, there was no significant difference between the proportions newly diagnosed with HIV in the two arms (adjusted RR [aRR]: 1.03, 95% CI: 0.76-1.39).

First-time Testing & Linkage to Care

Of the 3646 partners without a prior HIV diagnosis who reported not testing previously, 3.9% (83/2157) were tested for the first time in the APS+HIVST arm vs. 14.1% (210/1489) in the Standard APS arm (Table 2). However, this difference was not significant (RR: 0.33, 95% CI: 0.07-1.46).

Of the 589 partners who received a new HIV diagnosis, 534 (90.7%) were linked to care (Table 2). 309 (86.6%) and 225 (97.0%) partners were linked to care in the APS+HIVST and Standard APS arms, respectively. After adjusting for age, sex, and income, there was no significant difference in linkage to care among those receiving a new HIV diagnosis in the two arms (aRR: 0.88, 95% CI: 0.74-1.06). In the intervention arm, linkage to care was similar among those who tested positive via HIVST (249/289=86.2%) versus provider-delivered testing (60/68=88.2%).

HIVST Experiences

Overall, of the 1785 partners who selected HIVST, 87.6% stated that they chose this option because it was easy to use, 20.6% easy to access, 16.4% preferred saliva-based testing, and 12.1% thought it safer due to COVID-19 (Figure 2). Almost all self-testers (99.9%) found the HIVST kits easy or very easy to use, 100% found it easy or very easy to read results, and 99.5% were sure or very sure that they used their HIVST correctly. Overall, 37.4% of people used HIVST alone, 29.7% used it with a friend, family member, or healthcare provider for emotional support and to help perform the test, and 27.6% used their kit with a friend, family member, or health provider to help perform the test only. Few (5.3%) used their kit with a friend, family member, or health provider for emotional support only.

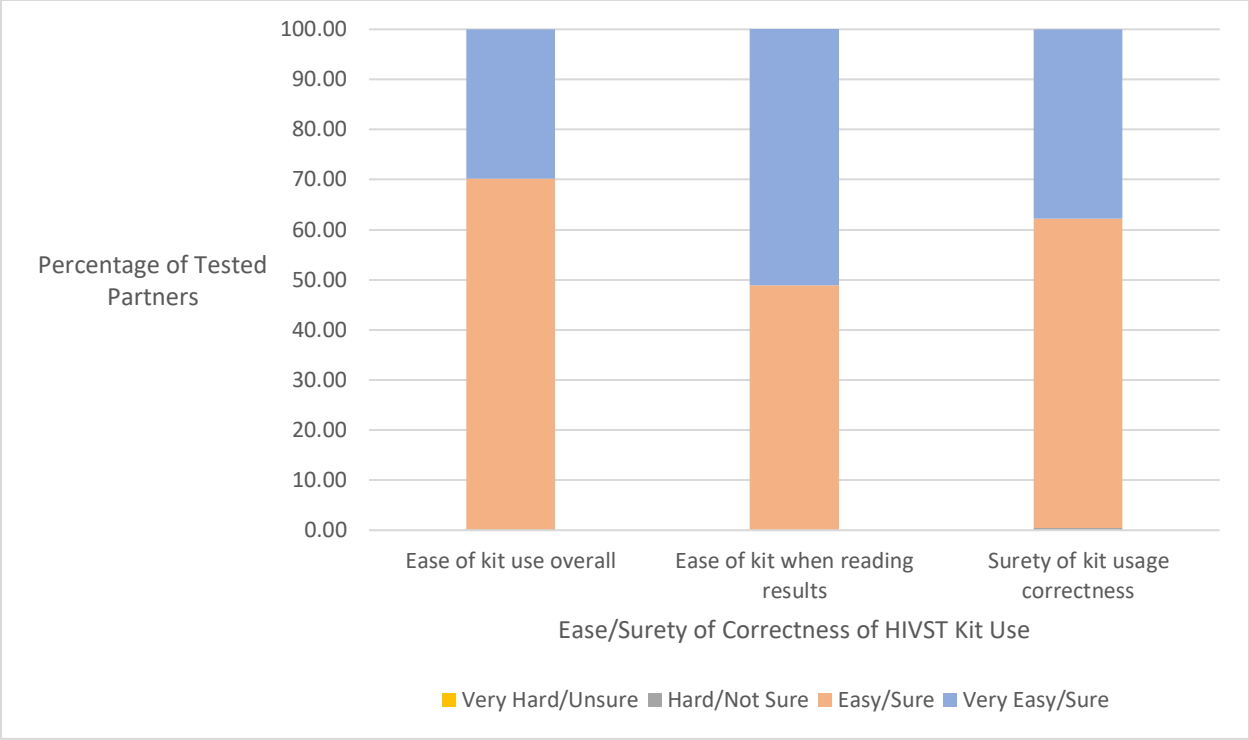


Figure 2. HIVST Kit Usage Experiences (n=1785). Partners of APS index clients in the intervention arm (APS+HIVST) that accepted HIVST described their experiences with the kits.

Discussion

In an established APS program in Western Kenya, we found no statistically significant differences in HIV testing, first-time testing, receiving a new HIV diagnosis, and linkage to care among partners offered a choice of HIVST or provider-delivered testing versus provider-delivered testing alone. As almost all partners were contacted and agreed to HIV testing, we could not observe meaningful increases in testing in either arm. Over four out of five partners chose HIVST given the option, indicating self-testing is highly acceptable among partners. This suggests that HIVST can be incorporated into APS successfully and may have the potential to reduce burden on providers and increase partner control over health.

While HIVST has been recommended by the WHO to be implemented within comprehensive HTS (8,19), the effectiveness of HIVST within an established APS framework in this setting has not been previously tested. HIV testing proportions being similar in both arms of our study shows that the introduction of HIVST within an established APS program may not negatively impact testing or diagnosis rates. We found that the majority of partners in the intervention arm chose HIVST and only 15.4% opted for provider-delivered testing. Most partners chose to complete the HIVST alone or with support from a friend, family member,

or healthcare provider, in performing the test (but not necessarily interpreting the result). This suggests that privacy may have been an important benefit of HIVST, and participants preferred to learn their results on their own.

Linkage to care was lower in APS+HIVST compared to the Standard APS arm, consistent with previous studies Kenya, Uganda, and Malawi showing lower linkage after HIVST versus provider-delivered testing (20–22). It is possible that some of the same reasons that make HIVST appealing – for example, the inconvenience of accessing clinics (travel, wait, expense, opportunity costs) or privacy concerns – may be barriers to accessing HIV care at a clinic. In the case of provider-delivered testing, providers provide encouragement and support in linkage to care, including explaining the benefits of ART. Those receiving HIVST do not have immediate post-testing counseling but rather must contact a provider or wait for study follow-up to report their results. Though lower linkage to care among those receiving HIVST is a concern, 86.6% is relatively high compared to other settings (14,23–25). Furthermore, linkage within the intervention arm for those who opted for HIVST and provider-delivered testing was similar. To further encourage linkage after HIVST, interventions focusing on training HTS providers to build stronger relationships with clients to allow them to feel comfortable engaging in care once they receive an HIV diagnosis could be helpful. It may also be useful to increase the number of follow-up attempts (26) or use phone applications or text messages to both report test results and encourage linkage to care (27). Lastly, we should explore alternative methods of delivering care to partners in the community as those who opted for HIVST may have done so to avoid clinic-based interactions, and so are hesitant to link to clinic-delivered care.

In addition to the many strengths already mentioned, our study had limited confounding due to randomization and further used robust analyses methods to account for the small number of clusters. Finally, building on the previous implementation science study allows this study to be representative of real-world results and therefore increases generalizability. Our study has several limitations. Before the initiation of the study, our team conducted a large-scale implementation study of Standard APS in the same setting with 31 study sites, which was successful in ramping up HIV testing, new diagnosis of HIV, and linkage to care (5,16). Due to this success and the team’s extensive experience in conducting APS prior to our trial, there was little room for improvement in these outcomes. However, it is encouraging that these outcomes did not decline upon introduction of HIVST. Another limitation was that data were not collected on reasons that partners did not participate in the study, i.e. agree to HIV testing and APS. Reasons for study refusal may have included: failure to contact due to index clients providing invalid contact information, either because index clients were not truly comfortable with APS or did not have accurate information for a partner; partners having a previous HIV diagnosis and not wanting to disclose via phone

to a HTS provider; or refusal to test due to lack of readiness. This lack of nuance may have introduced misclassification in the testing outcome, as named partners may have been ineligible for testing due to a prior diagnosis but were included in the denominator for testing as their reason for refusal or being unreachable was unknown. Lastly, HIVST results being self-reported can be perceived as a limitation due to reporting bias. However, previous work has shown that self-reported outcomes for HIVST are mostly trustworthy and most false reported negative results are due to issues with result reading and interpretation (28) and our study participants reported the kits were easy to use and interpret results.

Conclusions

In conclusion, we found that offering HIVST as an option for partner testing can achieve similar outcomes to Standard APS, providing the opportunity to increase access to APS while maintaining current testing levels. Further studies should explore the effectiveness of APS+HIVST in reaching inaccessible areas and reducing the human resource burden of APS while maintaining current testing, diagnosis, and linkage, and its potential impact in vulnerable populations. Studies on costing, feasibility, acceptability, and delivery strategies for HIVST within APS are also needed.

Appendix

Appendix Table 1. Randomization of Study Sites and their Characteristics

County	Facility	Urban/Rural	APS	HIV Testing	Study Arm
			Performance	Volume	
Homa Bay	Atela	Rural	High	Low	Control
Homa Bay	Kabondo	Rural	High	High	Intervention
Homa Bay	Kasewe	Rural	High	Low	Control
Homa Bay	Kauma	Rural	High	Low	Intervention
Homa Bay	Kokwanyo	Rural	High	Low	Control
Homa Bay	Matata	Urban	High	High	Control
Homa Bay	Nyalgosi	Rural	High	Low	Control
Homa Bay	Nyangiela	Rural	High	Low	Intervention
Homa Bay	Ober	Rural	Low	Low	Control
Homa Bay	Othoro	Rural	Low	Low	Intervention
Homa Bay	RDH	Urban	Low	High	Intervention
Homa Bay	Tala	Rural	High	Low	Intervention
Kisumu	Airport	Urban	High	High	Intervention
Kisumu	Chiga	Rural	Low	Low	Control
Kisumu	Kajulu/Gita	Rural	Low	High	Control
Kisumu	Kowino	Urban	Low	High	Intervention
Kisumu	Migosi	Urban	Low	High	Control
Kisumu	Nyalenda	Urban	Low	High	Control
Kisumu	Ober Kamoth	Rural	High	High	Control
Kisumu	Ojola	Rural	Low	Low	Intervention
Kisumu	Port Florence	Rural	Low	High	Intervention
Kisumu	Simba Opepo	Rural	Low	Low	Intervention
Kisumu	St. Elizabeth Chiga	Rural	High	High	Intervention
Kisumu	St. Mark's Lela	Rural	Low	High	Control

Abbreviation: APS, assisted partner services.

Appendix Table 2. Demographic characteristics of Index Clients who enrolled in the APS Study upon receiving a HIV diagnosis

	APS with HIVST N=409 Median (Range) or N (%)	APS without HIVST N=346 Median (Range) or N (%)	Overall N=755 Median (Range) or N (%)
Age (in years)	35 [19, 72]	35 [18, 82]	35 [18, 82]
Sex			
Female	278 (68.0)	240 (69.4)	518 (68.6)
Male	131 (32.0)	106 (30.6)	237 (31.4)
County			
Homa Bay	184 (45.0)	219 (63.3)	403 (53.4)
Kisumu	225 (55.0)	127 (36.7)	352 (46.6)
Marital Status			
Cohabiting	1 (0.2)	0 (0)	1 (0.1)
Divorced or Separated	37 (9.0)	20 (5.8)	57 (7.5)
Married, monogamous	271 (66.3)	217 (62.7)	488 (64.6)
Married, polygamous	15 (3.7)	24 (6.9)	39 (5.2)
Single or Never Married	65 (15.9)	62 (17.9)	127 (16.8)
Widow/er	20 (4.9)	23 (6.6)	43 (5.7)
Highest Level of Education Completed			
Never Attended School	1 (0.2)	9 (2.6)	10 (1.3)
Some Primary School	48 (11.7)	65 (18.8)	113 (15.0)
Primary School	84 (20.5)	78 (22.5)	162 (21.5)
Some Secondary School	101 (24.7)	79 (22.8)	180 (23.8)
Secondary School	125 (30.6)	85 (24.6)	210 (27.8)
Post-Secondary School	50 (12.2)	30 (8.7)	80 (10.6)
Monthly Income (1 USD = ~123 KSh)			
0 to 10,000 KSh	314 (76.8)	229 (66.2)	543 (71.9)
10,000 to 50,000 KSh	90 (22.0)	113 (32.7)	203 (26.9)
50,000 to 100,000 KSh	5 (1.2)	4 (1.2)	9 (1.2)

Abbreviations: USD, United States Dollars; KSh, Kenyan Shillings.

Chapter 3: Effectiveness of Using Additional HIV Self-Test Kits as an Incentive to Increase HIV Testing within Assisted Partner Services

Unmesha Roy Paladhi^{1,2}; David A. Katz²; George Otieno³; James P. Hughes⁴; Harsha Thirumurthy⁵, Harison Lagat⁶; Sarah Masyuko^{2,7}; Monisha Sharma²; Paul Macharia⁷; Rose Bosire³, Mary Mugambi⁸; Edward Kariithi^{3*}; Carey Farquhar^{1,2,9*}

1. Department of Epidemiology, School of Public Health, University of Washington, Seattle, WA, USA
2. Department of Global Health, University of Washington, Seattle, USA
3. PATH-Kenya, Kisumu, Kenya
4. Department of Biostatistics, University of Washington, Seattle, USA
5. Department of Medical Ethics and Health Policy, University of Pennsylvania, Philadelphia, USA
6. School of Nursing, University of Washington, Seattle, USA
7. Ministry of Health, Nairobi, Kenya
8. Kenya Medical Research Institute (KEMRI), Nairobi, Kenya
9. Department of Medicine, University of Washington, Seattle, USA

*co-senior authors

Abstract

Objective To test the effectiveness of offering additional HIV self-tests (HIVST) as a non-monetary incentive to increase HIV testing within assisted partner services (APS) in Western Kenya.

Design Single crossover study nested within a cluster randomized controlled trial.

Methods Twenty-four facilities were randomized 1:1 to either 1) control- provider-delivered testing, or 2) intervention- offered one HIVST or provider-delivered testing through APS for six months (pre-implementation), then switched to offering two HIVSTs for six months (post-implementation). A difference-in-differences approach using generalized linear mixed models, accounting for clustering by facility and adjusting for age, sex, and income, was used to estimate the effect of the incentive on HIV testing overall and first-time testing among partners participating in APS.

Results From March 2021-June 2022, 1127 index clients received APS and named 8155 partners, among whom 2333 reported a prior HIV diagnosis and were excluded from analyses, yielding 5822 total partners: 3646 (62.6%) and 2176 (37.4%) in the pre- and post-implementation periods respectively. Of the 944 partners offered a second HIVST during post-implementation, 34.3% picked up two kits, of whom 71.7% reported that the second kit encouraged testing. There was no significant difference in testing for HIV (relative risk[RR]:1.01, 95% Confidence Interval[CI]:0.951-1.07) or HIV testing for the first time (RR:1.23, 95%CI:0.671-2.24) between those partners offered one vs. two HIVSTs.

Conclusions Offering a second HIVST as an incentive within APS did not significantly impact HIV testing or first-time testing, though those opting for two kits reported it incentivized them to test.

Introduction

The World Health Organization (WHO) recommends both assisted partner services (APS) and HIV self-testing (HIVST) as approaches for reaching people with undiagnosed HIV (4). The primary goals of APS are to ensure that partners are notified of their potential exposure, HIV tested, and linked to appropriate care. While APS can be an effective method for identifying those at higher risk of acquiring HIV, it can also be resource-intensive and may require travel to physical health clinics (29). HIVST has been proposed as a method to reduce the resources required to successfully implement an effective APS program and increase access to testing more generally (30), by lowering burden from provider-delivered testing and both increasing and diversifying testing delivery points (31). Although a meta-analysis showed that offering HIVST results in higher testing rates than provider-delivered facility-based rapid HIV testing (31), we previously found that offering HIVST as an option for partner testing within APS results in similar levels of HIV testing and new diagnoses in western Kenya (32), indicating a potential need for strategies to improve the delivery of HIVST distribution in this context.

Behavioral economics (BE) applies key principles from psychology and economics to address obstacles to behavior change and has the potential to address barriers to HIVST and testing within APS. Specifically, even if HIVST is easy to use and available, individuals may not utilize them if there are barriers associated with acquiring self-tests (30,33) or due to biases in decision-making (34,35). Financial incentives have been effective in increasing HIV testing uptake in sub-Saharan Africa (36–41), and specifically for increasing HIVST in social network, peer-referral, or couples settings in China and Zimbabwe (42,43). However, there are concerns that financial incentives may not be a sustainable method to maintain the required rates of consistent HIV testing at scale (44,45). Studies have begun exploring the effectiveness of non-monetary incentives on HIV testing, but have shown mixed results (46–49).

Prior work has established that HIVSTs are viewed as a valuable commodity in Kenya (30), and there may be inherent public health value in offering additional HIVSTs to increase partners tested via APS as the additional test can provide an opportunity for future re-testing among people at higher risk of HIV infection or reaching additional people who may also be at risk in the partners' networks. This suggests that offering an additional HIVST may be an effective incentive for testing among partners receiving APS and lead to increased testing in networks of people at risk for HIV. We examined the impact of offering two HIVSTs as a non-monetary incentive compared to a single HIVST on HIV testing and first-time testing among partners of PLWH participating in APS in Western Kenya.

Methods

Study Design

We conducted a nested single-crossover study within a cluster-randomized control trial (cRCT), the APS-HIVST Study (32). In the original cRCT, 24 health facilities (i.e. clusters) in Kisumu and Homa Bay counties of Western Kenya, including a mix of low- and high-volume facilities in both urban and rural settings, were randomized 1:1 to deliver either Standard APS (Control) or APS+HIVST (Intervention) within their HIV testing services (HTS) (Supplemental Table 1). In this single-crossover trial, we maintained this randomization. Intervention sites offered partners of index clients who tested positive for HIV (see below) provider-delivered testing or a single HIVST (APS+HIVST) to those enrolled from March-December 2021 (Pre-Implementation Period) and then switched to offer partners provider-delivered testing or two HIVSTs (APS+HIVST+Incentive) to those enrolled from December 2021-May 2022 (Post-Implementation Period), with the additional kit being worth approximately 470 Kenyan shillings or 3.40 US dollars (Figure 1). Control sites implemented Standard APS, where partners were offered only provider-delivered testing for the full study period.

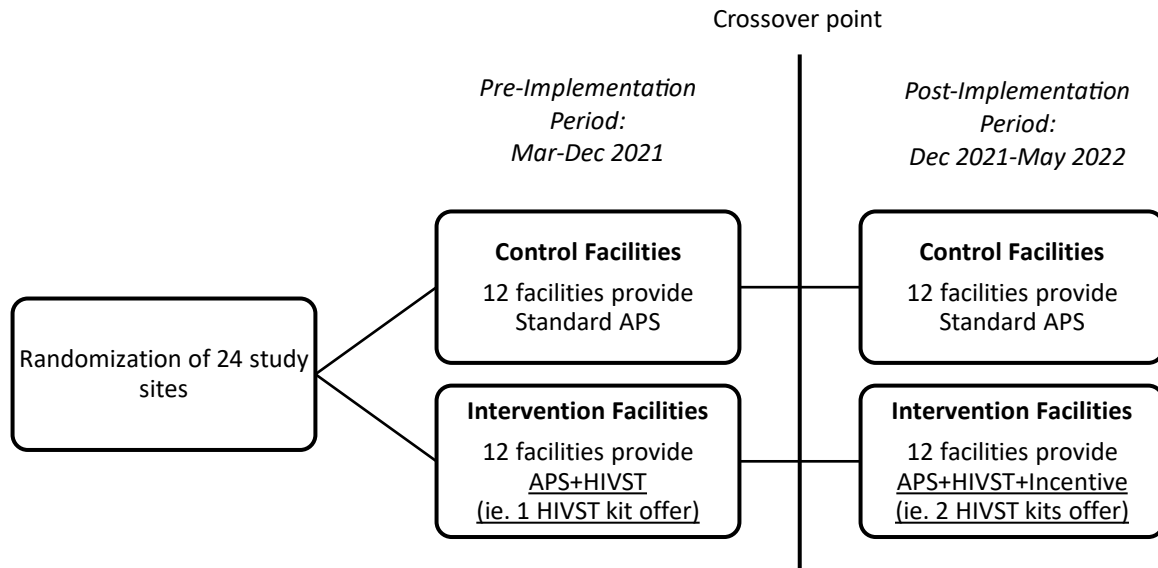


Figure 1. Single-crossover study design. Standard APS was defined as provider-delivered HIV testing within APS, APS+HIVST was defined as the offer of 1 HIVST as a testing option or provider-delivered testing within APS, and APS+HIVST+Incentive was defined as the offer of 2 HIVSTs or provider-delivered testing within APS. Abbreviations: APS, assisted partner services; HIVST, HIV self-testing.

Study Population

Index clients testing positive for HIV at a study site were invited to enroll into APS and offered participation in the study. Staff attempted to locate all sexual partners from the past three years, named by index clients by phone or in-person in the community to notify them of potential HIV exposure and encourage them to HIV test. Partners who were reached were invited to enroll in the study and offered either provider-delivered testing alone (Standard APS), provider-delivered testing or one HIVST (APS+HIVST), or provider-delivered testing or two HIVSTs (APS+HIVST+Incentive) depending on site arm and time of enrollment. Exclusion criteria included being pregnant, under the age of 18, reporting intimate partner violence (IPV) within one month of enrollment, or being unable to provide informed consent.

Study Procedures

Study procedures were completed by clinic-specific Ministry of Health-employed HTS providers and two study-employed nurse Health Advisors (HA) who assisted HTS providers and answered study-related questions. After being named as a sexual contact of an index client, partners were attempted to be contacted via phone. After three failed phone attempts or if no phone numbers were available, partners were traced in-person in their community. When reached, partners were notified of their potential HIV exposure and encouraged to test for HIV or, if previously diagnosed with HIV and not in HIV care, offered assistance linking to care.

Control – Standard APS

If partners agreed to testing, they provided verbal informed consent via phone and enrolled in the study. Partners in the control arm were then offered provider-delivered HIV testing, either at the study health facility (facility-based testing) or by an HTS provider at a location of their choosing (community-based testing). Demographic data and HIV testing and care history were collected during this visit.

Intervention, Period 1 – APS+HIVST

Partners consented and enrolled in the study in the same manner as in the Control arm. However, partners in the intervention arm between March-December 2021 were offered a single HIVST as a testing option in addition to provider-delivered testing. If participants opted for provider-delivered testing, study procedures were conducted as described in the *Control – Standard APS* section. If participants opted for HIVST, they were provided a unique alpha-numeric code via text message to pick-up a single free-of-charge HIVST at their local pharmacy/chemist or study site at their convenience. Lastly, they were informed that the HTS provider would contact them again if the HIVST had not been picked up and again 6 weeks post-enrollment

to follow-up regarding test results. Demographic data and HIV testing history were collected during this visit.

Intervention, Period 2 – APS+HIVST+Incentive

In addition to the procedures described under *Intervention, Period 1*, partners in the intervention arm between December 2021 to May 2022 were asked if they wanted one or two HIVSTs if they opted for self-testing and provided with a unique alpha-numeric code for kit pick-up. Participants opting for two HIVSTs were encouraged to use the second kit with a family member or friend at their convenience. No more than two kits could be requested. Preference of 1 vs 2 HIVSTs was collected during this visit.

Six-week Follow-up

Six weeks after enrollment, HTS providers followed-up with all partners via phone (or in-person if not reachable by phone) to assess HIV test results, diagnosis, and linkage to care, if not already reported. Partners reporting a negative test were encouraged to consider condoms and/or pre-exposure prophylaxis (PrEP) and offered a referral. Partners testing positive with HIVST were encouraged to come into the study site for confirmatory testing if they had not already done so themselves. All partners newly diagnosed with HIV were connected to their local HIV care clinic for treatment or, if already connected, their clinic ID number was collected.

In the Intervention arm, partners also answered questions on their reason for choosing self-testing via OraQuick® HIV Self-Test, a saliva-based test kit, and experiences of HIVST, including ease of use, ease of reading results, surety that they used the kit correctly, if they used the kit alone or with someone, and if they sought or received any additional post-test counseling. Partners who accepted a second HIVST were asked what they did with the second test; if they gave or used it to test someone else, who; and if having the opportunity to receive 2 HIVST kits, instead of 1, made them more likely to get HIV tested.

Partners in all arms who tested positive were asked to name their sexual partners from the last three years for APS, and any sexual partners other than the original index client then underwent APS notification procedures as previously described. While all index clients and partners were offered and encouraged to enroll in this study, enrollment was not necessary to get HIV tested at any stage.

Data Collection

Data were collected on study tablets using the open-source Open Data Kit (ODK) (17,50) platform by study staff, HTS providers, HAs, and pharmacy workers.

Outcomes

Primary outcomes were (denominators in parentheses): HIV testing (named partners who were eligible for testing, i.e. without a prior HIV diagnosis) and first-time testing (named partners who were eligible for testing). Secondary outcomes were (denominators in parentheses): new HIV diagnosis (partners tested for HIV) and linkage to care (partners newly diagnosed with HIV). For those testing with HIVST, only a positive confirmatory test was considered a new HIV diagnosis. Partners reporting a prior HIV diagnosis at baseline were enrolled in the study to complete APS procedures and offer linkage to HIV care as needed, but excluded from the analyses as they were not eligible for testing.

Statistical Analysis

We used a difference-in-difference (DID) approach (51,52) to create Poisson generalized linear mixed models (GLMM) for all outcomes, using the log link function. This quasi-experimental approach tested the hypothesis that offering an additional HIVST as an incentive increased HIV testing, first-time testing, new diagnosis, and linkage to care. This approach measures the difference between the difference in the proportion of partners who tested from the pre- to post-implementation of the second HIVST offer in the intervention arm and the difference in this proportion over the same period in the control arm (who were not offered HIVST in either period). This approach accounted for differences in time-invariant characteristics between the two arms by measuring within-arm changes over time and for temporal trends in outcomes by measuring baseline differences between the two arms. The latter assumes that testing and first-time testing rates among those in the intervention arm would be the same in the absence of the incentive-based intervention as the trends among those in the control arm, a reasonable assumption as study arm assignment was randomized. Regression models included the outcome (primary: testing or first-time testing; secondary: new HIV diagnosis and linkage to care), intervention arm (APS+HIVST vs. Standard APS), time (pre- vs. post-implementation), and the interaction between intervention arm and time, with the interaction term estimating the difference-in-differences.

Models accounted for clustering at the clinic level. A two-sided p-value less than 0.05 was considered statistically significant. Analyses were conducted using R software version 2022.12.0+353 (18).

Ethical Reviews

The study was approved by the University of Washington Institutional Review Board (IRB; STUDY00002420) and the Kenyatta National Hospital Ethics and Research Committee (ERC; P465/052017).

Results

From March 2021-May 2022, 1127 index clients enrolled in APS following a new HIV diagnosis and named a total of 8155 sexual partners. Of these, 2333 self-reported a prior HIV diagnosis, resulting in 5822 partners who were eligible for HIV testing and included in analyses. In the pre- and post-implementation periods, 113/3646 (3.1% [46, 1.3% in the intervention arm and 67, 1.8 % in the control arm]) and 273/2176 (12.5% [157, 7.2% in the intervention arm and 116, 5.3% in the control arm]) partners respectively, were either unreachable or refused to test through the study. Overall, 3646 partners were recruited during the pre-implementation period (2157 in the intervention arm, 1489 in the control arm) and 2176 partners were recruited during the post-implementation period (1361 intervention, 815 control) (Table 1). Overall, the median age of partners was 35 years (inter-quartile range 31-41years), 59.2% were male, 64.2% received APS from facilities in Homa Bay, 34.7% had completed secondary school, 84.7% were married, and 63.7% had a monthly income of <10,000 KSh (~0-72.78 USD). Similar demographic distributions were observed across the four intervention-by-time groups.

Table 1. Demographic characteristics of sexual partners, named by index clients newly diagnosed with HIV, stratified by intervention arm, pre- and post- implementation of the APS+HIVST+Incentive Program.

	Pre-Implementation of Incentive			Post-Implementation of Incentive			Overall n=5822 n (%) or median (IQR)
	Intervention: APS+HIVST N=2157 n (%) or median (IQR)	Control: Standard APS N=1489 n (%) or median (IQR)	Overall n=3646 n (%) or median (IQR)	Intervention: APS+HIVST +Incentive N=1361 n (%) or median (IQR)	Control: Standard APS N=815 n (%) or median (IQR)	Overall n=2176 n (%) or median (IQR)	
Age (in years)	35 (31-41)	35 (31-41)	35 (31-41)	35 (31-41)	38 (32-43)	36 (31-42)	35 (31-41)
Sex							
Female	882 (41.8)	614 (43.2)	1496 (42.3)	444 (36.9)	277 (39.6)	721 (37.9)	2217 (40.8)
Male	1229 (58.2)	808 (56.8)	2037 (57.7)	760 (63.1)	422 (60.4)	1182 (62.1)	3219 (59.2)
County							
Homa Bay	1436 (68.0)	761 (53.5)	2197 (62.2)	861 (71.5)	432 (61.8)	1293 (67.9)	3490 (64.2)
Kisumu	675 (32.0)	661 (46.5)	1336 (37.8)	343 (28.5)	267 (38.2)	610 (32.1)	1946 (35.8)
Highest Level of Education Completed							
Never Attended School	3 (0.1)	21 (1.5)	24 (0.7)	7 (0.6)	5 (0.7)	12 (0.6)	36 (0.7)
Some Primary School	210 (9.9)	162 (11.4)	372 (10.5)	76 (6.3)	84 (12.0)	160 (8.4)	532 (9.8)
Primary or Some Secondary School	867 (41.1)	615 (43.2)	1482 (41.9)	440 (36.5)	241 (34.5)	681 (35.8)	2163 (39.8)
Secondary School	698 (33.1)	438 (30.8)	1136 (32.2)	485 (40.3)	265 (37.9)	750 (39.4)	1886 (34.7)
Post-Secondary School	333 (15.8)	186 (13.1)	519 (14.7)	196 (16.3)	104 (14.9)	300 (15.8)	819 (15.1)
Marital Status							
Divorced or Separated	48 (2.3)	27 (1.9)	75 (2.1)	14 (1.2)	10 (1.4)	24 (1.3)	99 (1.8)
Cohabiting or Married, monogamous or polygamous	1766 (83.7)	1190 (83.7)	2956 (83.7)	999 (83.0)	583 (83.4)	1655 (87.0)	4611 (84.8)
Single or Never Married	284 (13.5)	186 (13.1)	470 (13.3)	133 (11.0)	65 (9.3)	198 (10.4)	668 (12.3)
Widow/er	13 (0.6)	19 (1.3)	32 (0.9)	12 (1.0)	14 (2.0)	26 (1.4)	58 (1.1)
Monthly Income (1 USD = ~123 KSh)							
<10,000 KSh	1493 (70.7)	768 (54.0)	2261 (64.0)	819 (68.0)	383 (54.8)	1202 (63.2)	3463 (63.7)
10,000 and higher	618 (29.3)	654 (46.0)	1272 (36.0)	385 (32.0)	316 (45.2)	701 (36.8)	1973 (36.3)

Partner participants were elicited from Index Clients who enrolled in the study. Standard APS was defined as provider-delivered HIV testing within APS, APS+HIVST was defined as the offer of 1 HIVST as a testing option or provider-delivered testing within APS, and APS+HIVST+Incentive was defined as the offer of 2 HIVSTs or provider-delivered testing within APS. Pre-implementation period was March-December 2021 and post-implementation period was December 2021-May 2022. APS, assisted partner services; HIVST, HIV self-test; IQR, inter-quartile range; USD, US dollars; KSh, Kenyan Shillings.

Primary Outcomes: HIV Testing & First-time Testing

In the intervention arm, 97.9% and 88.5% of partners reported testing in the pre- and post-implementation periods respectively. Similarly, in the control arm, 95.5% and 85.8% of partners reported testing in the pre- and post-implementation periods respectively (Figure 2A). The DID model showed no statistically significant difference between offering two versus one HIVST in partner testing for HIV (relative risk [RR] 1.01, 95% confidence interval [CI] 0.951-1.07, $p=0.734$; Table 2).

In the intervention arm, 3.8% and 3.2% of partners reported first-time testing in the pre- and post-implementation periods respectively. In the control arm, 14.1% and 8.1% of partners reported first-time testing in the pre- and post-implementation periods respectively (Figure 2B). The DID model showed no statistically significant difference between offering two versus one HIVST in first-time testing (RR 1.23, 95% CI 0.671-2.24, $p=0.508$; Table 2).

Secondary Outcomes: New HIV Diagnosis & Linkage to Care

In the intervention arm, 16.9% and 15.5% of partners who tested reported a new diagnosis in the pre- and post-implementation periods respectively. Similarly in the control arm, 16.3% and 16.0% of partners reported a new diagnosis in the pre- and post-implementation periods respectively (Figure 2C). The DID model showed no statistically significant difference between offering two vs. one HIVST and receiving a new HIV diagnosis (RR 0.945, 95% CI 0.692-1.29, $p=0.723$; Table 2).

In the intervention arm, 86.6% and 88.8% of partners who received a new diagnosis reported linkage to care in the pre- and post-implementation periods respectively. In the control arm, 97.0% and 97.3% of partners reported linkage to care in the pre- and post-implementation periods respectively (Figure 2D). The DID model showed no statistically significant difference between offering two vs. one HIVST and linkage to care (RR 1.04, 95% CI 0.918-1.17, $p=0.557$; Table 2).

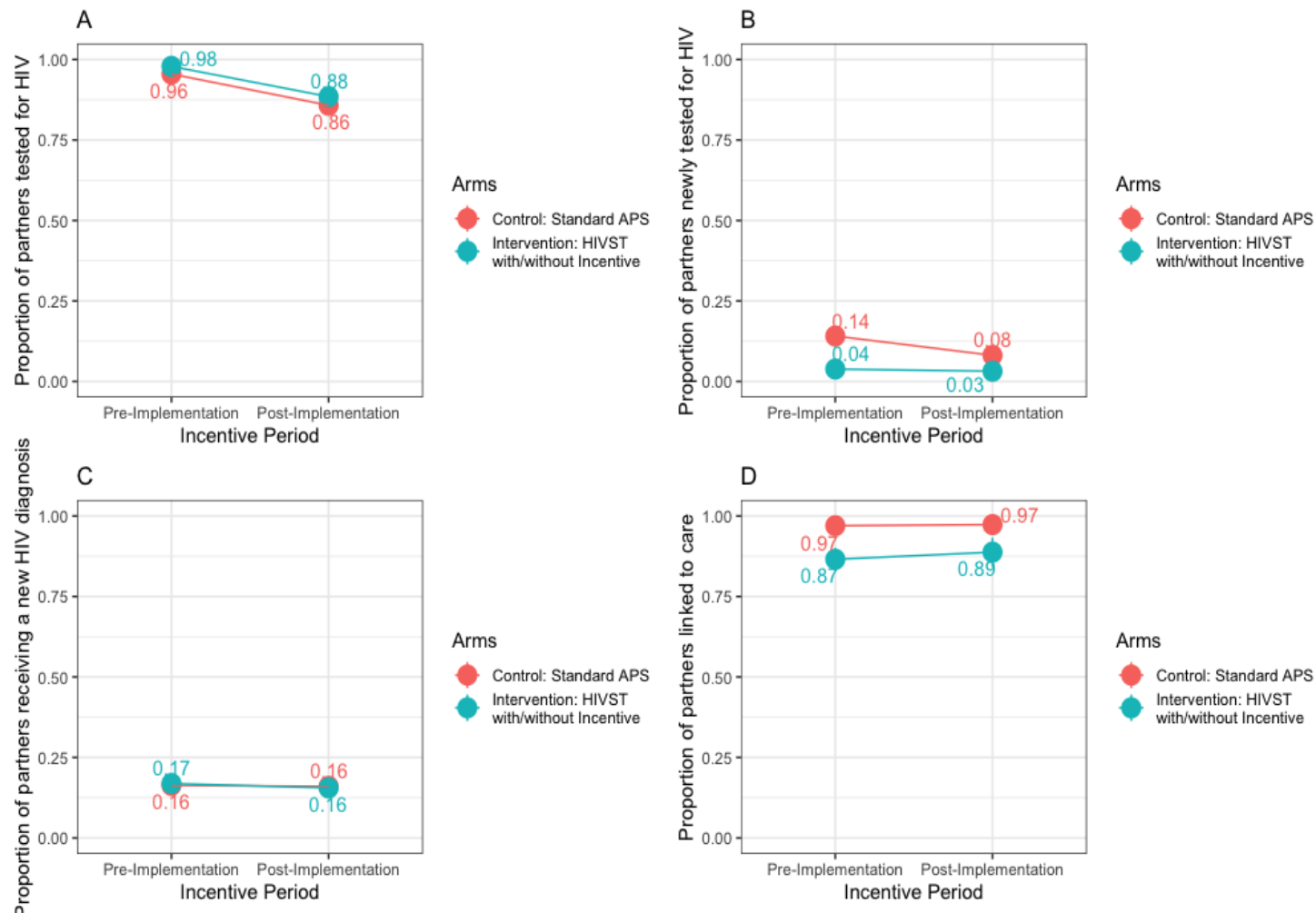


Figure 2. Differences between pre- and post-implementation periods for partners in the Intervention and Control arms for all study outcomes. Outcomes were A) HIV testing, B) first-time testing, C) new HIV diagnoses, and D) linkage to care. Standard APS was defined as provider-delivered HIV testing within APS, APS+HIVST was defined as the offer of 1 HIVST as a testing option or provider-delivered testing within APS, and APS+HIVST+Incentive was defined as the offer of 2 HIVSTs or provider-delivered testing within APS. Pre-implementation period was March-December 2021 and post-implementation period was December 2021-May 2022. Abbreviations: APS, assisted partner services; HIVST, HIV self-testing.

Table 2. Average incentive intervention effects on all study outcomes (relative risk estimates of difference-in-differences)

	N	Pre-implementation of Incentive		Post-implementation of Incentive		DID of RR (95% CI), p-value
		APS+HIVST n/N (%)	Standard APS n/N (%)	APS+HIVST +Incentive n/N (%)	Standard APS n/N (%)	
HIV Tested	5822	2111/2157 (97.9)	1422/1489 (95.5)	1204/1361 (88.5)	699/815 (85.8)	1.01 (0.951, 1.07), p=0.734
First-time Tested	5822	83/2157 (3.8)	210/1489 (14.1)	43/1361 (3.2)	66/815 (8.1)	1.23 (0.671, 2.24), p=0.508
New HIV diagnosis	5436	357/2111 (16.9)	232/1422 (16.3)	187/1204 (15.5)	112/699 (16.0)	0.945 (0.692, 1.29), p=0.723
Linked to HIV Care	888	309/357 (86.6)	225/232 (97.0)	166/187 (88.8)	109/112 (97.3)	1.04 (0.918, 1.17), p=0.557

All estimates constructed using generalized linear mixed models with a Poisson distribution for a DID analysis. All models accounted for clustering by study site and excludes partners with a previously known HIV diagnosis at initial contact, as not eligible for HIV testing and consequently other outcomes. Standard APS was defined as provider-delivered HIV testing within APS, APS+HIVST was defined as the offer of 1 HIVST as a testing option or provider-delivered testing within APS, and APS+HIVST+Incentive was defined as the offer of 2 HIVSTs or provider-delivered testing within APS. Pre-implementation period was March-December 2021 and post-implementation period was December 2021-May 2022. APS, assisted partner services; HIVST, HIV self-testing; DID, difference-in-differences; RR, relative risk.

Second HIVST Kit as Incentive

Of the 1204 partners who were offered up to two HIVSTs and tested in the post-implementation intervention arm, 940 (78.1%) self-tested and 264 (21.9%) opted for provider-delivered testing. 100% of those who self-tested responded to questions regarding their use of the HIVSTs. About one-third (322=34.3%) picked up two HIVSTs, of whom 71.7% (231) said the second kit served as an incentive to test for HIV, and 618 (65.7%) picked up one HIVST. Of the 322 partners who picked up two HIVSTs, 39.8% (128) used the second kit to test someone, 27.3% (88) gave someone else a test to test while they themselves tested, 17.4% (56) gave it to someone to use on their own, 9.6% (31) gave it to someone to test with their help, 4% (13) kept it for later, and 1.9% (6) used it to test themselves again. Of the 303 who gave it to someone else or used it to test someone other than themselves, 9.2% (28) gave it to a husband or wife, 80.2% (243) gave it to another partner, 6.3% (19) gave it to a friend, and 4.3% (13) gave it to another family member.

Discussion

This nested single-crossover study conducted in 24 health facilities in Western Kenya found that offering two HIVSTs as an incentive compared to a single HIVST, within a successful established APS program, did not increase HIV testing, first-time testing, new diagnosis, or linkage to care. However, it did reach and test people at risk for HIV beyond the scope of our typical APS approach, mostly sexual partners of the named partners and would be worth replicating in settings where more barriers to testing partners through APS exist.

The original scale-up of APS in this setting had sustained success in testing partners, identifying new HIV diagnoses, and linkage to care (5,16), resulting in almost universal testing (>95%) in both arms immediately prior to and during the pre-implementation period of this study. This limited the opportunity for our incentive to impact testing outcomes as well as the study's generalizability to APS programs with lower baseline testing rates. However, there was a decrease in testing in the post-implementation period in both arms, likely due to healthcare strikes and shortages of all HIV rapid tests (including for confirmatory tests) and HIVST kits in 2022. We may have expected the combination of HIVST and an incentive to help mitigate this decrease, but unfortunately, it did not.

Our findings contribute to a growing body of work on using behavioral economics principles to increase HIV testing and other testing-related outcomes. Our results indicate that provision of an HIVST as a non-monetary incentive alone may not be an effective method to increase HIVST, especially in APS programs that already have a very high baseline testing rate. However, it is possible that the design and implementation of the incentive may also have influenced this outcome. While the HTS providers were trained by study staff on a script prior to implementation of the 2 HIVSTs offer, the offer of the second HIVST may not have been made consistently or not made to sound like an incentive (i.e. framed as a gain) (46). In addition, the monetary value of the additional HIVST itself (~3.40 USD in 2021-22) may have been insufficient to serve as an incentive in this population, setting, and time period. Studies in South Africa and rural Zimbabwe have found that non-monetary incentives worth up to 5 USD and ~1.50 USD respectively were effective in increasing testing rates (43,53), though inflation and differences between settings make direct comparisons of the monetary value challenging.

Beyond monetary value, this incentive was also designed to engage partners' interest in their own and their community's health. It is possible that being notified of potential HIV exposure and offered a free HIV test as part of APS was sufficient motivation for partners who would be motivated by health-related reasons, and the additional health-related value did not speak to those who chose not to test as part of APS when

offered single HIVST or provider-delivered testing alone. As a result, different non-monetary incentives, like movie tickets or grocery coupons (34), may be more effective in this context. Alternatively, other BE-informed approaches such as commitment contracts may be considered (47), where people can commit to a certain task ahead of time and may receive a perk or avoid a loss if they uphold their commitment. Since all outcomes were self-reported, they were susceptible to social desirability bias. However, this impact was likely minimal as a recent study showed that social desirability is not as impactful as in the past when collecting sensitive self-reported information such as HIV status (54).

Only one-third of those offered a second HIVST accepted. This may have been an indication that the incentive was not universally attractive to the majority of partners. It is also possible that many partners thought that APS would cover any potential partner they would have shared the second HIVST with. However, over 76% of partners who accepted a second HIVST either tested someone else, tested themselves alongside someone else, or helped someone else test using the second kit, indicating that the second kit was helpful to facilitate another layer of HIV testing, as seen in other settings and populations in Kenya and China (55–57), and can facilitate social and moral support for testing. This may also have additional implications for changing negative social norms by reducing the stigma around HIV testing (58) and eventually, linkage to care, mitigating an existing barrier in Kenya where heterosexual transmission is the main mode of transmission and men are a particularly hard to reach population for testing (59,60). Because the additional people tested with the second HIVST were not enrolled in the study, we relied on the participant's report that they tested and were unable to assess test results or linkage to care in this group. Determining the effectiveness of this strategy at reaching people with undiagnosed HIV and linking them to care can inform decisions regarding whether to implement this at scale.

While our study design and analyses accounted for temporal or seasonal variations throughout the study and clustering of the data, an additional limitation was that since the assignment of interventions (i.e. the offer of one vs. two HIVSTs) was clustered and both the HTS providers and health advisors were implementing the interventions at the clinic level, their individual performance may have had significant impact on the recruitment and consequently the outcomes of the study.

Conclusions

The offer of a second HIVST as an incentive did not significantly increase the overall rates of HIV testing, first-time testing, new HIV diagnoses, or linkage to care in an APS program with near universal HIV testing among partners. This incentive may be more effective in APS programs reaching fewer partners for testing,

in other HIV testing service models, or in combination with other BE concepts. Future work should also investigate different non-monetary incentives and the effectiveness of providing additional HIVSTs in APS for reaching priority populations with HIV testing, prevention, and care.

Supplemental Materials

Supplemental Table 1. Randomization of Study Facilities and their Characteristics.

County	Facility	Urban/Rural	Previous APS Performance	HIV Testing Volume	Study Arm
Homa Bay	Atela	Rural	High	Low	Control
	Kabondo	Rural	High	High	Intervention
	Kasewe	Rural	High	Low	Control
	Kauma	Rural	High	Low	Intervention
	Kokwanyo	Rural	High	Low	Control
	Matata	Urban	High	High	Control
	Nyalgosi	Rural	High	Low	Control
	Nyangiela	Rural	High	Low	Intervention
	Ober	Rural	Low	Low	Control
	Othoro	Rural	Low	Low	Intervention
	RDH	Urban	Low	High	Intervention
Tala	Rural	High	Low	Intervention	
Kisumu	Airport	Urban	High	High	Intervention
	Chiga	Rural	Low	Low	Control
	Kajulu/Gita	Rural	Low	High	Control
	Kowino	Urban	Low	High	Intervention
	Migosi	Urban	Low	High	Control
	Nyalenda	Urban	Low	High	Control
	Ober Kamoth	Rural	High	High	Control
	Ojola	Rural	Low	Low	Intervention
	Port Florence	Rural	Low	High	Intervention
	Simba Opepo	Rural	Low	Low	Intervention
	St. Elizabeth Chiga	Rural	High	High	Intervention
St. Mark's Lela	Rural	Low	High	Control	

Chapter 4: Partner Characteristics and HIV Outcomes among Partners Reached by Phone vs. In-person for Assisted Partner Services in Western Kenya

Unmesha Roy Paladhi^{1,2}, Edward Kariithi³, George Otieno³, James P. Hughes⁴, Harison Lagat⁵, Monisha Sharma², Sarah Masyuko^{2,6}, Paul Macharia⁶, Rose Bosire³, Mary Mugambi⁷, Carey Farquhar^{1,2,8}, David A. Katz²

1. Department of Epidemiology, School of Public Health, University of Washington, Seattle, WA, USA
2. Department of Global Health, University of Washington, Seattle, USA
3. PATH-Kenya, Kisumu, Kenya
4. Department of Biostatistics, University of Washington, Seattle, USA
5. School of Nursing, University of Washington, Seattle, USA
6. Ministry of Health, Nairobi, Kenya
7. Centre for Clinical Research, Kenya Medical Research Institute (KEMRI), Nairobi, Kenya
8. Department of Medicine, University of Washington, Seattle, USA

Abstract

Introduction: While assisted partner services (APS) are an effective strategy of reaching and testing people with undiagnosed HIV, less is known about the effectiveness of reaching partners for APS via phone.

Methods: We analyzed data from 31 facilities in Kenya, that provided APS to female index clients living with HIV, their male partners, and female partners of those men testing HIV-positive. APS providers attempted to contact partners using phone first if a number was available and, if unsuccessful, in-person in the community. Using log-linear mixed models, we estimated relative risks between phone being the final (i.e. successful) contact method for notification and demographic characteristics (age, sex, income, education, key population membership, and clinic urbanicity) and HIV outcomes (testing, first-time testing, new diagnosis, and linkage to care).

Results: From May 2018-March 2020, 2534 female index clients named 7614 male partners, of whom 772 tested positive and named an additional 4956 female partners. Overall, we reached 94% of partners, 43.5% via phone and 56.5% in-person. Being male and completing at least secondary education was associated with successful contact by phone ($p < 0.05$ for both). Being reached by phone was not associated with age, income, key population membership, or clinic urbanicity. Of the 11,912 partners eligible for testing, 99.7% tested and 11.2% first-time tested. Of those tested, 13.1% received a new diagnosis, of whom 87% linked to care. Partners who received a new diagnosis were less likely to have been reached by phone vs. in-person (9.8% vs. 15.9%; RR:0.61, 95%CI:0.53-0.70). Being reached by phone was not associated with testing, first-time testing, or linkage to care.

Conclusions: In an APS program that reached 94% of partners elicited from index clients, fewer than half were successfully contacted by phone only. Males and those with higher education were more likely to be reached via phone, and partners receiving a new HIV diagnosis were more likely to be contacted in-person. While phone-based tracing may reduce resources required for APS, a combined phone and in-person approach is likely essential to maintain a successful and equitable program.

Introduction

Assisted partner services (APS) is effective for testing partners of people living with HIV (PLWH), diagnosing them with HIV, and linking them to care (16,61,62), and is recognized as a critical strategy for achieving the UNAIDS goal of 95% of PLWH being aware of their status by 2030 (63–65). However, questions remain regarding how best to implement APS at scale, sustainably, and cost-effectively (66,67). Notably, the traditional approach of conducting in-person notification in the community can be resource-intensive and may not be acceptable or effective in all populations and contexts (68). As a result, many programs have turned to using phone calls as a method for initiating contact with partners. However, little evidence regarding the reach and effectiveness of phone tracing in APS exists, particularly outside the US, to inform successful implementation.

APS have typically been provided in-person rather than by phone, due to: 1) a historical precedent – contact tracing was initially developed in the 1930s in Scotland where communication mediums were limited (69), 2) privacy laws in the US and Europe (2,70), where APS programs were originally more common, and 3) perception of client preference. However, even prior to the start of the COVID-19 pandemic, both the Centers of Disease Control and Prevention (CDC) and the World Health Organization (WHO) had recommended that APS be provided over the phone if partners could not be reached in-person (4,71). In light of the COVID-19 pandemic, it became increasingly important for those unwilling or unable to engage with in-person APS and to comply with pandemic control measures such as curfews (72). While notification of potential exposure had been initially conducted in-person in Kenya, the Ministry of Health (MoH) also updated their recommendations to endorse phone notification with in-person notification as a back-up option for those unable to be reached by phone (64).

Prior studies in the US found that phone-delivered APS resulted in fewer new HIV diagnoses compared to in-person contact, though the number of partners notified of potential exposures and HIV testing was higher in some programs (73–75). Furthermore, acceptance and satisfaction of phone-based interviews were high among partners aged <30 as well as other specific populations (76). Understanding the characteristics of individuals being reached when prioritizing phone-based APS as well as its impact on HIV testing and care outcomes is important to understand any existing gaps of coverage in current APS delivery. Within a study evaluating the integration of APS within HIV testing services (HTS) in Western Kenya (APS Scale-up Study), we compared sociodemographic characteristics and HIV outcomes among sexual partners reached by phone versus in-person for APS.

Methods

Study Design

The APS Scale-up Study was a hybrid type 2 implementation-effectiveness study, conducted at 31 health facilities that varied by urbanicity and HIV testing volume in Homa Bay and Kisumu counties in Western Kenya from May 2018-March 2020. It was designed to assess the real-world performance of APS when integrated into government-run facilities in Kenya and is described in detail elsewhere (5,16,77,78).

Participants and Procedures

Female index clients who visited the study sites for HIV testing services (HTS), received a new HIV diagnosis, and were not currently receiving antiretroviral therapy (ART) were asked to provide informed consent for APS and study participation. Index clients who were pregnant, <18 years old (unless ≥ 15 years old and emancipated), or who reported intimate partner violence during the last month were excluded.

Participating index clients were asked to name and provide contact information, including phone numbers and physical addresses, of any male sexual partners during the past three years. HTS providers were Kenyan Ministry of Health (MoH) employees who implemented APS in the study facilities and abstracted program data for the study. HTS providers contacted these male sexual partners, notified them of potential exposure, encouraged them to test for HIV, and offered participation in the study and APS. Male partners who accepted were enrolled and received a positive test result were asked to provide contact information for their female partners. These female partners were also contacted, notified of their potential exposure, and encouraged HIV test. For our analyses, we refer to the male and female partners collectively as ‘partners’. Partners who reported a previous HIV diagnosis were linked to care, if not already in care, and offered APS. Index clients and partners who received a new HIV diagnosis were followed for 12 months to elicit additional partners periodically during the study period.

Method of Contact

The notification protocol was for all partners to be contacted via phone first. After three failed attempts via phone, they were attempted to be contacted in-person up to three times. If all six attempts were unsuccessful, the partner was marked as unreachable. If someone was ultimately contacted in-person after three failed phone attempts, they were recorded as “contacted by both phone and in-person” but their final contact method was recorded as “in-person”. Partners for whom female index clients or male partners were unable to provide phone numbers were first contacted in-person.

HIV Outcomes

HIV outcomes included the following with denominators in parentheses: HIV testing (named partners who were eligible for testing, i.e. without a prior HIV diagnosis), first-time testing (named partners who were eligible for testing), new HIV diagnosis (partners tested for HIV), and linkage to care (partners newly diagnosed with HIV). Linkage to treatment was defined as being connected by the HTS provider to a Comprehensive Care Clinic (CCC), a local HIV care clinic in Kenya, and confirmed by collecting their CCC number.

Statistical Analysis

Descriptive statistics of demographics and clinic urbanicity are presented within groups contacted via phone and in-person as their last contact method. Partners who were not successfully contacted by HTS providers for APS were excluded from this analysis.

First, we assessed the association between partner demographics (age, biological sex, income, education, key population membership, and clinic urbanicity) and the outcome of phone (vs. in-person) as final method of contact using generalized linear mixed models (GLMM) with log link functions and a Poisson distribution with robust variance. All models accounted for clustering at the clinic level and included all partners who were successfully contacted by HTS providers, including those who had received an HIV diagnosis prior to being contacted for APS.

Second, we used multivariate GLMMs with log link functions and a Poisson distribution with robust variance to evaluate the association between the final method of participant contact being phone and the outcomes of HIV testing, first-time testing, new HIV diagnoses, and linkage to care. All models accounted for clustering at the clinic level. Adjusted models included age and sex *a priori*. Although considered as a potential confounder, key population membership was not included in adjusted models due to very small numbers. Partners reporting an HIV diagnosis prior to APS were excluded as they were ineligible for HIV testing, and consequently first-time testing, diagnosis, and linkage to care. Two-sided p-values <0.05 were considered statistically significant for all models. Analyses were conducted using R software v.4.2.2 (2022-10-31) (18).

Results

Between May 2018-March 2020, 2534 female index clients were diagnosed with HIV at the 31 study health facilities and named 7614 male partners, of whom 772 (10.1%) were newly diagnosed with HIV and named an additional 4956 female partners. We reached 94.7% (11,912) of the total 12,570 elicited partners. Of partners reached, HTS counselors attempted to contact 42% (5008) of partners only by phone, 28.8% (3429)

only in-person, and 29.2% (3475) by both methods. Ultimately, 43.5% (5179) partners were reached by phone as final method of contact and 56.5% (6733) in-person.

Overall, successfully contacted partners were a mean age of 34.2 years, 59.4% were male, 81% cohabitating or married, either monogamous or polygamous, 43.8% had completed primary school, 67.8% earned a monthly income <10,000 Kenyan Shillings (KSh= ~71 USD), and 2.9% identified as being part of a key population. About two-thirds presented to facilities in Kisumu County (67.8%) and in rural settings (71.8%).

Table 1. Characteristics of Partners Reached for APS Delivery.

	Overall (N=11,912) Mean (SD) or N (%)
Age (in years)	34.2 (8.7)
Sex	
Female	4837 (40.6)
Male	7075 (59.4)
County	
Kisumu	8072 (67.8)
Homa Bay	3840 (32.2)
Marital Status	
Single or Never Married	1525 (12.8)
Cohabitating or Married (monogamous or polygamous)	9653 (81.0)
Divorced or Separated	473 (4.0)
Widow(er)	260 (2.2)
Highest Level of Education	
Completed	
Did not complete Primary School	1808 (15.2)
Primary School	5216 (43.8)
Secondary School	3314 (27.8)
Post-Secondary School	1574 (13.2)
Monthly Income (1 USD = ~123 KSh)	
0 to 10,000 KSh	8079 (67.8)
10,000 KSh and higher	3832 (32.2)
Key populations*	
Yes	345 (2.9)
No	11,567 (97.1)

Urbanicity

Urban	3364 (28.2)
Rural	8547 (71.8)

*Key populations were collectively included if they self-reported as any of the following (% of overall): female sex worker (0.02%), person who injects drugs (0.01%), fisherfolk (0.85%), or adolescent girls and young women (2.02%). SD, standard deviation; USD, United States Dollars; KSh, Kenyan Shillings.

The majority of the following partner subgroups were reached in-person: females and males (61.9% and 52.8%, respectively), Kisumu and Homa Bay residents (54.6% and 60.6%), all marital statuses (>55%), partners earning <10,000Ksh or ≥10,000KSh (55.7% and 58.3%), and partners from key and general populations (65.2% and 56.3%) (Table 2). Notably, more partners who completed secondary school and presented to an urban facility were contacted by phone (53.9% and 53%, respectively) compared to in-person.

Table 2. Comparison of demographic characteristics of partners reached by phone vs. in-person.

Exposures	Phone (N=5179) Mean (SD) or N (row%)	In-person (N=6733) Mean (SD) or N (row%)	RR (95% CI)
Age	34.2 (8.7)	34.2 (8.7)	1.00 (1.00, 1.00)
Sex			
Female	1843 (38.1)	2994 (61.9)	Ref.
Male	3336 (47.2)	3739 (52.8)	1.25 (1.17, 1.35)*
Monthly Income (1 USD = ~123 KSh)			
0 to 10,000 KSh	3581 (44.3)	4498 (55.7)	Ref.
10,000 KSh and higher	1597 (41.7)	2235 (58.3)	0.98 (0.91, 1.05)
Education			
Did not complete Primary School	605 (33.5)	1203 (66.5)	Ref.
Primary School	2043 (39.2)	3173 (60.8)	0.96 (0.87, 1.09)
Secondary School	1785 (53.9)	1529 (46.1)	1.22 (1.09, 1.38)*
Post-Secondary School	746 (47.4)	828 (52.6)	1.21 (1.05, 1.37)**
Key populations[§]			
No	5059 (43.7)	6508 (56.3)	Ref.
Yes	120 (34.8)	225 (65.2)	0.86 (0.70, 1.04)

Urban clinic

Rural	3394 (39.7)	5153 (60.3)	Ref.
Urban	1785 (53.0)	1580 (47.0)	1.45 (0.88, 2.40)

*Significant at $p < 0.001$ level. **Significant at $p < 0.01$ level. Model accounted for individual clinics (ie. clusters). §Key populations were collectively included if they self-reported as any of the following: female sex worker, person who injects drugs, fisherfolk, or adolescent girls and young women. SD, standard deviation; RR, relative risk; CI, confidence interval; Ref, reference group; USD, United States Dollars; KSh, Kenyan Shillings.

Male partners were significantly more likely to be reached by phone than female partners (RR:1.25, 95%CI:1.17-1.35, $p < 0.001$) [Table 2]. When compared to not completing primary school, there was no association between completing primary school (RR:0.96, 95%CI:0.87-1.09) and being contacted by phone. However, compared to not completing primary school, those completing secondary school (RR:1.22, 95%CI:1.09-1.38) and completing post-secondary school (RR:1.21, 95%CI:1.05-1.37) were more likely to be reached by phone. There were no significant associations between age, income, key population membership, or presenting at an urban facility and being reached by phone.

Of the 11,912 partners reached by the APS scale-up study, 3836 reported a prior HIV diagnosis and were therefore not eligible for testing and excluded from analyses of HIV outcomes (Figure 1). Of the 8076 partners reached and eligible for testing, 99.7% (8054) tested for HIV (99.7% for both by phone and in-person) and 11.2% (901) were first-time testers (10% by phone, 12.1% in-person) (Table 3). Of those who tested, 13.1% (1052) received a new HIV diagnosis (9.8% by phone, 15.9% in-person), of whom 87% (914) linked to HIV care (94.5% by phone, 82.9 in-person). In multivariate regressions, those reached by phone were less likely to receive a new HIV diagnosis (adjusted RR:0.61, 95%CI:0.53-0.70, $p < 0.001$). There were no significant associations between being reached by phone and HIV testing, first-time testing, or linkage to care.

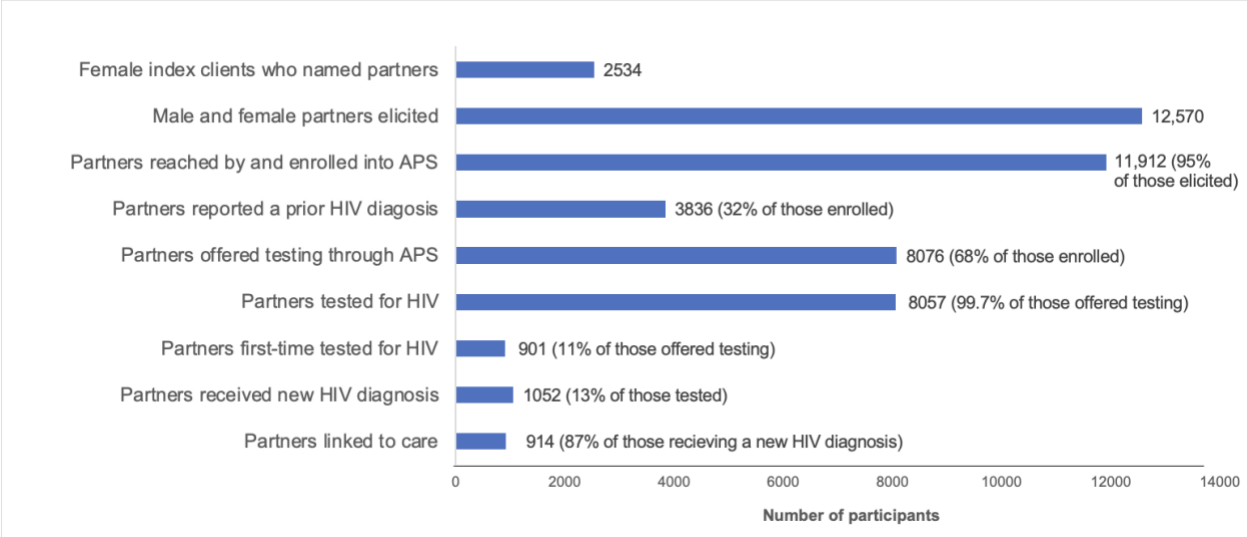


Figure 1. APS cascade and testing outcomes of partners of index clients. APS, assisted partner services.

Table 3. Association between final method of contact by phone and outcomes of male partner HIV testing uptake, first-time testing, new diagnosis, and linkage to care.

Outcome	N	Phone (n, row%)	In-person (n, row%)	Overall (N, col%)	Unadjusted RR (95% CI)	Adjusted [§] RR (95% CI)
HIV Tested	8076	3701 (99.7)	4353 (99.7)	8054 (99.7)	1.00 (0.96,1.04)	1.00 (0.96,1.04)
First-time Tested	8076	372 (10.0)	529 (12.1)	901 (11.2)	0.90 (0.78,1.04)	0.90 (0.78,1.04)
New HIV diagnosis	8054	362 (9.8)	690 (15.9)	1052 (13.1)	0.64 (0.56, 0.73)*	0.61 (0.53,0.70)*
Linked to HIV Care	1052	342 (94.5)	572 (82.9)	914 (87.0)	1.13 (0.98,1.30)	1.13 (0.98,1.30)

*Significant at the $p < 0.001$ level. [§]Adjusted for age and sex. All models accounted for clustering by study site and exclude partners with a previously known HIV diagnosis at initial contact, as not eligible for HIV testing and consequently other outcomes. RR, relative risk; CI, confidence interval.

Discussion

Within APS integrated into a routine HTS in Western Kenya, HIV testing, first-time testing, and linkage to care were similar between partners reached by phone vs. in-person tracing, suggesting that phone tracing for initial contact attempts can be effective for and has potential to reduce human resource burdens for APS programs. However, more than half of partners could not be reached by phone; female partners and those with primary education or less were less likely to be reached by phone; and those reached by phone were less likely to receive a new HIV diagnosis, suggesting that in-person APS remains essential to reaching all partners, particularly more vulnerable populations, and those most likely to have undiagnosed HIV infections.

Our finding that partners reached by phone were less likely to receive a new HIV diagnosis than those reached in-person was similar to previous studies in the U.S. (73,75). This association remained significant when adjusting for age and sex, though it is possible that additional unmeasured social and structural factors that may simultaneously pose barriers to phone ownership and healthcare access and result in vulnerabilities to HIV may have contributed to this difference (79). In addition, partners who were aware of their risk for HIV and concerned about testing positive may have found it easier to ignore phone calls than an in-person visit or may have preferred in-person contact because of the additional opportunities to build trust or receive support during a face-to-face interaction (80). Lower levels of new diagnosis with phone-delivered APS may also be a result of reaching more women in-person, who have a higher prevalence of HIV in Kenya compared to men (81). However, unlike in New York (75), phone contact did not decrease HIV testing in our study. These results suggest that using initial phone contact with in-person support as the secondary

contact method may be effective in maintaining sufficiently high levels of HIV testing and linkage, while saving the resources it would take to conduct purely in-person notification.

Male partners were more likely to be reached by phone than female partners, encouraging since men are generally less willing to access HTS in low- and middle-income countries (82) and considered “hard to reach” (59,83). This may be due in part to gender disparities within phone ownership in Kenya. A higher percentage of men own phones in Kenya, specifically in rural settings, compared to women, mostly fueled by affordability barriers (79,84). In addition, study HTS providers suggested that men may more readily share their phone numbers with their partners, and as a result, female index clients were more likely to be able to provide a phone number to APS providers to contact their male partners. This difference may also be driven by partner preference. For example, male partners may have been more likely to prefer the convenience or greater privacy afforded by phone contact (83), or female partners may have been more likely to prefer the potential for rapport-building and support offered by in-person contact. Similarly, having higher education may be a contributing factor to being reached by phone as these individuals may have greater access to phones and greater initial willingness to engage with HTS providers regarding their health (84,85).

This study has several strengths and limitations. The parent APS Scale-up Study collected programmatic data, and though they conducted weekly data checks to ensure high data quality, it resulted in some constraints to our analyses. There was substantial missingness of post partner elicitation, time-to-trace partner data and HIV risk behavior of partners was provided by index clients instead of being self-reported by partners themselves, both of which may be important considerations when looking at the characteristics of who is being reached by phone vs. in-person. Additionally, there were very low numbers of key populations in our study which may reduce the generalizability of our results to key populations, who may benefit more from phone-delivered APS as it affords more privacy than in-person APS.

A main strength of this study was the very large sample size across 31 health facilities in two counties with high HIV burden in Kenya, which may be generalizable to similar settings, though less so in less resourced or successful programs. The parent study was also designed and implemented by partnerships with the Kenya Ministry of Health, the non-governmental organization, PATH, and the University of Washington. These collaborations may be representative of program implementation though capacity building, and these results are therefore likely to have captured the real-life impact of conducting APS in a setting where phone contact is prioritized but supported with in-person APS delivery.

Conclusions

Slightly fewer than half of partners were reached by phone for APS, suggesting that phone-based APS is acceptable to many partners of people living with HIV and that – insofar as phone-based notification is less resource-intensive than in-person tracing – utilizing phone-based tracing may reduce costs associated with APS implementation. However, more than 55% of partners were reached by in-person APS rather than phone alone, and those reached in-person were more likely to be newly diagnosed with HIV, women, and have completed less years of formal education, suggesting that a continued combination of phone and in-person APS delivery is essential to maintain a successful and equitable APS program. This combined approach can ensure continued coverage for potentially vulnerable populations while also engaging heterosexual men in the HIV care cascade, historically a challenge in Western Kenya and similar settings. Additional research is needed to explore the costs and cost-effectiveness of phone, in-person, and combined approaches to partner notification; the potential to use additional forms of contact such as text and mobile apps into APS; and to understand contact method preferences and potential impacts among key populations. Policymakers may consider how best to support phone-based APS while maintaining support for in-person APS to ensure equitable and effective access to these essential HIV testing services.

Chapter 5: Conclusions

This work provided an opportunity to improve upon the established real-world implementation of assisted partner services (APS) in Western Kenya. Our key findings include:

- In an established APS program in Western Kenya, we found no statistically significant differences in HIV testing, first-time testing, new HIV diagnoses, and linkage to care among partners offered a choice of HIV self-testing (HIVST) or provider-delivered testing versus provider-delivered testing alone.
- We also found that offering two HIVSTs as a non-monetary incentive compared to a single HIVST did not increase HIV testing, first-time testing, new diagnosis, or linkage to care.
- Lastly, we found that 43.5% were reached by phone alone compared to 46.5% in-person, in the previous iteration of our APS program (APS Scale-Up). Partners reached by phone were more likely to be male and have completed higher education levels while those reached in-person were more likely to receive a new HIV diagnosis.

Our results suggest that HIVST can be integrated into APS successfully without reducing testing rates, new diagnosis, or linkage to care, which may have the potential to reach areas with lower access to physical healthcare facilities and promote partner control over their health. As majority of those offered, accepted self-testing, HIVST seems to be a helpful testing modality to integrate within comprehensive HTS within APS in similar settings. Furthermore, partners using HIVST reported it was easy to use and read results, indicating high acceptance of HIVST among this population.

The offer of a second HIVST as an incentive was not effective to increase testing uptake in this population and setting, though we were underpowered to see this difference given our high baseline uptake. Despite this, the intervention did reach and test people at risk for HIV beyond the scope of more typical APS approaches, mostly the unnamed sexual partners of the named APS partners. Since the baseline testing rates were already very high for our study, which may have been a hindrance to any observed effect of the incentive, it would be worth replicating in settings where more barriers to testing partners through APS exist.

The original APS Scale-up Study results suggest that a solely phone-based APS programs would miss women and other vulnerable populations, especially those potentially living with HIV, despite potentially saving cost for immediate APS implementation. Like in our program, a combined phone and in-person

approach is essential to maintain an APS program that is successful in identifying people living with HIV in the community.

Future Research

Our results highlight important outcomes of HIVST within APS and the coverage of a combination approach of phone and in-person delivered APS, but also present opportunities for future research. Future studies should explore the effectiveness of APS+HIVST in reaching inaccessible areas with high HIV burden and its potential impact in key populations, whilst reducing the human resource burden of APS and maintaining current testing, diagnosis, and linkage rates. Studies on costing, feasibility, acceptability, and delivery strategies for HIVST within APS also are needed. Further work utilizing Behavioral Economics (BE) levers could also explore the effectiveness of additional HIVSTs as non-monetary incentives in APS programs reaching fewer partners for testing, in other HIV testing service models, in combination with other BE concepts including different non-monetary incentives, and for reaching key populations with HIV testing, prevention, and care. Lastly, additional research is needed to explore the costs and cost-effectiveness of phone, in-person, and combined approaches to partner notification; the potential to use additional forms of contact such as text and mobile apps into APS; and to understand contact method preferences and potential impacts among key populations.

Recommendations for Policymakers

Overall, we would recommend considering the integration of HIVST into APS in Kenya, and similar settings, as the testing, new diagnoses, and linkage to care rates remain high when this less human resource intensive technology is introduced into an established program. However, offering two HIVSTs to every partner client is not currently advisable, as the costs of keeping sufficient amounts of HIVSTs stocked at pharmacies and dispensaries may outweigh the current demand and benefit of multiple HIVSTs as an incentive. Policymakers should also consider how best to support phone-based APS while maintaining support for in-person APS to ensure equitable and effective access to these essential HIV testing services.

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