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Increases in HIV Testing and Case Detection from NIMH Project Accept (HPTN 043) among 16–32 Year Olds: A Randomized Community-Based Intervention in Tanzania, Zimbabwe, and Thailand

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SUMMARY

BACKGROUND—HIV counseling and testing is the gateway to treatment and care and provides important preventative and personal benefits to recipients. However, in developing countries the majority of HIV infected persons have not been tested for HIV. Combining community mobilization, mobile community-based HIV testing and counseling, and post-test support may increase HIV testing rates.

METHODS—We randomly assigned half of 10 rural communities in Tanzania, 8 in Zimbabwe, and 14 in Thailand to receive a multiple component community-based voluntary counseling and

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¹¹See Appendix

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testing (CBVCT) intervention together with access to standard clinic-based voluntary counseling and testing (SVCT). The control communities received only SVCT. The intervention was provided for approximately 3 years. The primary study endpoint is HIV incidence and is pending completion of the post-intervention assessment. This is a descriptive interim analysis examining the percentage of the total population aged 16–32 years tested for HIV across study arms, and differences in client characteristics by study arm.

FINDINGS—A higher percentage of 16–32 year-olds were tested in intervention communities than in control communities (37% vs. 9% in Tanzania; 51% vs. 5% in Zimbabwe; and 69% vs. 23% in Thailand). The mean difference between the percentage of the population tested in CBVCT versus SVCT communities was 40.4% across the 3 country study arm pairs, (95% CI 15.8% – 64.7%, p-value 0.019, df=2). Despite higher prevalence of HIV among those testing at SVCT venues the intervention detected 3.6 times more HIV infected clients in the CBVCT communities than in SVCT communities (952 vs. 264, p< 0.001). Over time the rate of repeat testing grew substantially across all sites to 28% of all those testing for HIV by the end of the intervention period.

INTERPRETATION—This multiple component, community-level intervention is effective at both increasing HIV testing rates and detecting HIV cases in rural settings in developing countries.

INTRODUCTION

HIV counseling and testing can reduce anxiety over infection and assist individuals in making informed reproductive health and breastfeeding decisions. Importantly, HIV counseling and testing has been demonstrated to lower risk behaviors,^{1–2} especially among those infected with HIV and for couples who test together.^{3–6} Gaining knowledge of HIV infection status is also the gateway to lifesaving HIV/AIDS treatment,^{7–9} which also significantly reduces HIV transmission.¹⁰ Recent statistical modeling also suggests that treating high proportions of HIV-infected persons in a community may slow or even stop an HIV epidemic.¹¹ However, among the over 33 million persons infected with HIV, most in developing countries,¹² less than 30% are aware of their own infection status, and only 10% are aware of their partner's HIV status.¹³ Thus, despite the major heralded successes in expanding access to HIV/AIDS treatment, a large proportion of people with HIV remain unaware they are infected, have a high likelihood of transmitting the infection to others, and cannot benefit from potentially lifesaving treatment programs without HIV counseling and testing.

In 2000 the first randomized controlled trial examining the efficacy of HIV counseling and testing in developing countries was published, demonstrating its impact on behavioral risk reduction.² Since then, and with the advent of expanded AIDS treatment in developing countries, there have been bold efforts to expand HIV testing with major increases in financial support for voluntary counseling and testing (VCT) programs, evolving strategies to increase uptake, and improvements in the linkage between HIV testing and treatment. Strategies include expansion of free standing VCT clinics, home-based testing,^{14–15} VCT clinics for adolescents,^{16–17} expansion of HIV testing for pregnant women,¹⁸ provider initiated testing in health care settings,^{19–20} and mass testing campaigns.²¹ Yet the proportion of persons aware of their HIV infection status has remained well below that which is required to have significant impacts on the epidemic in terms of behavioral risk reduction, linkage to care and treatment, community-level awareness of the scope of the epidemic, and reductions in HIV-related stigma and discrimination. With so few people aware of their HIV infection status and thus unable to access treatment, the potential impact of ARVs in reducing HIV infectivity is also compromised. Mobile VCT has been suggested as a strategy which may help to expand knowledge of personal HIV infection status.^{22–23}

However, rigorous studies examining the comparative benefit of mobile VCT in reaching large proportions of vulnerable populations have to date not been conducted.

This study was designed to test the hypothesis that easily accessible mobile voluntary counseling and testing services coupled with community mobilization programs and post-test psychosocial support will increase HIV testing rates and detection of HIV-infections, reduce individual risk behaviors, enhance reproductive health decision making, improve access to treatment, reduce HIV/AIDS-related stigma and discrimination, and ultimately lower HIV incidence. In this analysis we specifically examine the effect of the intervention on uptake of HIV testing and counseling, and HIV case detection.

METHODS

Study Design

Project Accept is a multisite, community randomized trial being conducted in Tanzania (Kisarawe District), Zimbabwe (Mutoko District), Thailand (Chiang Mai Province), and two sites in South Africa (Kwa Zulu Natal, and Soweto). At each of the South African and Zimbabwean sites there are 8 communities participating in the study, 10 communities in Tanzania, and 14 communities in Thailand. Each community was identified based on ethnographic mapping conducted during the formative phase of the study. Community pairs in each location were matched for similar demographics and environmental characteristics using community mapping results. One community from each pair was randomly selected by the project Statistics Center to receive the standard clinic-based voluntary counseling and testing intervention (SVCT), with the other community selected to receive both the SVCT intervention and an enhanced community-based voluntary counseling and testing intervention (CBVCT). Quality assurance was regularly assessed to maintain intervention fidelity to the protocol and standardization of the CBVCT and SVCT interventions across sites (countries) and venues (testing services).

Here we report only on results from the Tanzanian, Zimbabwean, and Thai sites. In the South African sites standard clinic-based VCT has been available since the inception of the study through a large number of public and private providers. VCT service venues in control communities in South Africa were not affiliated with our study. Thus, we have excluded the South African sites from the analyses herein as we do not have requisite utilization data from control venue service providers.

Persons aged 16 years and older residing in all study communities, whether intervention or control, had access to HIV counseling and testing. The target age group for the Project Accept intervention was 16–32 years based on the high HIV incidence in this age group.¹² Here we assess the secondary study endpoint of uptake of HIV testing using intervention utilization data and limit all analyses to persons aged 16–32 years. Collection of post-intervention assessment data is ongoing, and the primary study endpoint is HIV incidence among those aged 18–32 years. HIV incidence is being measured in a post-intervention cross-sectional probability-based sample using an algorithm based on the BED assay, avidity index, and CD4+ T-cell count. Additional information on the study design and assessment of the primary study endpoint can be found in the study protocol, which is registered with ClinicalTrials.gov (identifier # NCT00203749),²⁴ and is an accepted study protocol with The Lancet (Protocol 05PRT/33).²⁵

Project Accept Intervention

The Project Accept intervention, described elsewhere,^{26–27} includes: (1) community mobilization activities, (2) easily accessible mobile HIV voluntary counseling and testing, and (3) community-based post-test support services. There are several key principles

underlying our intervention strategy. A basic premise of the intervention strategy is that individuals typically benefit from learning whether they are infected with HIV. Clients' capacity to plan for the future is enhanced, they are able to assuage fears and concerns over whether or not they are infected with HIV, and they are empowered to appropriately adjust behaviors to reduce HIV acquisition and transmission. Project activities were conducted without attempting to conceal HIV testing. This was both to destigmatize HIV testing and encourage a sense of community ownership of the project and collective commitment to addressing HIV. In addition, the intervention strategy was based on the assumption that as large proportions of the population learn their infection status there will be a growing demand for HIV counseling and testing, disclosure and open discussion about HIV will increase, HIV-related stigma will be reduced, and increasing numbers of people will access treatment for HIV/AIDS. Ultimately, we hypothesize that these forces will lead to declines in HIV incidence. To realize these goals, three main intervention components were implemented for the project.

Community Mobilization—The goals of community mobilization activities are to destigmatize and normalize HIV counseling and testing, inculcate a sense of collective commitment to address the HIV epidemic, raise awareness about HIV, and model positive acceptance of those infected and affected by HIV/AIDS. To achieve these goals, project staff worked closely with community members through a series of meetings and consultations to link the intervention to felt needs in the community and to encourage a sense of community ownership of the project. Core intervention elements were adapted to the local environmental conditions and culture, and volunteers recruited from the community were supported as project team members to educate others about the project and to encourage personal participation from their peers and neighbors. Leaders in the community were encouraged to come and be seen receiving HIV counseling and testing and to give testimonials about their experience. This process was ongoing throughout the life of the project. Post-test services, described below, also had community mobilization components including activities to integrate HIV-infected and uninfected people around educational, social, and political goals. Community events were also supported by the project, such as sports teams and presentations in schools and at existing community events. In each site a Community Mobilization coordinator organized and supervised field activities. There were also additional community mobilization outreach workers on staff at the field level – 5 in Tanzania, 2 in Zimbabwe, and 16 in Thailand on average throughout the study. In addition, local volunteers were recruited from each CBVCT community who assisted in mobilizing community members to utilize the intervention (an average at any one time of approximately 74 in Tanzania, 42 in Zimbabwe, and 57 in Thailand).

Mobile Voluntary Counseling and Testing—A core component of the intervention was to provide free HIV testing in easily available venues. We selected high profile venues for our mobile HIV testing services to enhance convenience and the visibility of both the service and of people coming to receive VCT. Uptake of testing and counseling was tracked, and areas and times of day with high utilization were targeted. In all sites community volunteers were mobilized when visits occurred, and together with staff they canvassed the area to alert people of the opportunity to come to intervention venues, ask questions, and receive VCT. Project staff were also positioned at each testing venue to provide educational sessions on HIV and HIV testing, and encourage people to receive HIV VCT. Standards for VCT conformed to the US CDC, WHO, and local national guidelines, and included pre-test counseling, rapid HIV testing while the client waited, and provision of the test result in the context of post-test counseling addressing personalized risk reduction. All counseling and testing was done anonymously, and in private. Free male and female condoms were offered to all clients at the time of HIV testing. HIV-infected clients were referred to treatment

services which were available in each of the study sites. In each CBVCT study site, mobile VCT service was provided by teams that rotated through the coverage area. Team size varied, but minimally included a driver, a team leader who also functioned as a VCT counselor, an additional VCT counselor, and a phlebotomist. Over the three year intervention period a mobile VCT team typically visited each community approximately two days a month on average to provide services.

In Tanzania mobile VCT was provided using tents transported to each venue and erected for the day. A community outreach tent was erected, as well as several additional tents that served as testing and counseling stations. In Thailand, the project team traveled to community villages by vehicle, hiking on foot, and by motor scooter. Requisite supplies were carried by staff, and local community centers such as schools and temples were used as service venues. In Zimbabwe, caravans (camper trailers) were converted to mobile HIV testing stations which were stationed in project venues. Tents were also used to provide additional space as needed.

Post-Test Support Services—Post-test support services (PTSS) were made available in all CBVCT study areas. The primary aim of PTSS was to provide psychosocial support to clients after being tested for HIV, regardless of serostatus. This component was organized as a club, with members including persons who previously tested for HIV, although guests were also free to attend. Activities included information-sharing group sessions, psychosocial support groups, crisis counseling, coping effectiveness training workshops, stigma reduction workshops, income generation training, and a referral system to link clients to other available social services. Post-test support services were mobile, and in each country there were at least two PTSS teams. Each team served several communities and was typically comprised of one team leader and two counselors with additional staff dedicated as needed during busy times. In addition there was a PTSS coordinator who supervised the teams. Over the 3 years of intervention provision each CBVCT community was visited by a PTSS team approximately 2–4 times a month on average. Additional details on the PTSS component have been previously published.²⁶

Utilization Data Collection

Data were collected in Tanzania from March 2006 through April 2009, and in Zimbabwe and Thailand from January 2006 through July 2009. Standardized utilization data collection instruments and procedures were used in all study sites, except the Thai SVCT service venues where utilization data was collected retrospectively from clinic records. Upon providing consent to be tested for HIV a client utilization form was completed by staff. Data collected in Tanzania and Zimbabwe included date, time of day, gender, age, whether the client was being testing with a partner, the community in which the client resided, if the client reported a previous HIV test, whether the client had been tested for HIV before by Project Accept, the specific services received (i.e., pre-test counseling, blood collection, post-test counseling, receipt of test results), and the HIV test result. For women, we additionally asked the client if she was pregnant. These same data were collected in Thailand at CBVCT venues, and in SVCT venues all data except for time of day of test, pregnancy status, and repeat testing were available from clinic records. No personal identifying information was collected.

Ethical Review

The study procedures and instruments were approved by the following ethical review committees: The Johns Hopkins University Committee on Human Research (Thailand); Chiang Mai University Research Institute for Health Sciences (Thailand); the Ministry of Public Health (Thailand); The Medical University of South Carolina IRB for Human

Research (Tanzania); Muhimbili University of Health and Allied Sciences IRB (Tanzania); The National Institute of Medical Research IRB (Tanzania); The University of California, San Francisco Committee on Human Research (Zimbabwe); and The Medical Research Council of Zimbabwe (Zimbabwe). Project Accept also has an independent Data Safety and Monitoring Board which biannually reviews project benchmarks, outcomes, and adverse events.

Outcome Measures

Client Characteristics and Service Utilization—Details on client characteristics were culled from utilization forms completed for every client receiving HIV testing in both intervention and comparison communities. All data presented are for those aged 16–32 years. Persons reporting previous HIV testing by Project Accept were excluded from analysis, except for Thai SVCT clients where these data were not available. In Tanzania and Zimbabwe Project Accept operated both CBVCT and SVCT intervention services, and we used our standard utilization data collection forms in these sites. In Thailand SVCT (control) service venues were not affiliated with the study. However, there were few such facilities and the study was granted excellent access to well maintained client records. Yet some variables were not originally collected at the Thai SVCT facilities, including pregnancy status, time of day the service was delivered, and whether clients had been previously tested by Project Accept or at the SVCT facility.

Number of HIV Cases Detected—HIV infection status was recorded for each client with their utilization data, and HIV infection was determined using the approved national rapid testing algorithm in each country. Those with equivocal test results are removed from analysis. It is possible that people may have tested for HIV outside our data catchment. Results presented on HIV infection are limited to only those results we had direct access to, and HIV cases detected from testing outside our direct data catchment are not estimated or included in the results shown in Table 1.

Percentage of Individuals Aged 16–32 Years Receiving HIV Counseling and Testing—For this measure the number of persons testing for HIV at least once over the 3 years of intervention provision was divided by the total population size of eligible persons. The total population size was derived from the study baseline evaluation in which we enumerated all household members in a probability-based sample of households. It is possible that testing occurred in other venues outside of our data catchment. However, reports from project staff are that this was rare. All of the study areas were rural, and there are significant transport and opportunity costs to leaving the area for HIV testing. Those reporting that they had previously tested for HIV with Project Accept were removed from analysis. In Thailand the SVCT service venues did not collect data on repeat testing. Based on interviews with project staff in Thailand we assumed that 50% of those residing in CBVCT areas and testing in SVCT venues were repeating their HIV test, and that 15% of those residing in SVCT communities and testing in SVCT venues were repeating their test.

Percentage of CBVCT Residents Aged 16–32 Years Repeating HIV Test at Project Accept CBVCT Service Venues—These values come from project utilization data for residents of CBVCT communities attending CBVCT venue services. Client reporting any previous testing for HIV by Project Accept are counted as repeat testers for analyses.

Statistical Analysis

Analyses were conducted with SPSS for Windows version 17TM. Non-parametric analyses used Pearson's chi-square to test for differences in client characteristics across strata. For

these tests significance was set at the $\alpha < 0.05$ level. The statistical analyses do not account for intraclass correlation that may have been present at the community, household, or couple levels. These data come from short questionnaires completed at the time of service utilization. Geographic location of residence was limited to whether clients lived in intervention or control communities, and identifying information, detailed household location, and linking information to sexual partners who may also have tested were not collected. As a result, the P-Values presented may be more likely to show statistically significant associations than if adjustments for interclass correlation had been made. A paired T-test analysis was also conducted to examine the mean difference in percentage of the population tested for HIV across CBVCT and SVCT community pairs (1 pair per country, $df=2$).

RESULTS

Client Characteristics and Service Utilization (Table 1)

In all sites the number of people testing for HIV was much larger in intervention communities than in comparison communities. In Tanzania approximately 4 times more clients in intervention communities utilized VCT services than in control communities (2341 vs. 579 respectively). In Zimbabwe VCT uptake in intervention communities was 9.0 times greater than control communities (5,437 vs. 602). In Thailand it was 3.4 times greater (9,361 vs. 2,721), although the Thai SVCT venues did not assess previous testing by Project Accept, and thus we are unable to remove cases from analysis who repeated their test at SVCT venues (note that an adjustment for repeat testing at Thai SVCT venues was estimated and is presented in subsequent sections). The mean client age was slightly lower among those testing in intervention communities compared to control communities in all sites. In Tanzania the mean age was 22.7 years for CBVCT clients versus 23.8 years for SVCT clients ($p < 0.001$). In Zimbabwe the mean age was 22.2 years for CBVCT clients versus 24.2 years for SVCT clients ($p < 0.001$). In Thailand the mean age was 23.6 years for CBVCT clients versus 23.5 years for SVCT clients ($p < 0.001$). However, the percentage of those testing for HIV age 16–17 years, while still infrequent, was markedly higher in intervention communities as compared to control communities in all sites. In Tanzania 15.8% of those testing for HIV from intervention communities were aged 16–17 years as compared to 8.5% from control communities ($P < 0.001$). Similarly, in Zimbabwe the percentage of HIV testers aged 16–17 years was 21.7% from intervention communities versus 8.2% from control communities ($P < 0.001$), and in Thailand the percentage was 17.9% and 11.9%, respectively ($P < 0.001$). In Tanzania and Zimbabwe, a larger percentage of clients in both intervention and control communities were male, while in Thailand the majority of clients were female. The only significant gender effect found across intervention and control communities is in Thailand, where a larger percentage of clients from intervention communities were male as compared to control communities (45.5% versus 34.1%, respectively, $P < 0.001$). The percentage of clients testing for HIV as a couple was modest in Tanzania and Zimbabwe, and was even less common among those from intervention communities as compared to control communities (Tanzania: 2.3% vs. 4.1%, $P = 0.011$; Zimbabwe 4.1% vs. 10.2%, $P < 0.001$). In contrast, the percentage of those testing as a couple in Thailand was much higher than in other sites, especially in control communities. In Thailand 27.5% of those testing for HIV did so as a couple in intervention communities, compared to 54.1% in control communities ($P < 0.001$). The percentage of female clients reporting pregnancy at the time of HIV testing was modest in all sites (Note: Data on pregnancy were not recorded in Thailand in SVCT community venues). Only in Tanzania were significant differences in pregnancy observed across study arms with 2.6% of clients from intervention communities reporting pregnancy compared to 10.7% from control communities ($P < 0.001$). In both Tanzania and Zimbabwe the time of day clients were

tested differed significantly across intervention and comparison communities, with clients testing later in the day in intervention communities (Note: Data on time of day were not recorded in Thai SVCT venues).

Number of HIV Cases Detected (Table 1)

Prevalence of HIV and the associated number of HIV infections are shown in Table 1. In Tanzania HIV prevalence was lower among intervention community members receiving HIV testing as compared to those in control communities (3.7% vs. 6.9%, $p < 0.001$). However, since many more people were tested in intervention areas, over twice as many HIV cases were detected in intervention as compared to control communities (86 vs. 40, $p < 0.001$). In Zimbabwe, HIV prevalence among those testing from intervention communities was 12.8% compared to 22.0% testing from control communities ($p < 0.001$), and there were 693 HIV cases detected from intervention communities compared to 132 in control communities ($p < 0.001$). A similar finding was seen in Thailand, with HIV prevalence among intervention community testers of 1.9% versus 3.4% among control community testers ($p < 0.001$), yet more HIV cases were detected in intervention communities than in control communities (173 vs. 92, $p < 0.001$).

Percentage of Clients Receiving an HIV Test at Project Accept Service Venues (Table 2 / Figure 1)

The patterns of HIV testing with regard to the number of total and repeat HIV tests by venue type among residents of each study arm are shown in Table 2. These values were used to calculate the estimated percentage of the total population aged 16–32 years who received at least one HIV test over the intervention period, shown in Figure 1. In Tanzania 37% (2,341 / 6,250) of residents in intervention communities received at least one HIV test, while in control communities the frequency was approximately four times lower at 9% (579 / 6,733). In Zimbabwe 51% (5,437 / 10,700) of intervention community residents tested for HIV as compared to 5% (602 / 12,150) of residents in control communities. In Thailand 69% (7,802 / 11,290) of intervention community residents received HIV counseling and testing compared to 23% (2,319 / 10,033) of control community residents. Note that for Thailand results we have adjusted values to reflect the estimated frequency of repeat testing that may have occurred at Thai SVCT venues, which lowers the frequency of testing from the unadjusted values.

In cross-site analysis there was a mean difference of 40.2% (95% CI: 15.8% – 64.7%) in the percentage of the population aged 16–32 years residing in CBVCT communities versus SVCT communities who were tested and counseled for HIV; $t(2)=7.07$, $p = 0.019$. This indicates that the difference in proportions tested across study arm is significant, even in a crude site-level analysis based on 3 observations (one pair per site).

The results shown in Table 2 also highlight that there were few clients who crossed over the randomized community boundaries to receive services. The exception is in Thailand, where a substantial number of clients in CBVCT communities opted to test in SVCT community venues (an estimated 20% of all HIV tests, excluding repeat testing).

Percentage of CBVCT Residents Aged 16–32 Repeating HIV Test at Project Accept CBVCT Service Venues (Figure 2)

In Tanzania during the first year of intervention delivery the project experienced a high frequency of repeat testing among those residing in CBVCT communities, approaching 35% of all HIV tests provided by Project Accept. Over time this rate dropped, and fluctuated between 15% and 20%. In Thailand and Zimbabwe there was a consistent increase in repeat

HIV testing over time, reaching 28% of all HIV testing in Project Accept CBVCT venues by the end of the intervention period for residents of those communities.

DISCUSSION

The results demonstrate that very large proportions of communities can be mobilized around HIV prevention and prompted to learn their HIV infection status, including in remote rural communities with limited infrastructure. Moreover, these results were consistent across different regions, epidemic settings, and cultures included in this multi-site community randomized trial. In Tanzania over four times as many people tested for HIV from intervention communities versus comparison communities. In Zimbabwe there were approximately nine times more persons testing in intervention communities, and in Thailand approximately 3.5 times more. We believe that the extremely high uptake of HIV testing in Thailand was supported to some degree by the many years of national support for HIV testing, which likely has made it more acceptable and normative. The lower, albeit still impressive, uptake in Tanzania is likely due to the more isolated nature of the communities where the study was based. In the study area in Tanzania there has been minimal media exposure (limited radio service, and no TV service) to HIV prevention campaigns, and little previous access to HIV testing services.

We believe that the intervention strategy succeeded at achieving an average of 55% HIV testing rates across the three sites among those 16–32 years old due largely to the multi-component, comprehensive, and integrated nature of the intervention. We also see evidence that the mobilization component stimulated demand for HIV testing, independent of improved access alone, given the number of persons residing in intervention communities who sought testing in SVCT venues as compared to control community members who sought HIV testing in CBVCT venues.

Important differences in the characteristics of clients who utilized CBVCT versus SVCT were found. In Tanzania, those testing in SVCT venues were more likely to be couples and pregnant women than in CBVCT venues. It is likely that the lower percentage of pregnant women in intervention communities in Tanzania seeking testing services is because SVCT services there are linked to public health clinics, which are also a major source of antenatal care for women. It is also notable that so few persons testing for HIV among those residing in intervention communities went to SVCT venues for HIV testing, indicating that ease of access for HIV testing services has a major impact on uptake.

In Zimbabwe, persons testing for HIV from intervention communities, versus comparison communities, were more likely to be adolescents, and have tested as an individual rather than couple. Standard clinic-based VCT in Zimbabwe has been criticized for not being youth friendly,²⁸ which may explain the higher rates of youth attending mobile services. The higher rate of testing for couples at SVCT venues may partially be due to the coexistence of antenatal services, which may promote males to test for HIV when their pregnant partner also tests for HIV. As well, it may be that couples prefer to test away from their home community over fears of loss of confidentiality.

In Thailand, VCT has been available in all government hospitals with only a minimal fee since 1992. All pregnant women receive VCT during antenatal care and financial institutions require loan applicants to provide proof of negative HIV infection status. Hence, independent of the Project Accept intervention, a large percentage of the Thai population has prior experience with HIV testing. Studies have shown that more than 40% of persons aged 18–35 have a history of HIV testing in northern Thailand.^{27, 29} This may account for the much higher general frequency of testing observed in both study arms in Thailand. There

were also higher rates of testing for females and couples from SVCT communities than CBVCT communities, and like Tanzania this may be due to the concurrent availability of antenatal testing available in Thai SVCT venues.

Against this backdrop of dramatically increased HIV testing associated with the intervention, we found couple testing to be infrequent. There is evidence that when clients test for HIV together as a couple they are more likely to reduce risk behavior.³⁻⁶ In all three countries couple testing was more frequent among clients from SVCT communities, especially in Zimbabwe and Thailand. Couples may prefer to test for HIV outside their home communities to enhance privacy, and may find the SVCT testing sites more private.

The experience of Project Accept also elucidates program evolution in the uptake of testing, and repeat testing, associated with community-based VCT. We believe that both community mobilization and social networking dynamics promoted uptake of HIV testing in intervention communities. As increasing numbers of people learn their HIV serostatus the likelihood of personally knowing someone who has tested grows, instilling trust in the safety and benefits of learning your serostatus. As well, by the end of the of the intervention period approximately 40% of persons testing presenting at CBVCT venues were repeating a previous HIV test conducted by Project Accept. This trend towards very high proportion of repeat testers over time is also correlated with reduced HIV infection case detection, as case detection is associated most commonly with first time testing. Thus, as a community-based VCT program matures the epidemiological benefits of the program also evolve from case detection towards behavioral reinforcement and prevention.

The utilization data for the study were carefully collected, and there were multiple layers of quality assurance to ensure that the results were accurate. However, the methodological challenges of measuring the complex patterns of HIV testing at the population level should not be underestimated. While the study results should be treated with some caution, we believe that they are reliable. The utilization information collected was based on self-report at intake to each service, and there was little reason for clients to provide inaccurate information. The questions asked were neither highly sensitive nor stigmatizing, and there was no discouragement to access services for those residing outside of geographic community boundaries defined for the study. Everyone coming to the intervention sites, regardless of where they lived, was allowed to access all services. We carefully mapped the communities prior to the study, and staff reported few problems determining whether clients resided in intervention, comparison, or other communities. Since we did not collect identifying information on clients we were unable to determine the individual pattern of repeat testing, other than by asking clients whether they had tested before, and whether Project Accept was the source of previous testing. One possible source of error is that community members may have tested for HIV in venues from which we did not have access to data. However, all of the study sites, both intervention and control, were rural, and access to alternative testing venues outside our data catchment was difficult. Additional testing outside our data catchment would only increase the numbers of people estimated to have tested for HIV, and there is little reason to believe that traveling to distant VCT testing venues would occur differentially across study arm communities. There are several additional study limitations that are noteworthy. Cost data for the project intervention is currently being collected, and is not yet available. The study also had some missing data for some variables. In most sites the number of cases with missing data is small, although in Thailand substantial cases in the intervention arm were missing data on time of day services were rendered, and pregnancy which likely does introduce a bias in these descriptive statistics. In Tanzania and Zimbabwe the study provided both the CBVCT and SVCT services, enhancing our ability to track uptake patterns. In Thailand the project relied on existing SVCT services, and we had excellent access to well maintained utilization data at

these clinics. The reliance on SVCT clinics in Thailand not affiliated with our project is also a potential source of bias that should be recognized. Yet the VCT provided at Thai government clinics is recognized to be of high quality, and it conforms closely to the same international standards applied by study-supported HIV testing services. The study results are also partially based on self-report data on repeat testing, and it is possible that some may have denied previous testing. In Tanzania and Zimbabwe few community members crossed over the randomized community boundaries to receive services. In Thailand approximately 20% of CBVCT community members received HIV testing in SVCT venues. Very few SVCT community members traveled to testing venues located in CBVCT communities in any site. Whether these events constitute contamination of the study design is most relevant to our main study outcome of HIV incidence, which is forthcoming. It can be said that clearly in some sites, especially Thailand, some people made a concerted effort to receive their HIV test in a less convenient venue, implying that publically seeking an HIV test does not appeal to all clients.

We also recognize that the main study design included matching community pairs for randomization, and intraclass correlation may be present at the community, household, and couple levels which should ideally be adjusted for in analysis. Thus, the P-values presented may be overly optimistic, and inferring statistical significance should be taken with caution. The utilization data included in this analysis did not include a level of geographic and individual measures that would allow us to identify intraclass correlation. To preserve client anonymity we opted to not collect information at the time of service delivery which could identify clients. Yet we would point out that the main effect presented on the differential percentage of the population who tested for HIV across study communities was enormous. The level of intraclass correlation that would be required to obviate statistical significance in this effect is highly unlikely to be present.

Our ultimate conclusion is that bringing VCT directly to communities and linking it with mobilization efforts and post-test support services results in substantially greater uptake of both HIV testing and HIV case detection than standard clinic-based VCT. This has important implications for both prevention and treatment of HIV in developing countries, especially in rural communities such as those in which this study was conducted, which are often neglected in the provision of HIV programming due to logistical and health systems challenges. The project's ability to mobilize such large proportions of the population to go through the difficult process of learning whether they are infected with HIV in such a short time speaks to the capacity of local communities to respond to HIV epidemics when comprehensive, user-friendly services are provided.

PANEL: Research in Context

Systematic Review—We searched PUBMED and the Cochrane Library using the following Boolean search terms with no date limitations: (“HIV voluntary counseling and testing” OR “VCT” or “HIV Testing”) AND (“utilization” OR “uptake”) AND (“trial” OR “randomized” OR “campaign”). We screened the results for randomized controlled trials of HIV testing interventions that reported on the uptake of HIV testing. Our search identified six citations on five relevant trials^{30–35}.

Interpretation—A total of 16,585 participants were involved in these trials, four of which were conducted in Sub-Saharan Africa, and one in Thailand. The study populations, endpoint measures, and interventions varied across trials making generation of a pooled effect size estimate infeasible. A trial among antenatal women found individual VCT resulted in significantly greater uptake over couples VCT (71% vs. 39% respectively; $p < 0.001$). A workplace-based study found that onsite VCT resulted in higher uptake than

off-site VCT (RR 2.8; 95% CI, 1.8–3.8). A study of community-based education and mobilization reported higher uptake of VCT compared to no intervention (RR: 2.9; 95% CI, 1.27–6.74). Two trials examined variants of home-based VCT, and both demonstrated significantly greater uptake of home-based VCT over clinic based-VCT (RR: 4.7; 95% CI, 3.62–6.21; OR: 2.76; 95% CI, 1.97–3.86). Our trial is the first to examine the effects of community-based VCT on uptake of HIV testing among a probability-based sample of community members. The intervention effect we found is consistent with the limited studies that have been conducted on home-based VCT in developing countries with generalized HIV epidemics.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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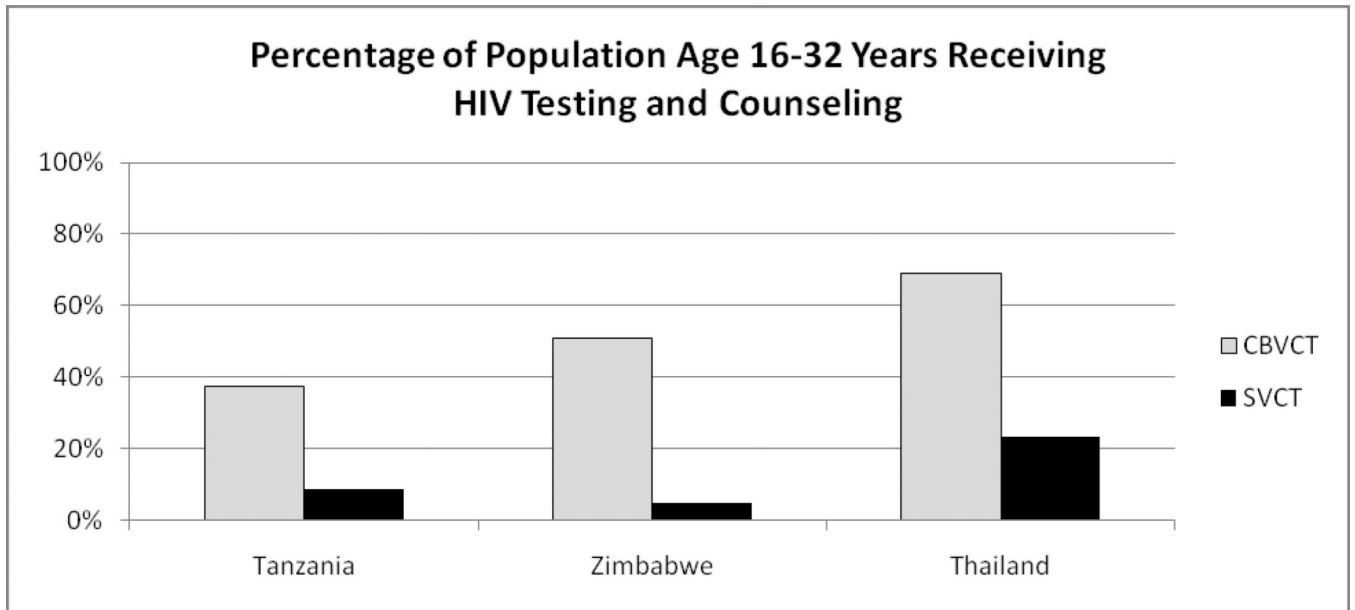


Figure 1.
Percentage of Population Aged 16–32 Years Receiving HIV Testing and Counseling

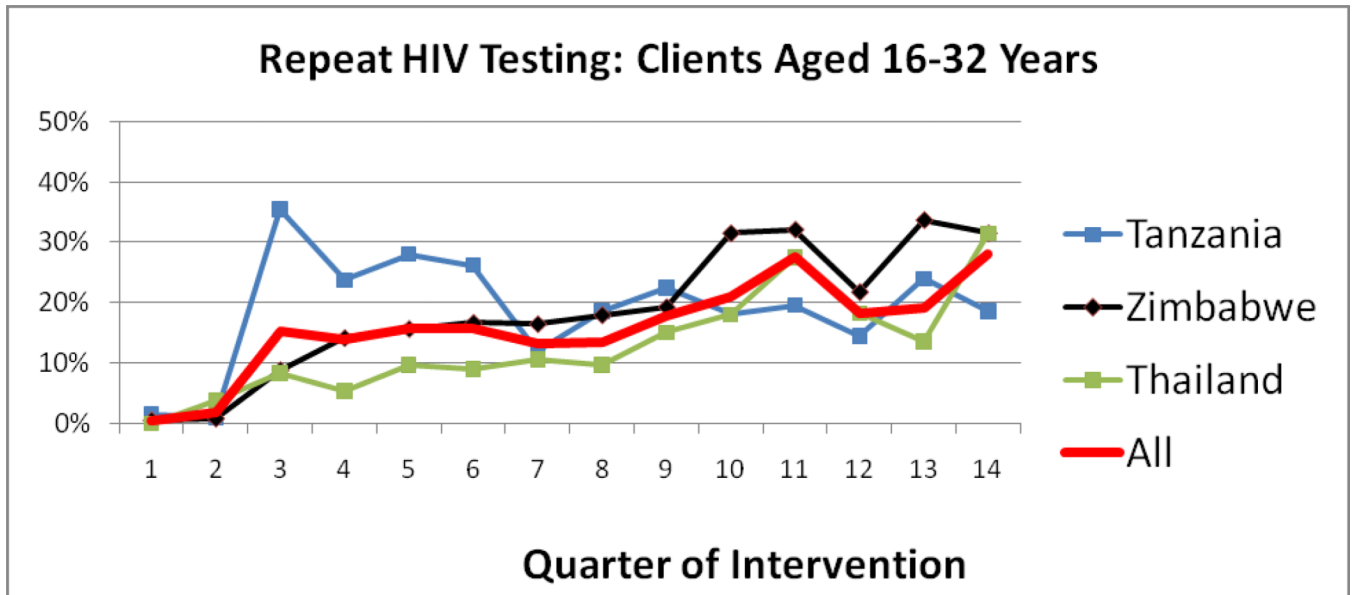


Figure 2.
Percentage of CBVCT Residents Repeating HIV Test at Project Accept CBVCT Service Venues for Persons Aged 16–32 Years

Table 1
Client Characteristics and Service Utilization Among Clients Aged 16 – 32 Years Testing for HIV

Characteristic Of Clients by Community Type	Tanzania		Zimbabwe		Thailand				
	Intervention N= 2,341	Control N= 579	P-value*	Intervention N= 5,437	Control N= 602	P-value*	Intervention [§] N= 9,361	Control [§] N= 2,721	P-value*
Age (Years)									
Mean	22.7	23.8	P<0.001	22.2	24.2	P<0.001	23.6	23.5	P<0.001
Median	22.0	23.4		21.6	24.0		22.8	23.7	
Age Groups (%)									
16 to 17	15.8	8.5	P<0.001	21.7	8.2	P<0.001	17.9	11.9	P<0.001
18 to 32	84.2	91.5		78.3	91.8		82.1	88.1	
Female (%)	41.7	47.2	P=0.019	48.2	46.3	P=0.386	54.5	65.9	P<0.001
Tested as Couple (%)	2.3	4.1	P=0.011	4.1	10.2	P<0.001	27.5	54.1	P<0.001
Pregnant at Time of Test (%) (Among Female Participants)	2.6 Mis=12	10.7 Mis=17	P<0.001	2.9 Mis=30	3.5	P=0.168	2.6 Mis=2,187	NA	NA
Time of Day Tested (%)									
Morning	36.1	50.9	P<0.001	13.4	49.2		12.1	NA	NA
Midday	50.3	44.9		50.9	40.2		2.1	NA	
Afternoon	13.6	4.1		35.7 Mis=29	10.6 Mis=110		85.8 Mis=3,118	NA	
HIV Prevalence (%)	3.7	6.9	P<0.001	12.8	22.0	P<0.001	1.9	3.4	P<0.001
Number Testing HIV Positive	86	40		693	132		173 Mis=181	92	

Mis = Missing data

NA = Not available, data were not collected

Source data do not include detail required to control for intraclass correlation from such sources as village or household proximity and thus p-values may be smaller than if adjustment for intraclass correlation had been made.

[§] Repeat testing data were not collected in Thailand in SVCT Venues. Values shown for Thailand include persons who repeat tested in SVCT venues. For results in Table 2 and Figure 1 an adjustment was made to remove these cases from analysis based on estimated frequency of repeat testing at Thai SVCT venues.

Table 2

Patterns of HIV Testing Across Study Arms for Persons Aged 16–32 Years

Parameter	Tanzania		Zimbabwe		Thailand	
	Among CBVCT Community Residents	Among SVCT Community Residents	Among CBVCT Community Residents	Among SVCT Community Residents	Among CBVCT Community Residents	Among SVCT Community Residents
[A] Population Size	6,250	10,033	10,700	10,033	11,290	10,033
[B] Total HIV Tests in CBVCT Venues	2,810	6	5,911	15	7,346	41
[C] Number of Repeat Tests in CBVCT Venues	487	1	1,106	1	1,103	0
[D] Total HIV Tests in SVCT Venues	22	679	668	595	3,118	2,680
[E] Number of Repeat Tests in SVCT Venues	4	105	36	7	1,559 [§]	402 [§]
Number of First Time HIV Tests*	2,341	579	5,437	602	7,802 (N= 9,361 without removal of estimated SVCT Repeat Testing)	2,319 (N= 2,721 without removal of estimated SVCT Repeat Testing)

* Number of First Time HIV Tests = ((B + D) – (C + E))

[§] Information on repeat testing was not collected in Thailand in SVCT Venues. Value estimated to be 50% of SVCT venue tests for CBVCT community residents. Value estimated to be 15% of SVCT venue tests for SVCT community residents.