California Center for Population Research
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Abstract

Objective: To examine the acceptance of repeat population-based voluntary counseling and testing (VCT) for HIV in rural Malawi.
Methods: Behavioral and biomarker data were collected in 2004 and 2006 from approximately 3,000 adult respondents. In 2004, oral swab specimens were collected and analyzed using enzyme-linked immunosorbent assay (ELISA) and confirmatory Western blot tests while finger-prick rapid testing was done in 2006. We use cross-tabulations with chi-square tests and significance tests of proportions to determine the statistical significance of differences in acceptance of VCT by year, individual characteristics and HIV risk.
Results: First, over 90% of respondents in each round accepted HIV test, despite variations in testing protocols. Second, the percentage of individuals who obtained their test results significantly increased from 67% in 2004 when the results were provided in randomly selected locations several weeks after the specimens were collected, to 98% in 2006 when they were made available immediately within the home. Third, whereas there were significant variations in the socio-demographic and behavioral profiles of those who were successfully contacted for a second HIV test, this was not the case for those who accepted repeat VCT. This suggests that variations in the success of repeat testing might come from contacting the individuals rather than from accepting the test or knowing the results.
Conclusions: Repeat HIV testing at home by trained health care workers from outside the local area, and with either saliva or blood, is almost universally acceptable in rural Malawi, and thus likely to be acceptable in similar contexts.

Keywords: Repeat acceptance; population-based voluntary counseling and testing; HIV; rural Malawi.

INTRODUCTION

Comprehensive and regular voluntary counseling and testing (VCT) for HIV has been promoted as one strategy to curb the spread of HIV and as an essential element for antiretroviral treatment (ART) programs.[1-3] In sub-Saharan Africa (SSA)-- the region most affected by the AIDS epidemic-- most of those who wish to be tested have to travel to a VCT or health facility, which may be a barrier to testing.[4] There has, however, been an increase in the number of population-based surveys that have conducted door-to-door HIV testing in the region, including the Demographic and Health Surveys (DHS) that have conducted population-based HIV testing in more than a dozen countries in SSA since 2001. Randomized trials and other community-based studies have documented greater acceptance of door-to-door VCT than when the services are provided in clinics.[4-8]

Although regular testing is a potentially promising prevention strategy in high HIV prevalence areas, few studies[2] of door-to-door testing in population-based samples have examined whether those who have received their results once will agree to be tested and receive their results again. This paper examines differentials in the acceptance of testing, test results, and repeat VCT for HIV among a population-based sample of adult respondents in rural Malawi.

METHODS

Data

The data come from the Malawi Diffusion and Ideational Change Project (MDICP), a longitudinal study conducted in three rural sites in Malawi: Rumphi in the Northern region, Mchinji in the Central region, and Balaka in the Southern region. The project has conducted five waves of data collection: 1998, 2001, 2004, 2006, and 2008; in 2008, the project's name was changed to Malawi Longitudinal Study of Families and Health (MLSFH) to reflect the diverse research interests of the project team members.

The project introduced HIV testing in the third wave of the study in 2004; a total of 3,284 respondents were contacted in their homes, and 2,983 (91%) provided samples for HIV testing. The samples were collected by trained nurses from outside the study sites using Ora-Sure™ Oral swabs. In addition, men were tested for Gonorrhea and Chlamydia using urine samples while women were tested for the two sexually transmitted infections (STIs) and Trichomonas using vaginal swabs. Consent for both tests (HIV and other STIs) was sought separately such that respondents could provide samples for either, both, or none of the tests. The percentage of contacted respondents that provided samples for the other STI tests was slightly lower than that for HIV test (89% versus 91%). Whereas equal proportions of men and women provided samples for HIV test (91%), a slightly lower proportion of women (88%) than men (91%) provided samples for the other STI tests, perhaps reflecting discomfort with vaginal swabs among some of the women. The specimens were analyzed at the University of North Carolina Project's laboratory in Lilongwe (Malawi) using enzyme-linked immunosorbent assays (ELISA) and confirmatory Western blot tests for HIV, and Roche PCR for STIs.[9]

Test results were available two to four months after collecting the specimens. To preserve confidentiality, each specimen was labeled with unique biomarker identification (ID) number, and respondents were given a Polaroid picture with their ID number to present when returning for test results. Team nurses provided the results and post-test counseling to respondents in mobile VCT clinics (small tents that served as private quarters) that were put up near the study villages once the results were available. To allow the investigation of the effect of distance on the uptake of HIV test results, the tents were placed at randomly selected locations within zones comprising villages grouped on the basis of the geo-spatial (GPS) coordinates of respondent households. The average linear distance to a tent was approximately two kilometers; 95% of those tested lived within five kilometers of the tents.[10]

The project also examined whether motivation to receive test results could be increased by a small monetary incentive. The VCT nurses offered those who provided specimens the opportunity to participate in an incentive lottery in which they drew bottle caps marked with amounts ranging from 0 to 300 Malawi Kwacha (approximately 0 to 3 US dollars) out of a bag. The amount drawn was recorded on a voucher bearing the respondent ID, which was to be redeemed upon returning for the test results.[10] The average voucher amount was approximately one US dollar, worth slightly less than a day's wage.[11] The zero incentive was intended to gauge the demand for learning HIV results among those receiving no financial incentives. The distribution of zero and non-zero incentives was closely monitored to ensure that rules of randomization were adhered to.[10]

In 2006, the project offered HIV testing again; certified VCT counselors (also from outside the study sites) conducted rapid HIV tests (using parallel Determine™ and UniGold tests) in respondents' homes. Respondents were given the option of receiving their test results in their homes or at mobile clinics (tents) which were to be set up at the end of the survey; virtually all of them chose the former. In order to preserve confidentiality, the respondent and the VCT counselor together disposed of the test kit in a pit latrine after the VCT counselor showed the respondent the test results and offered post-test counseling. A total of 2,987 respondents were successfully contacted and offered an HIV test; 2,758 (92%) were tested. There was no incentive lottery in 2006 due to the use of rapid testing.

Of those sample members who were successfully contacted in 2006, 26% had not been tested in 2004 because they refused (5%), were away at the time of the survey (4%), or were included in 2006 as new sample members, that is, new spouses to those already in the sample (17%). In addition, about one-third (32%) of those who accepted an HIV test in 2004 were not tested in 2006 primarily due to mobility (12%), refusal (4%), death (1%), and inability to trace the respondent (15%). Loss to follow-up was somewhat higher in the South compared to the other two sites due to higher mobility and frequent name changes among respondents. However, this is unlikely to introduce bias.[12-14]

This paper presents data from the 2004 and 2006 waves. The data collection during these two waves, including the HIV/STI tests and the 2004 incentive lottery, were approved by the Ethical Review Committees of the University of Malawi's College of Medicine and the University of Pennsylvania in the United States.

Analysis

The analytic strategy in this paper is based on simple descriptive statistics, primarily cross-tabulations with chi-square tests as well as tests of proportions to determine the statistical significance of the observed associations and differences in acceptance of testing, test results, and repeat VCT for HIV by year, individual characteristics, and HIV risk. Acceptance of repeat VCT in this analysis refers to accepting testing, obtaining the test results and receiving post-test counseling in 2006, conditional on being tested and obtaining the test results in 2004.

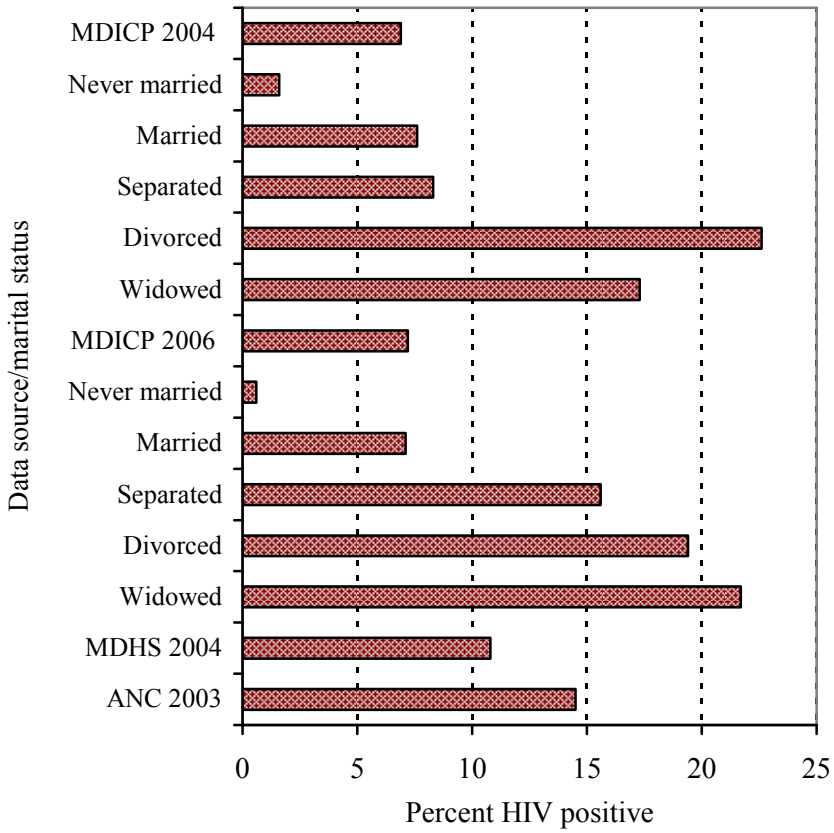
RESULTS

HIV/STI prevalence and HIV incidence

HIV prevalence in the MDICP sample remained stable at 7% between 2004 and 2006. The 2006 prevalence is likely to be a slight overestimate, however, since it includes those who were HIV-positive in 2004 but refused the test in 2006 or were temporarily away in 2006 (non-respondents), and excludes those who were negative in 2004 but were not tested in 2006, for similar reasons. The rationale for this approach (of obtaining the 2006 prevalence), which in our opinion yields a more accurate estimate, was the higher loss to follow-up in that year (conditional on survival) and the higher likelihood of refusal among those who were HIV-positive in 2004 compared to those who were HIV-negative (see below), combined with the known HIV status of surviving non-respondents of the former (HIV-positive) but not of the latter (HIV-negative) group.

Both the 2004 and the 2006 MDICP estimates of HIV prevalence are considerably lower than the estimates for rural Malawi based on data collected in 2003 from all the rural antenatal clinics (ANC) in the national HIV surveillance system (15%).[15] They are also lower than the estimates based on the 2004 Malawi Demographic and Health Survey (MDHS 2004), which tested a representative sample of the national population and found rural prevalence to be 11%[16] (Figure 1). Age-standardization, using the MDHS 2004 age distribution as the standard, did not significantly change the MDICP estimates. A potential explanation for the variations in the HIV prevalence estimates between the MDICP and the MDHS is sampling variability coupled with the geographic variation in HIV prevalence. HIV prevalence has, for instance, been found to be higher near the market centers than in the rural villages.[17] The MDICP sample probably consists of a larger proportion of individuals from the rural villages than the MDHS or ANC, hence the lower prevalence. Differentials and trends in prevalence are unlikely to be significantly affected by variations in the availability of antiretroviral treatment, since rural Malawians had limited access to treatment before 2004.[18]

Figure 1: HIV prevalence in rural Malawi by data source and by marital status (for MDICP data only)



MDICP- Malawi Diffusion and Ideational Change Project; MDHS- Malawi Demographic and Health Survey; ANC- antenatal clinic.

The prevalence of the other STIs was also low. Only 3% of the respondents who accepted STI testing tested positive for Gonorrhea. The prevalence of Gonorrhea was significantly higher among women (5%) than among men (0.3%; $p<0.01$) and in the South (5%) than in the Center (2%) or the North (1%; $p<0.01$ in each case). The prevalence of Chlamydia (0.3%) was substantially lower than that of Gonorrhea but reflects similar differentials: higher among women (0.5%) than among men (0.1%), and in the South (0.5%) than in the Center (0.2%) or the North (0.1%). Unlike Gonorrhea or Chlamydia, however, the prevalence of Trichomonas among women who accepted STI testing (2%) was higher in the Center (4%) than in the South (3%) or the North (1%). The low STI prevalence in the MDICP sites is consistent with the low national prevalence of Syphilis (3%).[15] With the exception of Trichomonas, the differentials in the prevalence of the other STIs in the MDICP sites largely mirror HIV prevalence: highest among women, and highest in the South followed by the Center and then the North.

The estimated HIV incidence for the sample is 0.7 (95% confidence interval (CI) 0.4-1.0) per 100 person-years (PY). Similar to differentials in the prevalence of HIV and

other STIs, incidence was higher among women (0.8 per 100 PY) than among men (0.5 per 100 PY), although the difference was not statistically significant. It was also significantly higher in the South than in the other regions (1.3 per 100 PY versus 0.3 per 100 PY in the Center and 0.4 per 100 PY in the North; $p<0.01$ in each case). These estimates are, however, based on the sample of individuals who participated in HIV testing in both 2004 and 2006. It is worth noting that the loss to follow-up (about 30% of those who were tested in 2004) may introduce an upward bias in the estimates if those who were HIV-negative in 2004 but who did not participate in the test in 2006 had a lower risk of infection than their counterparts who accepted the subsequent test; a downward bias would result if they had a higher risk of infection than those who accepted the second test.

Acceptance of HIV testing

The acceptance of HIV testing among those successfully contacted for the test remained high (over 90%) and stable over the two survey years. There was also no significant difference in the proportion of individuals accepting the test by respondents' background characteristics such as age, gender or study site (Table 1). The high acceptance contrasts with our expectation of high likelihood of refusal, which was based on various factors such as ambivalence about the value of an HIV test, the potential fear of stigma, and the limited availability of treatment prior to 2004.[19-22]

An obvious advantage of being tested at home is that it reduces the cost incurred in terms of distance and time to obtain the services. At the time of the 2004 testing, for instance, the nearest clinic where respondents from the study site in the South could obtain HIV tests was in Blantyre, about a two-hour drive, with bus fare costing on average the equivalent of US $4. In the Northern site, the nearest HIV testing facility was in Mzuzu, about a one-hour drive, with bus fare costing on average the equivalent of US $2. In addition, home-based testing might also have reduced the psychosocial costs of coping with an unfamiliar urban health facility, perhaps amplified by the widespread perception of health facility personnel as unfriendly. Our explanation cannot be complete, however, since the MDHS also conducted door-to-door HIV testing in 2004 and a high proportion of individuals (22% of rural respondents) refused the test.[16] The MDHS took blood samples, which may have accounted, at least in part, for the high percentage of individuals refusing the test. In addition, perhaps the MDICP was advantaged by being known in the community, since respondents had already been surveyed twice before 2004.

Table 1: Percentage of individuals who accepted HIV test among those contacted for the test and percentage that obtained the test results among those who accepted the test by selected background characteristics, MDICP 2004-06

	MDICP 2004				MDICP 2006			
	Accepted HIV test		Obtained test results[a]		Accepted HIV test		Obtained test results	
Characteristics	%	*N*	%	*N*	%	*N*	%	*N*
Age group								
Adolescents (15-24)	90.1	1,124	63.0	1,009	92.6	769	98.6	712
Adults (25+ years)	91.3	2,153	69.5	1,960	92.3	2,218	98.3	2,047
Gender								
Male	90.7	1,517	66.6	1,373	92.2	1,326	98.5	1,222
Female	91.0	1,767	67.8	1,600	92.5	1,661	98.4	1,573
Study site								
South	90.2	1,189	71.6	1,072	87.4	955	98.0	836
Center	90.1	1,000	72.9	893	91.9	1,041	99.1	957
North	92.2	1,095	57.6	1,008	97.5	991	98.1	966
Highest education level								
No formal schooling	91.7	506	76.3	464	90.2	755	98.4	682
Primary education	91.0	2,244	68.2	2,036	92.9	1,810	98.7	1,681
Secondary and above	91.4	443	54.7	402	94.1	406	97.1	382
Marital status								
Never married	92.7	558	64.3	516	94.5	329	99.0	311
Currently married	90.7	2,455	68.5	2,217	92.1	2,479	98.3	2,283
Formerly married[b]	94.6	129	71.3	122	92.1	178	98.8	164
HIV status								
Negative	n/a	n/a	67.6	2,755	n/a	n/a	98.7	2,610
Positive	n/a	n/a	62.8	204	n/a	n/a	94.4	142
Indeterminate[c]	n/a	n/a	64.3	14	n/a	n/a	83.3	6
Total	**90.8**	**3,284**	**67.2**	**2,973**	**92.3**	**2,987**	**98.4**	**2,758**

[a]Specimens for 10 individuals who accepted HIV test in 2004 were spoilt; [b]Formerly married refers to separated, divorced and widowed; [c]These were results that remained ambiguous: all the indeterminate cases in 2004 turned out to be HIV-negative in 2006 when a different testing protocol was used; *N*- total number of respondents: under each category, this may differ from the grand total due to missing data; n/a- not applicable because HIV status is only determined for those who accepted the test; MDICP- Malawi Diffusion and Ideational Change Project.

Obtaining the test results

In 2004, HIV test results were available for 99.7% of those who provided the saliva specimens. Of these, about two-thirds (67%) obtained them. In contrast, nearly all respondents (98%) who accepted HIV test in 2006 obtained the results (Table 1). There were significant differences in the proportion of individuals who obtained their test results in 2004 by age group (χ^2=12.6; p<0.01), study site (χ^2=64.2; p<0.01), and educational attainment (χ^2=46.8; p<0.01). In 2006, however, these differences were not significant. These changes (in the proportion obtaining test results and in the significance of variations by socio-demographic characteristics) could partly be attributed to the introduction of rapid testing in 2006. Nonetheless, some of the concerns for HIV testing

such as distance, treatment availability, and ambivalence might also be relevant for obtaining the test results.

To begin with, distance from the respondent's home to the VCT tent was found to have a strong negative effect on whether an individual obtained the test results in 2004: those who lived within 1.5 kilometers were 4.4 percentage points more likely to obtain their test results than those who lived more than 1.5 kilometers but within 5 kilometers from the tents.[10] Second, the significantly larger fraction of respondents who obtained their HIV test results in 2006 as compared to 2004 is also likely to be related to the differential time lag in the availability of results. Rapid testing in 2006 provided the results within 20-30 minutes; in 2004, the requirement for lab testing and establishing mobile VCT clinics caused a delay of two to four months. The time lag in 2004 may have reduced the uptake of HIV test results as some people might have changed their mind while others might have moved, died, or were temporarily away or bed-ridden by the time the test results were available. Third, in contrast to 2004, by 2006 treatment was more available and free, which might have motivated more people to learn their HIV status during the second testing. In addition, Malawi held its first National Testing Week in July 2006, which may have increased the motivation to learn the results.

The incentive experiment was also significantly associated with the likelihood of obtaining the test results in 2004. In particular, drawing a non-zero incentive and the amount of the non-zero incentive were found to be significantly associated with higher likelihood of obtaining the test results in 2004 compared to drawing a zero or small incentive amount.[10]

The overwhelming majority of those who received their results in 2004 were, as expected given the local prevalence, HIV-negative. In communities (such as the study sample) where individuals overestimate the prevalence of HIV and their likelihood of being HIV-positive,[23] disclosure of negative HIV test results to others could motivate them to learn whether they also were negative. The likelihood that an individual obtained test results in 2004 was, for instance, found to be significantly associated with nearby neighbors also obtaining theirs.[24] In addition, the 2006 survey round asked respondents to whom they disclosed their results and who disclosed their results to them. A high proportion told someone: 85% of HIV-negative women reported telling their results to their spouses (with 95% of the spouses of these women confirming that they were told the results), 47% told a relative, and 33% told a friend. A lower but nonetheless substantial proportion of those who were HIV-positive (79%) disclosed their results to someone.

Acceptance of repeat VCT

Slightly more than three-quarters (77%) of those who were tested for HIV and who obtained their test results in 2004 were successfully contacted for a second test (Table 2). The probability of successful contact for repeat HIV testing in 2006 was higher for those who tested negative in 2004 than for those who tested positive ($p<0.01$), a pattern that is most likely related to the differential morbidity and mortality by HIV status i.e., some of those who were HIV-positive in 2004 might have died or they might have been hospitalized with complications from HIV infection.

It is notable that whereas there were significant variations in the socio-demographic and behavioral profiles of those who were re-contacted for a second HIV test, there was little significant variation in the profiles of those who accepted the second test or those who obtained the test results (Tables 2 & 3). Multivariate logit models of the probability of being successfully contacted in 2006 and of accepting testing conditional on being contacted result in similar conclusions (Appendix Table A1). In addition, nearly all those who obtained a negative HIV test result and were re-contacted accepted a second test and virtually all those who accepted the test obtained the results. Of those who learned in 2004 that they were HIV-positive, slightly more than half (52%) were re-contacted. Of these, 82% accepted a second test and nearly all those who accepted the second test obtained their test results.

Table 2: Conditional on accepting testing and obtaining the test results in 2004, percentage of respondents who were successfully contacted for HIV test in 2006, percentage of those who were contacted that accepted testing, and percentage of those who accepted testing that obtained the test results by HIV status in 2004 and by background characteristics, MIDCP 2004-06

	Successfully contacted in 2006 by HIV status in 2004 (%)			Accepted testing by HIV status in 2004 (%)			Obtained test results by HIV status in 2004 (%)		
Characteristics[a]	HIV-negative	HIV-positive	All respondents	HIV-negative	HIV-positive	All respondents	HIV-negative	HIV-positive	All respondents
Age group	**	ns	**	ns	ns	ns	ns	ns	ns
Adolescents (15-24)	64.5	28.6	64.1	96.5	100.0	96.5	99.1	100.0	99.1
Adults (25+ years)	84.2	53.7	81.7	96.0	81.5	95.2	99.5	98.1	99.5
Gender	*	**	*	ns	ns	ns	ns	ns	ns
Male	76.3	38.0	74.3	96.2	94.7	96.2	99.2	94.4	99.1
Female	80.4	61.5	79.1	96.0	77.1	95.0	99.6	100.0	99.6
Study site	ns	ns	*	**	*	**	ns	ns	ns
South	76.9	50.0	74.8	93.0	67.9	91.8	99.4	100.0	99.4
Center	77.5	53.2	76.0	95.9	88.0	95.6	99.6	100.0	99.6
North	81.7	56.0	80.6	100.0	100.0	100.0	99.3	92.9	99.2
Highest education level	**	ns	**	ns	ns	ns	**	ns	*
No formal schooling	85.6	62.5	83.8	95.3	84.0	94.7	99.5	100.0	99.5
Primary education	77.0	50.7	75.4	96.2	79.0	95.5	99.8	96.7	99.7
Secondary and above	74.3	30.8	72.0	97.7	100.0	97.8	97.7	100.0	97.7
Marital status	**	ns	**	ns	ns	ns	ns	ns	ns
Never married	61.5	14.3	60.3	96.5	100.0	96.5	98.8	100.0	98.8
Currently married	82.7	55.2	80.9	96.0	82.8	95.5	99.5	97.9	99.4
Formerly married[b]	78.6	50.0	74.8	96.3	75.0	94.4	100.0	100.0	100.0
Total	**78.5**	**52.3**	**76.9**	**96.1**	**82.1**	**95.5**	**99.4**	**98.2**	**99.4**
N	**1,862**	**128**	**1,999**	**1,462**	**67**	**1,537**	**1,405**	**55**	**1,468**

[a]All characteristics pertain to 2006; [b]Formerly married refers to separated, divorced and widowed; MDICP- Malawi Diffusion and Ideational Change Project; Chi-square tests: *p<0.05, **p<0.01, ns- not significant.

Table 3: Conditional on accepting testing and obtaining the test results in 2004, percentage of respondents who were successfully contacted for HIV test in 2006, percentage of those who were contacted that accepted testing, and percentage of those who accepted testing that obtained the test results by HIV status in 2004 and by HIV-risk characteristics, MIDCP 2004-06

	Contacted in 2006 by HIV status in 2004 (%)			Accepted testing by HIV status in 2004 (%)			Obtained test results by HIV status in 2004 (%)		
Characteristics[a]	HIV-negative	HIV-positive	All respondents	HIV-negative	HIV-positive	All respondents	HIV-negative	HIV-positive	All respondents
Number of unions	**	ns	**	ns	ns	ns	ns	ns	ns
Never married/married once	76.7	45.0	75.3	96.1	81.5	95.8	99.5	100.0	99.5
Multiple unions	84.8	58.8	81.9	96.2	82.5	95.1	99.8	97.0	99.6
Number of life-time sexual partners	ns	ns	ns	ns	ns	ns	ns	ns	ns
No partner/one	79.2	48.2	78.0	95.6	84.6	95.3	99.2	100.0	99.2
Multiple partners	82.3	56.8	80.3	96.4	81.5	95.7	99.6	97.7	99.5
Suspects spouse/partner of infidelity	**	ns	**	ns	ns	ns	ns	ns	ns
No/ no partner/ don't know	81.7	55.7	80.5	96.3	84.1	95.9	99.3	97.3	99.3
Suspects/ knows	73.3	48.9	70.3	95.1	78.3	93.7	100.0	100.0	100.0
Worried about getting AIDS	**	ns	**	ns	ns	ns	ns	ns	ns
No/ don't know	82.4	53.6	81.0	96.5	86.7	96.2	99.4	96.2	99.3
Worried a little/a lot	74.1	51.4	72.3	95.5	78.4	94.6	99.5	100.0	99.5
Perceived risk of current infection	*	ns	*	ns	ns	ns	ns	ns	ns
No/low risk/ don't know	79.1	49.0	77.5	95.9	81.6	95.4	99.4	97.5	99.3
Medium/high risk	72.1	64.3	70.9	99.1	83.3	96.8	100.0	100.0	100.0
Knows someone with/died of AIDS	**	*	**	ns	ns	ns	ns	ns	ns
No/don't know	59.3	88.9	62.0	98.2	75.0	95.2	100.0	100.0	100.0
Yes	81.2	50.4	79.3	96.0	83.1	95.5	99.4	98.0	99.4
Total	**78.5**	**52.3**	**76.9**	**96.1**	**82.1**	**95.5**	**99.4**	**98.2**	**99.4**
N	**1,862**	**128**	**1,999**	**1,462**	**67**	**1,537**	**1,405**	**55**	**1,468**

[a]All characteristics pertain to 2006; MDICP- Malawi Diffusion and Ideational Change Project; Chi-square tests: *p<0.05, **p<0.01, ns- not significant.

DISCUSSION AND CONCLUSIONS

The results of this study expand the available evidence on repeat HIV testing among population-based samples. First, the proportion of respondents accepting HIV testing was high and stable over time despite the obstacles (real or perceived) to testing and regardless of the testing protocol. There are a number of possible explanations for the apparent preference for at-home testing, including the cost of traveling to health facilities and what appears to be a greater trust that the testing procedure will be confidential. Qualitative evidence from the MDICP as well as from a similar study in Uganda that provided rapid testing at home show that individuals expressed preference for home-based to clinic-based VCT because of confidentiality concerns at the clinic.[4,25,26] This is a useful result for policy-makers, given the recommendations of WHO and UNAIDS regarding regular testing for all to curb the spread of HIV/AIDS.[3]

Second, both distance and a delay between testing and the availability of results are important barriers to receiving results. Distance is associated with costs in transport and time; delay means that the circumstances or motivation of some of those who would have obtained their results may have changed-- they may have moved, died, or changed their mind.[27] The role of distance and delay are likely to be amplified in contexts where people overestimate the transmission probabilities of HIV and thus their likelihood of being HIV-positive, as in rural Malawi.[23]

Third, our study documented significant variations in the socio-demographic and behavioral characteristics of those who were successfully contacted for the second HIV test. In contrast, there was little significant variation in the profiles of those who accepted repeat VCT (accepted testing and obtained the test results for the second time conditional on having done so during the first testing). This suggests that significant variations in the success of repeat population-based testing arise due to the differential probabilities of finding individuals for repeat VCT, rather than from the differential probabilities of accepting the test conditional on successful re-contact or of learning the results of the test. We can, however, only speculate as to why individuals accepted repeat VCT. Perhaps those who learned they were HIV-positive in 2004 hoped that a test in 2006 would disprove those results; perhaps those who learned they were HIV-negative in 2004 but had subsequently engaged in risky behavior hoped that a test in 2006 would show that they were still negative. In addition, it is likely that having been tested once would reduce the psychosocial costs of testing. We also speculate that in a context where many overestimate their likelihood of being HIV-positive as well as the prevalence of HIV in their community,[23] the disclosure of negative test results to relatives, friends and neighbors may increase the acceptability of testing, as would, dissemination of accurate information about HIV prevalence in the area.

KEY FINDINGS/MESSAGES

- Repeat door-to-door HIV testing is almost universally acceptable in rural Malawi and the few studies (of home-based VCT) from elsewhere suggest that it is likely to be so in similar contexts.

- Distance to a VCT facility is an important barrier to receiving results; a delay between testing and the availability of test results, and the accessibility and cost of treatment may also be important barriers to receiving results.
- Significant variations in the success of repeat population-based HIV testing are likely to result from the differential probabilities of locating individuals for repeat VCT, rather than from the differential probabilities of accepting the test conditional on successful re-contact, or of learning the results of the test.

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COMPETING INTERESTS

The authors have no competing interests; none of them is affiliated with the NIH or the NICHD that funded the project.

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CONTRIBUTIONS OF AUTHORS

Francis Obare worked as a Graduate Student Assistant in the 2004 and 2006 MDICP surveys; he was in charge of preparing this manuscript and doing the relevant analyses.

Peter Fleming served as the Research Director in the two surveys; he worked closely with Francis Obare in preparing this manuscript.

Philip Anglewicz coordinated the biomarker collection in 2004 and served as Fieldwork Director in 2006; he was also in charge of data management and prepared the data for this paper.

Rebecca Thornton was in charge of the incentive experiment and the provision of VCT in 2004; she has also contributed toward the preparation of this manuscript, especially the sections on incentives and obtaining of the test results in 2004.

Francis Martinson was responsible for managing the laboratory analysis of HIV and STI samples and for reviewing the HIV testing protocol in 2004.

Agatha Kapatuka was responsible for training the nurses and VCT counselors in 2004 and 2006 respectively.

Michelle Poulin served as Fieldwork Director in 2004 and also contributed toward the preparation of this manuscript.

Susan Watkins and **Hans-Peter Kohler** were the Principal Investigators in 2004 and 2006; they were also responsible for giving direction on the shape and form of this manuscript.