The Impact of Incentives on Learning HIV Status: Evidence from a Field Experiment

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ABSTRACT

Many argue that there are huge monetary and psychological costs to learning HIV status. I find that these barriers can be easily overcome. After being tested for HIV, individuals in rural Malawi were randomly assigned monetary incentives to return for their results. Without any monetary incentives demand for HIV was moderate: 39 percent of those tested returned to learn their HIV results. However, randomly assigned monetary rewards had large and significant effects on learning HIV results and increased overall attendance to counseling centers by over 100 percent. Distance to randomly-placed counseling centers had a negative impact on returning for results where living under a kilometer from the center increased attendance by 8 percent. These results have strong policy implications for designing interventions to increase testing, especially as antiretroviral therapies become more available.

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1 Introduction

Over the past two decades, the HIV/AIDS epidemic has devastated Africa with over 2.3 million AIDS-related deaths and 25 million adults and children infected with HIV in 2001 (UNAIDS 2001). One suggested intervention to promote behavioral change and alleviate the spread of the disease is HIV testing. In fact, voluntary counseling and testing (VCT) programs have been declared the "missing weapon" in the battle against AIDS (Holbrooke and Furman 2004). Many international organizations and governments throughout Africa have called for massive scaling-up of counseling and testing, requiring large amounts of monetary and human resources to be devoted to providing testing services. For example, in South Africa government expenditures on counseling and testing went from 2.4 million dollars in 2000 to 17.3 million in 2004 and in Mozambique, 55 percent of the total expenditure on HIV/AIDS programs was spent on VCT (Martin 2003)[1]. Although testing is currently conducted among referred and voluntary clients, mandatory testing has been widely discussed as a potential option to increase knowledge of HIV status, promote behavioral change, and administer antiretroviral therapies (Holbrooke and Furman 2004), (Reporter 2004), (Mandatory Testing Bolsters Botswana in Combating AIDS 2004), (Nyathi 2003)[2].

Underlying the emphasis on testing are two assumptions: first, that individuals want to know their HIV status and would utilize services if they were provided inexpensively. Second, that after being tested and learning HIV results, individuals positively change their behavior. That is, those diagnosed HIV positive prevent the spread of the disease to others, and those diagnosed HIV negative protect themselves from future infection. Despite the fact that understanding these assumptions theoretically and testing their validity empirically is crucial, there have been few rigorous evaluations to do so ((Glick 2004), (Catania

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et al. 1990)). In this paper, I address the first assumption: whether there is a demand for learning HIV results, and, how changes in costs and benefits impact this demand.

It is theoretically ambiguous if the individual value of HIV testing is positive or negative. While there may be strong motivations for testing and acquiring the results for diseases that are easily and inexpensively treated, these incentives may be absent for HIV because of the inability to cure the disease and the limited access to anti-retroviral therapies. Many have suggested that there huge barriers to HIV testing that include monetary costs of paying for tests, traveling and opportunity costs of time, social stigma, and psychological costs such as fear, worry, and stress. Individuals may also overestimate the negative emotional impact of hearing that they HIV positive when calculating the expected value of learning results further reducing the demand for knowing results (Wilson and Gilbert 2003). On the other hand, there may be large benefits to knowing HIV status: testing reduces uncertainty thereby increasing utility, those diagnosed negative can protect themselves from future infection, and altruistic individuals diagnosed positive can prevent spreading the virus to children or sexual partners.

Because it is uncertain whether or not there are strong barriers to testing and how costs affect the demand for learning HIV status from a theoretical standpoint, it is even more important to address these questions empirically. Yet previous studies suffer from selection bias, where the location of the testing center or the type of patient recruited for the study is correlated with his or her decision to test. This is the first study that randomly allocates knowledge of HIV status estimates the elasticity for the demand for learning HIV results and individuals' response to varying private incentives. In 2004, respondents in an on-going longitudinal study in rural Malawi were offered a free test for sexually transmitted diseases including HIV in their homes. At the time of the test, respondents were given vouchers, redeemable upon attending a VCT center to hear their results two months later. The amount of each voucher ranged between zero and three dollars and was randomly allocated to each individual.

I find that the demand for HIV information without incentives is moderate: 39 percent of those who were given no monetary incentive returned for their results. More notably however, returning for results is highly elastic and varies greatly with the small amounts of monetary incentives: receiving any incentive increases attendance at the testing centers by 100 percent. Although three dollars of incentives is worth several days' wages in rural Malawi, the response to incentives is non-linear, where even tiny amounts of money offered shows large gains in VCT attendance.

In addition to using the randomized monetary incentives to vary private returns to learning HIV results, the location of each testing center was randomly assigned, ensuring that non-observables usually correlated with the location of testing centers are independent of attendance. This also provides for the secondary estimation of the impact of varying distance on test center attendance to learn HIV results. Distance has a negative impact of on returning for results: living within one kilometer from the VCT center increases attendance by 8 percent. I also find strong effects of spouses' incentives on VCT attendance, although no effects of neighbors' incentives.

The paper proceeds as follows. Section 2 provides information on the study design and data. Section 3 presents background on testing and the demand for HIV results. Section 4 presents results and section 5 concludes.

2 Project Design

2. 1 Background on Malawi and Description of the Data

Malawi is a land-locked country located in southern Africa that is ranked with one of the highest estimated HIV prevalence rate in the world (UNAIDS 2004) (Figure 1). The Malawi Diffusion and Ideational Change Project (MDICP), a collaborative project between the University of Pennsylvania and the Malawi College of Medicine, is a panel study of men and women randomly selected from 145 villages in the districts of Rumphi, Mchinji, and Balaka. These districts are located in the north, central, and southern regions respectively and differ by ethnicity, language, geography, religion, and primary occupations. Although the sample is not a nationally drawn sample, many characteristics match those observed in the Demographic and Health Survey (DHS) which nationally covers Malawi. Respondents were interviewed in 1998, 2001, and 2004. During the most recent data collection in 2004, an additional sample of adolescents (ages 15-24) residing in the original villages were added[3].

In 2004, all respondents were offered free tests for sexually transmitted infections including gonorrhea, chlamydia, trichomoniasis, and HIV. During May-August of 2004, nurses from outside each area engaged respondents in pre-test counseling and separately offered a free test for HIV and other sexually transmitted infections. Samples were taken through oral swabs for HIV and urine samples (men) or self-administered vaginal swabs (women) to test for other sexually transmitted infections (STI's)[4]. Table 1 presents the sample of respondents interviewed and tested in each of the districts. Sample attrition and test refusals are discussed below.

Across the three districts, 2720 respondents were tested for HIV and have basic demographic data of age and education; this sample is used for the main analysis in this paper. The sample consists of 46 percent males and the average age of adults and adolescents is 34 (Table 1). 68 percent of the respondents were married at the time of the interview and eighty percent had ever gone to school, attending an average of five years. There are large differences in ethnicity and religion across the three districts: the Chewas in Mchinji and the Tumbukas in Rumphi are primarily Christian, the Yaos in Balaka traditionally practice Islam. The majority of the respondents are subsistence farmers, with fishing also a common profession in Balaka. The average annual crop yield in 2004 was 329 dollars[5].

The HIV prevalence rate was 6.7 percent (7.5 percent rates for females, 5.5 percent for males). Prevalence rates for other sexually transmitted diseases were even lower, with 3.5 percent infected with gonorrhea, 0.4 percent with Chlamydia, and 2.1 percent with trichomoniasis (not shown). The level of HIV infections for the MDICP sample is considerably lower than national and district hospital rates. The main source of this discrepancy is that most prevalence rate estimates are based on urban and antenatal

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[3] For further sampling details see http://www.malawi.pop.upenn.edu/Level%203/Malawi/level3_malawi_sampling.htm
[4] (Bignami-Van Assche et al. 2004) provides the full testing protocol.
[5] I calculate the annual production yield from shelled maize (4.5 dollars per 50 kg), tobacco (2 dollars per kg)of Tobacco, cottong (thirty cents per kg) and soy beans (60 cents per kg).

samples rather than rural population based samples[6]. Longitudinal sample attrition from death and migration (discussed below) may also bias the estimates downward as well as the fact that the prevalence rates in Table 1 include adolescents with lower rates of infection[7]. Respondents report an acute awareness of the impact of AIDS in their lives: 42 percent said they were very worried about being infected and a similar number report thinking they have a likelihood of being infected. Moreover, respondents attended an average of three funerals in the month preceding the interview, report having seven friends or family that died from AIDS and nine that they believe to be currently infected.

2.2 Experimental Design

The first part of the experimental design involved giving monetary incentives to respondents to obtain their test results. After taking the test samples, the nurses gave each respondent vouchers redeemable upon obtaining either their HIV or STI results. Voucher amounts were randomized for each individual by letting each respondent draw out of a bag a token indicating a monetary amount. In Mchinji and Balaka each respondent received two vouchers, one for returning for HIV results, and one for returning for STI results. In Rumphi, respondents received only one voucher redeemable by returning for either HIV or STI results[8]. I examine the impact of the total value of the incentive (the sum of the HIV and STI incentives). This distribution is presented in Appendix A. Vouchers ranged between one and three dollars. The average total voucher amount was 1.03 dollars, worth less than a day's wage[9].

The distribution of vouchers was carefully monitored to ensure that each nurse followed the rules of randomization[10]. Incentives were randomized at the individual level in order to provide transparency

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[6] Recent population-based studies in Kenya, Mali, and Zambia also find lower HIV prevalence rates than UNAIDS estimates.
[7] For example, the HIV rate among adolescents was only 1.7 percent.
[8] In Mchinji and Balaka there were no respondents who wanted HIV results but not STI, or vice versa.
[9] Using data from IFPRI between 2001-2002 I find that the average hourly wage among day-laborers ("ganyu work") is roughly 30 cents per hour ((IFPRI) 2000-2002). This does not take into account the fact that most individuals are not day laborers. Among the MDICP sample that tested for HIV, the reported average weekly income in 2001 was 9.5 dollars. To understand this wages in terms of purchasing power, the price of a coke is approximately 30 cents and a pair of Bata plastic shoes is approximately 1.80 dollars.
[10] On the first day of fieldwork nurses gave out higher incentive amounts than the distribution would suggest probable. This was evaluated and the nurses were instructed that continuation of employment was contingent upon

by allowing respondents to select their own voucher amount. Each voucher included the amount of the voucher, a respondent ID, nurse's signature, and a carbon copy was made in order to prevent forgeries. If a respondent drew a token indicating zero incentive, no voucher was given to the respondent. 20 percent received no monetary incentive to return for either HIV or STI results[11].

One to four months after collecting samples, test results became available and temporary VCT centers consisting of small portable tents were established in each study area[12]. In order to exogenously vary the distance needed to travel to the centers, VCT centers were placed randomly throughout the areas, stratified by village. Based on their Geo-spatial (GPS) coordinates, respondent households in villages were grouped into "VCT Zones" and a point was randomly selected within each zone to place a VCT tent[13]. The average distance from respondents' homes to a VCT center was 2.1 km. All respondents were within walking distance of an assigned VCT site and over 95 percent of those tested lived within five kilometers. Distance from houses to the VCT center is calculated as a straight-line distance and does not take into account roads or paths[14]. Appendix B shows the density of the distance from respondents' homes to VCT centers.

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following the instructions of randomization. Thereafter there was no significant difference between actual and assigned distributions of voucher amounts.

[11] Drawing a "zero" from the possible choices of incentives may have had a de-motivating effect on individuals, which may have impacted VCT attendance. Those drawing a "zero-incentive" may have been less likely to return for their results if they were upset by not receiving a positive-valued voucher, resulting in a downward bias of return rates and an over-estimate of the impact of the incentive. Because all of the respondents participated in the "lottery" draw, I am unable to estimate the potential effect of disappointment of drawing a "zero". However, this is likely to have had only a weak effect: HIV results were only available at VCT centers between one and four months after specimen collection, a substantial period of time for disappointment to diminish.

[12] At the time of this study rapid test were available for HIV tests but other STI tests required laboratory analysis in Lilongwe, Malawi. Additionally, the large number of samples tested at the laboratory as well as shortages in chemical reagents significantly increased the time to distribute results (Anglewicz et al. 2004). Additionally, although samples were taken in respondents' homes, giving HIV results immediately in respondents' homes may have threatened confidentiality.

[13] Depending on the number of tracked satellites, GPS locations are accurate between 10-15 meters. In most instances VCT tents were placed in the exact selected location and paths were created for easy accessibility.

[14]Calculating straight-line distance ignores natural boundaries such as roads or rivers and may underestimate the actual distance needed to travel. Respondents attending the VCT were asked how long it took them to travel to the VCT center (multiplying total time by two for those traveling by bicycle). The average time to reach the center was 43 minutes although distance and reported time traveled to the VCT only have a correlation of 0.39. This is likely to be low because respondents reported the general time needed to reach the VCT center rather than the time needed traveling from their home. Approximately 7 percent of the sample households have missing household GPS coordinates and in these cases, the distance to randomly assigned VCT centers are imputed by calculating the average distance to the center of each village.

Village leaders were notified when the centers were established and respondents were informed of the times and locations results were available. Respondents were allowed to attend any of the VCT centers but were only informed of the location and time of their assigned VCT center. Approximately six percent of respondents went to a center that they were not assigned to. Each center remained operational for approximately one week. Those who tested positive for sexually transmitted diseases were given free treatment and those who were HIV positive were referred to the nearest hospital or clinic for further counseling[15].

2.3 Sample Attrition and Test Refusals

In general, there is a good relationship between MDICP and its respondents and there have been no villages that have ever refused to participate in any of the three waves of data collection and refusal rates among respondents who are approached is low[16]. However, because the same respondents are followed over time, sample attrition occurs across waves due to death and migration. Between 1998 and 2001, 19 percent of all males and 16 percent of females were attritors, mostly due to migration (Van-Asche, Reniers, Weinreb, 2003). Appendix C presents longitudinal rates of successful interviews. In 2004, less than one percent of those approached refused to be interviewed, three percent of the interviewed sample in 2001 had died or were hospitalized, and 18 percent were away or had moved. The main reason for attrition across all waves of data is temporary and permanent migration[17].

In 2004, because HIV testing was conducted by taking saliva samples, rather than blood, there were relatively low refusal rates for the HIV test: 92.7 percent of those approached agreed to be tested. The refusal rates for other sexually transmitted diseases were also similarly low[18]. Not all spouses of

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[15] At the time of the study Antiretroviral therapies (ART) were not easily available for those living in the MDICP study sites due to extremely limited availability, high cost of drugs, and bureaucratic obstacles.

[16] This may in part be due to respondent gifts or to the employment of local high-school graduates as interviewers.

[17] Sample attrition is comparable to other longitudinal studies in Africa. In 2004, 11.3 respondents had attrited from a panel of Zambia households originally surveyed in 2001 ((Chapoto and Jayne 2005)). Similarly, KwaZulu-Natal Income Dynamics Study (KIDS) had 16 percent attrition between 1993 and 1998 ((Maluccio 2000)).

[18] Overall refusal of either an HIV or STI test were 9.8 percent, 7.6 percent, and 5.5 percent in Mchinji, Balaka, and Rumphi, respectively. These refusal rates are low in comparison to other population based testing programs. 2004-2005 Malawi DHS data collection involved test for HIV with blood specimens and had an estimated refusal rate of

respondents were offered a test: men who divorced or were widows and spouses of the newly sampled adolescents were ineligible for testing. Of all married individuals who agreed to an HIV test, 65 percent of their spouses accepted an HIV test, 3.1 percent refused, and 32 percent were ineligible or away and were not approached by nurses.

Sample attrition from the panel means there are disproportionately fewer mobile and sick individuals potentially leading to a downward bias in HIV prevalence rate[19]. Concerns that attrition poses a potential threat to the external validity of the study may be ameliorated because of the new representative sample of adolescents introduced in 2004 and the fact that HIV testing refusal rates were low. The sample used for analysis throughout this paper consists of those who accepted an HIV test and for whom basic demographic data of age and years of education is available.

3 Demand for Knowing HIV Status

Philipson and Boozer (2004) illustrate several factors affecting the demand for HIV results that shed light into the possible effects of monetary incentives. Given a prior belief of being HIV-positive before testing, and the expected utility of a behavioral outcome after learning negative or positive status, testing occurs when the expected utility of learning results is greater than the costs. The benefit of knowing HIV status is the value of updating behavior, weighted by the likelihood of being diagnosed HIV-positive or HIV-negative and may be either positive or negative. For those diagnosed HIV-positive, access to treatment is limited. For those that are altruistic, however, learning an HIV positive diagnosis will allow an individual to alter behavior and prevent HIV infection of sexual partners or children. For those that are HIV negative, after learning HIV status, individuals can also change their sexual behavior to protect themselves from infection, increasing future discounted utility. However, there are costs to learning HIV results.

over 25 percent. January 2005, Personal Correspondence, Zomba Malawi. In the Kenya DHS, 26.6 either refused or were absent for the test. (Lawrence Marum et al. 2004)

[19] However, observable characteristics of gender, age, religion, weekly income, and education, as well as worries of being infected are not significant predictors of accepting an HIV test.

The costs of testing include both direct monetary costs and non-trivial transportation and opportunity costs of traveling to the nearest VCT center. Although free testing is available is several urban centers in Malawi, the availability and costs of public transport make travel to VCT centers difficult, especially in the survey areas in this analysis. These types of costs have been suggested to be strong deterrents of attending testing centers in other studies ((Forsythe, Arthur et al. 2002), (Forsythe, Arthur G et al. 2002), (Laver 2001), (Leibowitz and Taylor 2004), (Fernandez et al. 2005)). In addition to tangible benefits and costs of testing, psychological factors may also influence the decision to test. Individuals may have disutility from the uncertainty of not knowing their HIV status ((Ransom et al. 2005), (Investigators 2004; Mugusi et al. 2002), (Flowers, Duncan, and Knussen 2003)). An adapted utility function, the psychological expected utility model (PEU), is one example where individuals experience feelings of anxiety prior to the resolution of uncertainty and have preferences for either early or delayed information (Caplin and Leahy 2004). A different psychological effect leads to anxiety in the present takes place where individuals overestimate the impacts of unpleasant events on future emotional states (Wilson and Gilbert 2003) [20]. Combining the fact that there is no cure for HIV with the expected psychological distress of being diagnosed positive may result in the expected value of learning results being considerably negative, reducing the demand for knowing results.

In fact, fear is often cited as one of the main reasons for low VCT utilization rates. Among study participants in Tanzania, 54 percent of those who did not return for HIV results stated that fear was the biggest factor (Mugusi et al. 2002). Individuals also report fear of stigma as a barrier to learning HIV results ((UNAIDS 2002), (Day et al. 2003), (Medley et al. 2004), (de Paoli, Manongi, and Klepp 2004) (Kalichman and Simbayi 2003)). The extent that fear or stigma plays a role in the decision to learn results is difficult to measure although anecdotal evidence suggests the fear of being HIV-positive is salient in the minds of those tested. Several respondents waiting to talk to nurses spoke about their fears and anxiety to hear results and one adolescent claimed "It is good that the VCT center is not located near the

[20] For example, a sub-sample of respondents in the southern region were asked: "How happy in general are you now?" on a scale from zero to ten. On average, respondents reported a happiness of 7.2. When asked how happy they would be if diagnosed negative, respondents reported a happiness level of 8.9 and a level of 3.1 if diagnosed positive.

river. If I were diagnosed positive, the only thing I could do is to throw myself into the river on my way home"[21] These psychological factors such as fear and anxiety may be strong deterrents to learning HIV results. VCT attendance by friends, neighbors, or a spouse may also impact the decision to return for results. To the extent that others' attendance reduces psychological anxiety, VCT attendance may increase if spouses or friends attend.

The many factors that affect the decision to test make it difficult to predict ex-ante the demand for learning HIV results and the distribution of these preferences. Surveys show considerable demand for HIV testing in the abstract but there is a considerable gap in the actual use of these services. According to a recent population-based survey in Malawi, although approximately 90 percent reported wanting an HIV test, only nine percent reported having been tested (DHS 2000). Another study in Zambia found that despite an initial interest in VCT services by 37% of respondents, only 3.6% actually went for VCT (Rosenvard et al. 1998). While it is likely that some of this apparent discrepancy is due to lack of testing centers, the extent to which people would utilize such services, were they provided to them, is not known, and asking individuals if they would like an HIV test may not be a reliable indicator of the demand for VCT services (Thornton et al. 2005).

Despite previous studies on testing and VCT, overall conclusions of the demand for knowing HIV results should be drawn with care. Most HIV testing in Africa is conducted in urban clinics whose clients mainly consist of either pregnant women attending ante-natal clinics or referred patients with HIV-related symptoms. Existing population-based studies have provided HIV results in respondents' homes (de Graft-Johnson et al. 2004) or have measured VCT uptake in existing peri-urban clinics (Matovu et al. 2002) which make generalizing their findings difficult. Factors that impact the decision to go to VCT may also be correlated with the location of the VCT center which biases the estimates of the demand for HIV testing. In this study, however, randomization ensures that observables and non-observables that are correlated to VCT location in other studies are independent of attendance.

[21] Author's Fieldnotes, December 20, 2004

Two views of the demand for knowing HIV status predict opposite effects of incentives on seeking HIV results. The first perspective suggests that there are large barriers to overcome in order to test for HIV, including both the monetary costs and any psychological costs. This would suggest that little impact of offering small incentives to learn results. Another view is that there are many people that are on the margin of wanting to know their results, implying that small changes to the costs or benefits of learning results would have large impacts. In this paper, I test between these two views.

It should be noted that learning HIV status often involves two separate decisions: first, the decision to give a blood or saliva sample for testing and second, the decision to learn results. Test results are typically not available until several days or weeks after samples are taken and a surprisingly large proportion of individuals who go to testing centers do not return for their test results. These statistics range between 33 and 95 percent in locations across Africa (Cartoux et al. 1998), and even in the United States where testing centers are relatively more convenient, only about two-thirds of all clients return for their results (Ekwueme et al. 2003). Same-day results (Rapid Tests) appear to increase uptake rates although it is not obvious if the client composition also changes. In the above discussion I have interchanged the decision to test with the decision to obtain results. For the analysis in this paper, however, I focus on the decision to learn HIV status condition on agreeing to an HIV test.

4 Results

The overall rate of returning for test results was relatively high with 72 percent of all respondents returning across the three districts. The rates of return differed slightly by region where 81 percent returned in Mchinji, 75 percent in Balaka, and 61 percent in Rumphi (not shown). The difference across regions may be due to the fact that VCT was conducted during different cycles of the agricultural season where there may have been higher opportunity costs of time during planting season resulting in lower average attendance rates[22].

[22] VCT was conducted immediately after harvest in Mchinji (July 2004), but during the planting season in Balaka (November 2004) and Rumphi (December 2004). Without more detailed time use data, however, effects of the agricultural season cannot be distinguished from regional effects.

4.1 Learning Results in Response to Incentives

To estimate the demand for learning HIV results and the response to monetary incentives, I denote Y_i as the decision of person i in village *j* choosing to hear her results, where Y=1 indicates attendance at the VCT center, and estimate:

$$(1)\ Y_{ji} = \alpha_i + \gamma_{1ij} AnyIncentive + \gamma_{2ij} TotalIncentive + X'\mu + \varepsilon_{ij}$$

In each specification I include age, age-squared, years of education, and gender as well as village fixed effects. Despite the fact that Y is a binary variable I use a linear model for the analysis because the estimates do not differ significantly from a probit model. I include both having any incentive and the total amount of the incentive because of non-linear effects of the incentive[23]. γ_1 is the estimate of the impact of being given any incentive on going for results and when $\gamma_1 \approx 0$ demand for HIV results are inelastic to small changes in costs and benefits. γ_2 indicates incremental effects of the amount of the incentive.

Receiving any positive-valued voucher increases VCT attendance by 38.4 percentage points (Table 2, column 1). Given that 39 percent of those with no incentive returned for VCT, having any incentive increased uptake by 100 percent. In each of the sample areas the presence of any monetary incentive increased the likelihood of obtaining results by 31, 49, and 40 percentage points respectively (not shown). An increase in one dollar increased the probability of returning for results by 9.3 percentage points significant at the 0.01 percent level (column 2) and this differs slightly across districts. The large values of β_1 indicate that returning to VCT is highly elastic to the presence of any monetary incentive. Figure 2 presents the histograms of the percent returning to hear HIV results as a function of receiving any incentive (Panel A) and the total amount of the incentive (Panel B). This diagram illustrates the large impact of receiving an incentive on attendance as well as the non-linear properties of receiving any incentive above zero. Vouchers valued over one dollar have similar effects on attendance.

[23] An alternative specification to the non-linearities would be to include log incentive or incentives squared although there is no change in results and specification (1) allows for easier interpretation.

Males are slightly more likely to attend than women and age has a positive impact on returning for results. Those under 20 years old were 4.0 percentage points less likely to attend VCT (significant at the 0.01 percent level, regression not shown), possibly due to the fact that many adolescents are in school and have larger opportunity costs of returning. VCT centers were open Monday through Saturday from approximately eight in the morning until six in the evening and it may have been more difficult for is school to attend VCT. On the other hand, it may be that unmarried adolescents were more shy to be seen attending the VCT signaling to others that they were sexually active: although 57 percent of those under 20 years old reported ever having sex, only 15 percent were married. In Balaka, those infected with HIV are ten percentage points less likely to attend VCT than those HIV-negative (14 percent less likely). In Mchinji and Rumphi HIV status appears to have no significant impact on attendance rates although it is difficult to make definitive conclusions because of the small number of HIV positives. Education is negatively associated with learning HIV results. Ever attending school (75 percent of the sample) reduces the probability of returning by 3.8 percentage points (significant at the 10 percent level, not shown).

To test interaction effects, I estimate:

$$(2)\ Y_{ji} = \alpha + \gamma_{1ij} AnyIncentive + \gamma_{2ij} TotalIncentive + \gamma_{3ij} V + \gamma_{4ij}(V * AnyIncentive) + X'\mu + \varepsilon_{ij}$$

where "V" is an observable characteristic of individual 'i' that I test for interaction effects with receiving an incentive. $\gamma_{4ij} \neq 0$ indicates any differential impact of the monetary voucher with "V" on VCT attendance. In Mchinji and Rumphi there are no differential impacts of the incentive on attendance between males and females. In Balaka, however, men receiving an incentive are 25 percentage points less likely to attend VCT than women receiving an incentive and overall, VCT attendance among women in Balaka is 17.6 percentage points lower than women in the other districts (significant at the 0.01 level, regression not shown). Because of historical gender restrictions within Islam, women in Balaka face higher opportunity costs of attending VCT, which may be one reason for the large differential impact of incentives[24]. There are no significant interaction effects of age or marital status and receiving an incentive. There is also no significant effect of being HIV positive and receiving an incentive although there is a relatively large, negative coefficient (-0.108, se 0.88, not shown). Those who have a larger annual crop production and receive an incentive are 5.5 percentage points less likely to attend VCT than those that don't receive an incentive (significant at the 0.01 percent level). This is confirmation that the monetary incentive is worth more to those with at lower levels of wealth or income.

In sum, incentives had a large impact on most individuals who received them on attending the VCT center. One good illustration of this was overheard by a woman saying "those who were lucky, were picking vouchers with some figures and were courageous to go and check their tests results because they were also receiving their money. Like me where I got a zero… I did not even go and check the results because I knew that there was nothing for me there."

4.2 Distance to Testing Centers

To measure the impact of distance from the nearest testing center on returning for HIV results, I first estimate a non-parametric locally weighted regression presented in Figure 3 (Fan 1992). I restrict the sample to the closest 95 percent of the sample, corresponding to those living within 5 km of each VCT center. Figure 3 clearly illustrates the strong negative impact of distance on returning for results, especially within one kilometer from the VCT center.

Regression estimates are presented in Table 3. Distance from the VCT center has a significant impact on returning to learn one's HIV status: each additional kilometer from the VCT center decreases the likelihood of returning for results by 2.9 percentage points (significant at the 0.05 percent level, not shown). Those living more than one kilometer of a center are 5.6 percentage points, or eight percent, less likely to attendance VCT than those living within one kilometer (column 1). The analysis includes basic demographic controls, HIV status, receiving an incentive as well as a control for the simulated average

[24] In Balaka 81 percent of the respondents are Muslim as opposed to less than one percent in Mchinji and Rumphi. Women in Balaka may also be less independent: in 2001, only ten percent of Balaka women reported going to the health center without their husband's permission as opposed to 22 percent in the other districts.

distance in each VCT zone. Because the location of the VCT centers were chosen randomly, as opposed to randomly assigning the distance needed to travel, I draw 1,000 simulated random locations in each VCT zone and calculate the average distance of each tested respondent from each of the 1,000 simulated locations. I average the distance for each respondent and take the mean distance across all respondents living in each zone. Without controlling for this simulated average term would ignore the fact that although locations were chosen randomly, the actual distance to the VCT center may be correlated with the density of the households in each zone. Not including it decreases the coefficient of distance in the pooled regression in column (1) of Table 8 to -0.029 (se 0.014).

The interaction of distance from a VCT center and receiving a monetary incentive has no significant impact on obtaining results (Table 3, column 3). In other words, monetary awards have the same impact on those living close and far away from the assigned center, implying time costs were not as important as monetary benefits in the decision to go to the VCT. Similarly, there are no interactions between distance and gender (not shown). There are substantial effects of being HIV positive and distance to the VCT: living within one kilometer of the VCT had a large positive impact on VCT attendance for those infected with HIV (column 4), perhaps because HIV positives were more likely to be bed-ridden or have difficulty traveling further distance. This may also be one explanation for any negative impact of HIV status on attendance overall (Table 2).

Despite the fact that the monetary vouchers were more influential in motivating individuals to travel to the VCT, distance does play a crucial role. Several VCT centers in Balaka were placed over 9 kilometers from sample households and were open several days without any attendance. Because of the lack of attendance, new random locations were chosen, sites re-located, and respondents informed of new VCT locations. The distant locations are excluded from analysis in this paper. This experience in Balaka suggests that distance has a non-linear impact on traveling to VCT centers and that the maximum distance individuals are willing to travel in this area was between 5 and 9 kilometers. This implies that the true effect of distance on VCT attendance may by underestimated and given that most permanent clinics in these areas are located over 20 kilometers away, distance may be one of the strongest contributing factors to the low VCT utilization rates.

4.3 Impact of Spouses Incentives on Attendance

Overall, having a spouse receive any incentive significantly increased VCT attendance by 8.9 percentage points, even when controlling for own incentives (not shown). However, almost all of this effect is being driven by the impact of wives' incentives on their husbands. Columns 1 and 3 of Table 4 present separate regressions for married men and married women whose spouses also tested for HIV, and shows that a spouse's incentive has a strong effect on men but almost none on women. Having a wife receive a positive valued voucher increases the likelihood of a man returning for his results by 19 percentage points, a magnitude even larger than the effect of his own voucher.

One potential explanation for the differential impacts of spouse incentives is that wives are influence their husbands to return for results. One qualitative study of individuals who tested for HIV in Australia found that men, rather than women, overwhelmingly stated the reason for testing was due to their sexual partner insisting on, and pressuring them to test (Luption, McCarthy, and Chapman 1995). Another possibility is no effect of a spouses' incentive is an indication of poor communication among partners. For example, it may be that men do not communicate monetary issues to their wives and thus there was no impact of a husband's incentive on his wife's attendance. On the other hand, those in poor relationships may not communicate with one another. Respondents were asked if they had any suspicion that their spouse had ever been unfaithful to them. 43 percent of men and 61 percent of women said that they suspected their spouse of cheating. Although there is little difference among men, for those women who said that they did not suspect their husband, there was a large positive impact of their husbands' voucher, which is suggestive that in relationships where there is still a good degree of trust between the couples, couples communicate well with one another and communicate about their voucher money (column 2).

5 Conclusion

In this paper I find that the demand for learning HIV status is highly elastic to small changes to its costs and benefits: a relatively small monetary incentive worth less than fifty cents increases VCT attendance by over 100 percent. Distance to VCT also has strong impacts on returning. The results in this paper suggest not only that the barriers to testing can be easily overcome but that financial incentives had similar effects among heterogeneous populations with differing ages, gender, HIV status.

There are several implications of these findings. First, if knowing HIV status has a positive impact on behavioral change, governments and health organizations wishing to promote voluntary counseling and testing may find it useful to offer subsidies to test and return for results. Providing access to clinics thereby reducing opportunity costs of attendance is also important and could be accomplished by bringing mobile VCT centers to rural populations or by giving small incentives less than 50 cents[25]. Small interventions such as educational programs that increase the salience of the benefits of testing or making testing centers more private and friendly may also have significantly large impacts on increasing testing rates. These results also suggest, however, that small increases in the costs to testing, such as negative rumors about HIV or the testing process, may have large negative effects.

These results may also explain the puzzle of underutilization of testing services, despite high levels of reporting intent to be tested: small changes in the costs to learning HIV results have large impacts. This presents an agenda for future research to understand why so many individuals are on the margin of wanting to know their results.

Reducing opportunity costs of attendance by offering subsidies to individuals to increasing the accessibility of clinics is likely to be an effective way to increase clinic attendance and testing. As antiretroviral therapies become more widely available, offering subsidies may be one strategy towards increasing adherence rates. Other studies have found strong positive impacts of offering subsidies for health behavior such as offering pregnant women free insecticide-treated bednets to attend prenatal clinics in rural Western Kenya (Dupas 2005). Offering cash incentives may also be a method to attract

[25] A recent program in Zimbabwe found that bringing portable VCT centers to communities to be highly effective after they had found high costs of the test and distance to be the biggest barriers to testing. (Janell Routh et al. 2004)

individuals to be tested and treated for other sexually transmitted diseases, having large impacts on reducing HIV transmission rates thereby reducing infections and (Oster 2005).

It is important to note as well that framing effects may impact alternative designs of giving incentives for learning HIV results. For example, travel reimbursements may not have the same impact as monetary vouchers, for example, when individuals are cash-constrained and unable to spend their own money on transportation.

Given these findings, it is ambiguous whether the social value of testing is positive or negative. While costly in terms of providing supplies, infrastructure, and training, testing may lead to either positive or negative behavioral changes. Knowledge of HIV status may affect sexual behavior, determining overall prevalence rates or may affect individual discount rates which in turn may impact levels of saving or investment or may increase overall productivity through the reduction of uncertainty or psychological costs of worrying about being HIV-positive. Currently there is a dearth of rigorous evidence that knowledge of HIV status affects subsequent behavior. In most instances, measuring the causal impact of learning HIV results on behavioral changes is difficult because of the selection bias of those that choose to get tested. The randomized incentives and costs of returning for results in this VCT experiment provide an opportunity to causally link the knowledge of HIV status to behavioral differences. Future research involves examining the short and medium run impact on sexual behavior after testing and counseling.

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Figure 1: Malawi and the Location of Study Sites

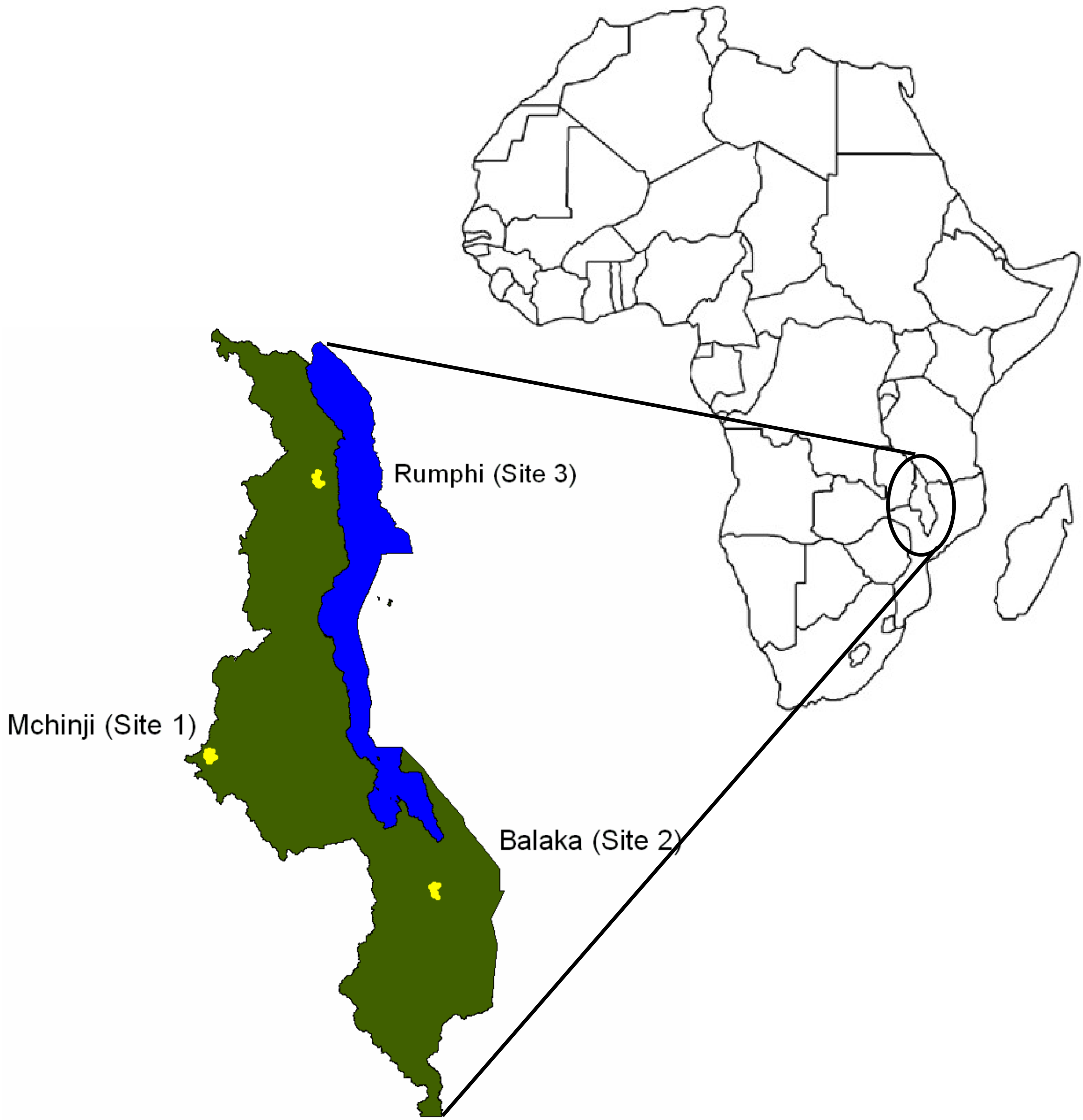


Table 1: Summary Statistics

	HIV Tested Sample (3 Districts)
Panel A: Respondent Characteristics	(1)
Sample Size	2720
Percent Male	45.7
Mean Age	33.6
Percent Married at Time of Testing	68.2
Mean Years of Education	5.0
Mean Weekly Income (Dollars) (2001)	9.8
Mean Value of Crops Produced (Dollars) (2003)	323.0
Panel B: Health and HIV Related Attitudes	
HIV Prevalence Rate[1]	6.7
Perceived HIV Rate[2]	22.4
Number of Friends Died from Aids (Past 12 months)	7.1
Number of Friends Infected now	9.4
Number of Funerals Attended (Past month)	3.0
Panel C: Random Assignment of Incentives and Distance	
Mean Incentive (Dollars)[3]	1.04
Mean Distance to VCT Center (km)[4]	2.0
Mean Minutes Traveled to Reach VCT[5]	42.6
Percent Attending VCT	71.5
Percent Attending VCT (Incentive=0)	38.7

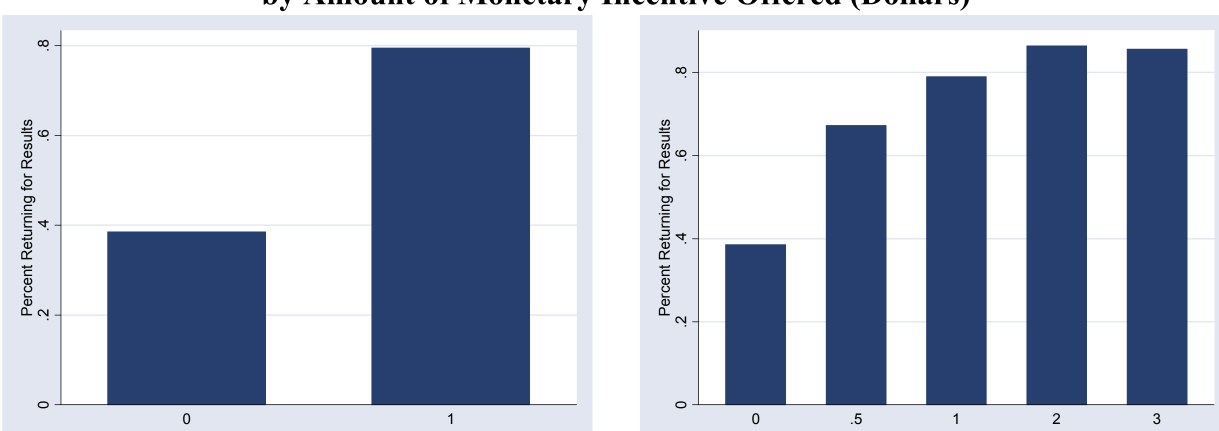
Notes: HIV tested sample includes respondents who accepted a test for HIV in 2004 and had age and education data.
[1]HIV prevalence rates do not include 14 respondents with indeterminate diagnosis.
[2]Respondents were asked “We tested 1,000 people in your area. How many of those do you think are HIV positive?”
[3]Total incentive is the amount of the sum of an incentive for learning HIV results and an incentive for learning other STI results
[4] Distance from assigned testing centers to respondents’ homes was calculated as a straight line spherical distance.
[5]Respondents who attended testing centers were asked “How many minutes did it take you to reach here?”.

Table 2: Impact of Monetary Incentives on Learning HIV Test Results

	(1)	(2)
Any Incentive	0.384***	0.259***
	(0.024)	(0.028)
Amount of Incentive		0.093***
		(0.011)
Male	0.012	0.010
	(0.017)	(0.016)
HIV+	-0.040	-0.040
	(0.035)	(0.035)
Observations	2720	2720
R^2	0.21	0.23
Average Attendance	0.71	0.71

Notes: Significantly different than zero at 90% (*), 95% (**), 99% (***) confidence. OLS regressions, standard errors in parenthesis with village fixed effects where there are 145 villages. The sample includes all respondents who were tested for a sexually transmitted disease. HIV indeterminates are treated as missing. Monetary incentives were randomly offered to respondents. "Any Incentive" is a dummy indicated receiving any non-zero incentive while "Amount of Incentive" is the total amount of HIV or STI incentives.

Figure 2: Percent Returning for HIV Results by Amount of Monetary Incentive Offered (Dollars)



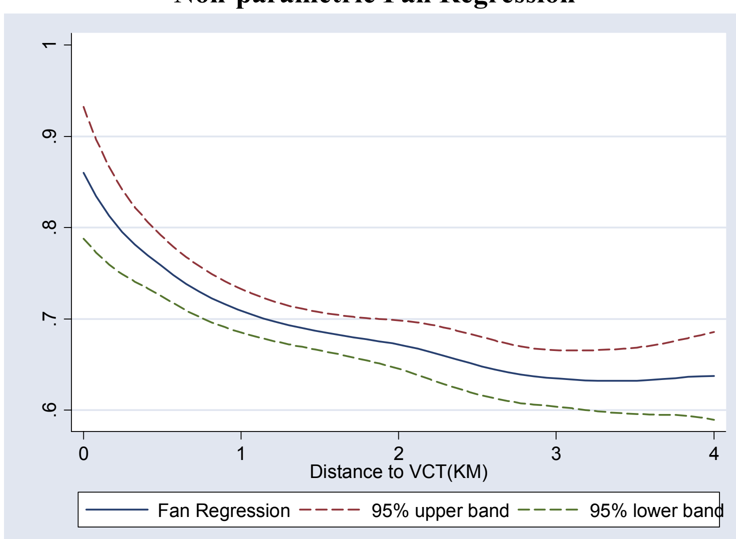
Panel A: Received Any Incentive **Panel B: Total Amount of the Incentive**

Table 3: Impact of Distance from VCT Centers on Learning HIV Results

	(1)	(2)	(3)
Under 1 km	0.056*	0.071	0.043
	(0.030)	(0.055)	(0.030)
Any Incentive	0.259***	0.264***	0.260***
	(0.028)	(0.031)	(0.028)
Total Incentive	0.093***	0.093***	0.093***
	(0.011)	(0.011)	(0.011)
Under 1 km*Any Incentive		-0.018	
		(0.053)	
HIV+			-0.087**
			(0.041)
Under 1 km* HIV+			0.189***
			(0.069)
Observations	2720	2720	2720
R-square	0.23	0.23	0.24
Mean	0.71	0.71	0.71

Notes: Significantly different than zero at 90% (*), 95% (**), 99% (***) confidence. Coefficients represent the estimated conditional probit., Huber robust standard errors in parenthesis. Disturbance terms are allowed to be correlated across observations in the same village where there are 145 villages. The sample includes all respondents who were tested for a sexually transmitted disease and does not include any HIV-indeterminants.

Figure 3: Impact of Distance to VCT on Probability of Returning for HIV Results
Non-parametric Fan Regression



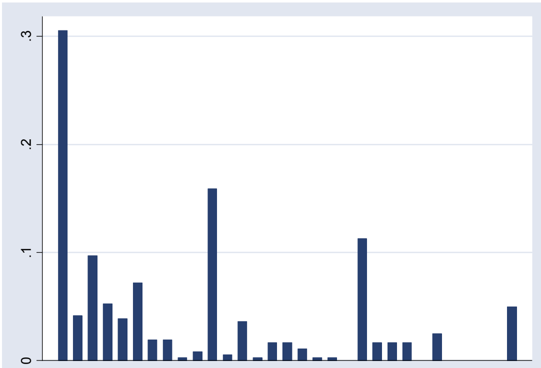
Notes: Non-parametric Fan regression where distance is measured as a straight line spherical distance from a respondent's home to randomly assigned VCT center from geospatial coordinates and is measured in kilometers.

Table 4: Impact of Spouse Incentives on Learning HV Results

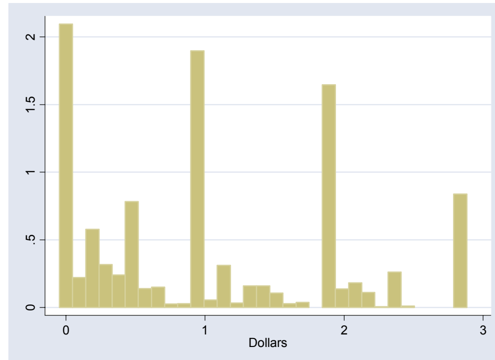
	Female Respondents		Male Respondents	
	(1)	(2)	(3)	(4)
Respondent Received Any Incentive	0.227***	0.238***	0.162***	0.191***
	(0.062)	(0.064)	(0.063)	(0.067)
Amount of incentive	0.111***	0.100***	0.124***	0.114***
	(0.023)	(0.022)	(0.024)	(0.026)
Spouse Received Any Incentive	0.034	0.137*	0.166***	0.176***
	(0.046)	(0.079)	(0.045)	(0.061)
Suspects Spouse of Cheating		0.187**		-0.066
		(0.092)		(0.088)
Suspects Spouse of Cheating*		-0.182*		0.036
Spouse Received Any Incentive		(0.099)		(0.099)
Sample Size	674	625	668	571
R^2	0.33	0.34	0.31	0.033

Notes: Significantly different than zero at 90% (*), 95% (**), 99% (***) confidence. Coefficients represent the estimated conditional probit., Huber robust standard errors in parenthesis. Disturbance terms are allowed to be correlated across observations in the same village where there are 145 villages. The sample includes all respondents who were tested for a sexually transmitted disease and does not include any HIV-indeterminants. Monetary incentives were randomly offered to respondents. “Any Incentive” is a dummy indicated receiving any non-zero incentive while “Amount of Incentive” is the total amount of HIV or STI incentives. Distance is measured as a straight line spherical distance from a respondent’s home to randomly assigned VCT center from geospatial coordinates and is measured in kilometers. “Simulated Ave” is the average distance of all respondents’ homes to 1,000 randomly selected locations in each VCT zone. Each closest neighbor was determined by calculating the distance between respondents using geospatial coordinates.

Appendix A: Distribution of Monetary Incentives to Return for HIV Results (Dollars)

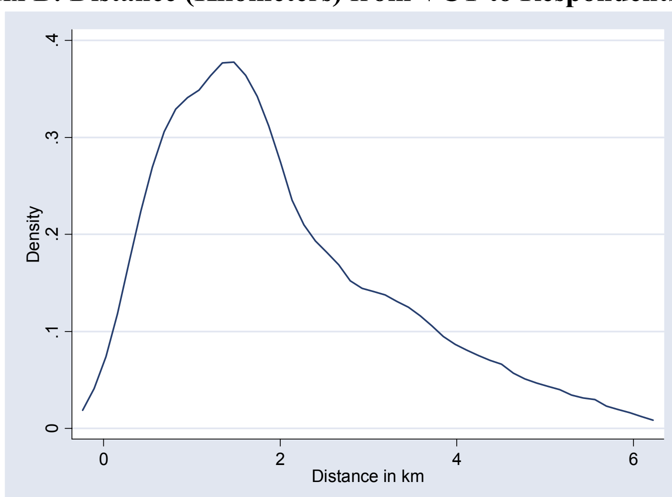


Panel A: Assigned Distribution of Monetary Incentives



Panel B: Actual Distribution of Monetary Incentives

Appendix B: Distance (Kilometers) from VCT to Respondents' Homes



Notes: Distance is measured as a straight line spherical distance from a respondent's home to randomly assigned VCT center from geospatial coordinates and is measured in kilometers.

Appendix C: Sample Attrition

Panel A: Sample Size and Attrition	**MDICP Full Sample** (1)
Adolescent Sample Interviewed in 2004[1]	973
Adult Sample Interviewed in 2004[2]	2231
Adult Sample Attrition from 1998 to 2001[3]	75.0
Adult Sample Attrition from 1998 to 2004	60.78
Panel B: Acceptance of STI Test[4]	
Percent Adolescents Tested for STI	91.7
Percent Adults Tested for STI	92.7

[1] Married and unmarried adolescents between 15 and 24 were randomly selected from sample villages in 2004 and added to the longitudinal sample. No information about these individuals are available before 2004.
[2] Includes married adult men and women that were initially sampled in 1998
[3] Attrition from the sample was due to a variety of reasons. In 2001 17.1 percent of the 1998 sample had migrated and 2.9 percent had died. In 2004 X percent had migrated and 2.6 had died.
[4] Respondents were offered free tests for HIV (by oral swab), Gonorrhea, Trichomoniasis, and Chlamydia (by vaginal swab for women or urine for men). Test acceptance rates includes those that accepted either an HIV test, a test for other sexually transmitted diseases (STIs) or both.