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Yutaka Arimoto, Narumi Hori, Seiro Ito
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Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo, 186-8603 JAPAN
http://cei.ier.hit-u.ac.jp/English/index.html
Tel:+81-42-580-8405/Fax:+81-42-580-8333

Impacts of an HIV Counselling and Testing Initiative: Results from an Experimental Intervention in South Africa

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Yutaka Arimoto[†] Narumi Hori[‡] Seiro Ito[§] Yuya Kudo[§] Kazunari Tsukada[§]

Abstract We have run experimental interventions to promote HIV tests in a large firm in South Africa. We combined HIV tests with existing medical check programs (MSP and HCT) to increase the uptake.

We have implemented three interventions intended to reduce fears and stigma for HIV tests: opt out, risk assessment, supportive information. Opt out asks subjects to opt out the test if one does not to take one. Risk assessment involves nurses to give immediate feedback on the set of questions on risky behavior. Under supportive information, subjects are shown five minute DVD to encourage testing.

Uptake rate increased dramatically, but not only under experimental arms but also under the control arm. We find substantial heterogeneity in responses by ethnicity. In particular, supportive information increased the uptake of Whites-Others by almost 100% at the margin. Generally, experimental arms were ineffective in increasing the uptake of Africans and Colored. This general ineffectiveness against Africans and Colored is common among both MSP and HCT samples whose educational and household background differ significantly. We thus conjecture that factors related to their ethnic background to be the possible deterrents to tests.

Keywords HIV/AIDS, stigma, randomized control trials in firms, South Africa.

[†] Institute of Economic Research, Hitotsubashi University.

[‡] St. Luke's College of Nursing.

[§] Development Studies Center, Institute of Developing Economies.

I Introduction

In rolling out HIV tests to general public, a popular approach beyond voluntary counselling and testing (VCT) is provider initiated counselling and testing (PICT) at medical facilities. Under PICT, a patient who visits to any health care facility for any ailment will be asked to take a test. While this should give a good opportunity for population in need of medical care, this is likely to leave healthy and sexually active population out of check. One potentially fruitful yet untapped source of at-risk population can be found in the corporate sector. Employees at corporate sector are likely to have stable and high earnings which can make them more demanded in the dating market.

We ran a HIV test promotion involving randomized control trials in a large manufacturing firm in South Africa. As a prepatory stage, we have conducted a survey to all employees on their knowledge, attitude, practice, and behavior (KAPB). Based on there responses, we have identified fears and social stigma as primary deterrents to test uptake. To remove social stigma, we have incorporated HIV test in their medical surveillance program (MSP) which is mandatory for employees with occupational health concerns. For the remainder of employees and executives, we have instituted a lighter-weight health counselling and testing (HCT) which involves tests for chronic conditions and HIV.

We found the uptake rates among employees increased dramatically from the pre-intervention period, yet there are limited overall impacts of experimental interventions that are intended to reduce fears and stigma. When we decomposed the impacts by ethnicity, we found heterogenous impacts and not all interventions are ineffective. However, Africans and Colored, the majority of population and considered to be higher in risks, are averse to tests. We also noticed that, despite the test aversion by Africans and Colored, the promotion *per se* nevertheless resulted in larger number of detection of HIV positive cases among them.

Policy makers may have two fold agenda in terms of HIV test promotion. First, they may want to see the general uptake rates to increase especially under the presumed high prevalence rate among the general population, as in South Africa. This is reasonable as self-protection and stopping contagion of HIV must start with knowing own status. Under this agenda, one should only be concerned with the uptake, not the resultant HIV positive cases to be found. Secondly, they may want to know which of the interventions is most efficient in detecting HIV positive cases, or the detection rates, defined as the number of HIV positive cases found among the number of people who were offered a test. Under a limited resource constraint, policy makers must pick the most effective tool in detecting the HIV positive cases. We will therefore also consider not just uptake rates but also the detection rates under each arms.

The rest of paper is organized as follows. In Section II, we review the background in South Africa, and in Section III existing literature on fears and stigma on HIV uptake is discussed. In Section IV, we discuss the design of the interventions. In Section V, we show the estimated results and discuss interpretations. In Section VI, we conclude and give policy recommendations.

II Background

South Africa has the largest number of People Living with HIV/AIDS (estimated 5.2 million or 10.6% of total population), representing a quarter of the disease burden in sub-Saharan Africa and a sixth of the global disease burden. In 2008, HIV prevalence among adults between ages 25 and older was 16.8%. While national prevalence rates plateaued, the province of KuwaZulu Natal, where our study site is located, saw an increase in adult prevalence rates from 11.7% in 2002 to 15.8% in 2008 (et al. and Team, 2009).

Under the past policy of encouraging VCT, South Africa did not achieve significant reduction in adult prevalence rate. Despite urgency of the matter, cumulative HIV test uptake lagged behind, with 47% of national target number is achieved between 2004 and 2009 (Table 1).

In an aim to turn this trend around, South African government introduced new guidelines on voluntary counseling and testing in August, 2010. The new guideline was expanded to include a number of new components, and is characterized by its proactive approach in reaching out at-risk population. These components include a revision of counseling protocols as well as a shift for PICT[*2] to be offered by health care service providers on the occasion of patient's visit to any health facility for any ailment (South African National AIDS Council, 2010).[*3]

While medical facilities are naturally becoming focal points of interventions, corporate sector is given little attention despite its potential advantages in rolling out HIV tests. It is well known that large firms in South Africa are complying with the legal framework and almost all of them have some sort of prevention programs (see Table 2).[*4] Bendell et al. (2003) notes that a South African Business Coalition on HIV/AIDS (SABCOHA) survey on business revealed that 81.25% of respondent firms have HIV policies in their companies and subsidiaries. Despite this, little is known about their achievements and efficacy.

Interventions under corporate setting has its advantages. Most of them originates from the facts that there are many people in a firm and that it is a structured organization. Ease of access to individuals, structured and functioning lines of command to allow effective implementation and follow up, availability of medical infrastructure (on site) and personnel who will be responsible for the program, availability of pre-existing information on individuals to fine-tune intervention design, assurance given to individuals on the availability of treatments, assurance of job security (under an assumption of adherence to rule of law) are such

[*2] Sometimes called as HIV Counseling and Testing (HCT). We avoid this terminology in this paper as we use HCT for Health Counselling and Testing.

[*3] See also Department of Health KuwaZulu Natal Province (2010) for KZN specific policies.

[*4] The South African government mandates the corporate sector to provide supports to employees with HIV/AIDS care and to protect the rights of PLWHA. In 2000, business sector also reacted to a spate of HIV infections and established a non-profit organization (South African Business Coalition on HIV/AIDS, SABCOHA) to promote good practices and share information.

Table 1: Cumulative HIV test uptake, 2004 - 2009

province	estimated population	target population	number tested	% of target tested
Eastern Cape	6,884,482	2,737,815	1,267,394	46
Free State	2,972,983	1,479,942	405,399	27
Gauteng	9,853,543	5,308,415	1,668,087	31
KwaZulu Natal	10,077,620	4,578,031	2,268,963	50
Limpopo	5,357,949	2,275,491	1,350,641	59
MP	3,646,123	1,660,038	739,226	45
North West	3,229,078	1,537,093	1,109,242	72
Northern Cape	1,108,599	485,391	282,211	58
Western Cape	4,945,732	2,203,620	1,481,729	67
Total	48,076,109	22,265,836	10,572,892	47

Source: Table 1 of South African National AIDS Council (2010).

Note: Repeated testing by same individual is not taken into account.

Table 2: Corporate HIV/AIDS Policies

countries	firms	HA policy	preven prog	VCT	ART
Southern African countries	225	83	86	56	38
South Africa	96	92	91	72	41
Large (> 500 employees)	107	85 – 90	98	74	40
Medium (100-500 employees)	196	65 – 70	78	47	17
Small (< 100 employees)	691	15 – 20	34	15	3
Financial sector	43	81	79	60	38
Mining sector	92	60	61	57	26
Manufacturing sector	317	47	65	34	11
Transport sector	111	52	61	34	15
Motor	38	24	44	21	9
Wholesale sector	77	25	40	23	3
Construction sector	201	24	31	15	3
Retail sector	153	12	27	13	4

Source: Table 3 of Mahajan et al. (2007).

examples. This obvious upside is accompanied with disadvantages that are usually found in corporate management. They are: a tightly knit community that will make anonymity difficult to assure, history of organizational disputes that can impede effective communications among managers and employees, fear of corporate punitive actions toward PLWHA, possible negative short term impacts on productivity, reluctance/sabotage by the personnel who fear additional workload and/or negative evaluations in the case of failure (See the Adam effect in List, 2011).

As South Africa remains to be the top business destination in Africa, better understanding and management of HIV/AIDS in the corporate sector will have unignorable cost implications.

When companies run programs, the experiences are rarely documented and shared publicly. Even when it is documented, it is mostly a case study which does not identify causal relationships. For example, Daly et al. (2002) cites several corporate cases and hints causal impacts on various outcome measures without paying due attention to identifiability of underlying parameters they are estimating.

To the best of our knowledge, there is no observational study with rigorous assessment of causal impacts nor experimental evidence on corporate HIV/AIDS interventions. The only exception is mining sector. Mining typically has employees to live close to the workplace, and some employers provide lodging. This gives rise to the necessity of the employers to provide essential health care, which includes prevention and treatments to HIV/AIDS. Given that the mining sector employment remains at 6.2% of all employment at the end of third quarter of 2011 (Africa, 2011) and its setting is somewhat different from the rest of the corporate sector, HIV/AIDS promotion experience under non-mining setting will help South African corporates as an important source of reference. Any policy implications from this study will be relevant and will benefit large firms in establishing workable program on HIV testing.

III Existing literature

In 2009, we have conducted interviews to all employess in the Company on their knowledge, aptitude, perception, and behaviours (KAPB). We have found that employees cite intrinsic fears towards disease and stigma to be the major deterrents to testing (Arimoto et al., 2012). We have taken these evidence seriously and designed our experimental interventions to reduce fears and stigma. We will review what the literature has say about these two reasons in this subsection.

There is a good load of studies that blame stigma as the root cause of low uptake rates of HIV tests. Despite its popular discourse, however, there is no prospective study on the general population that measures the impacts of stigma with an exception of Simpson et al. (1998), and there is no rigorous study how stigma affects the uptake in the corporate sector. Fear is relatively understudied in the context of HIV. So in what follows in this section, we will mostly focus on how stigma is discussed in the literature. We will review the definitions of stigma used in the literature, previous measurement attempts, and estimation of causal impacts.

III.1 Definitions

There are several influential studies that set out the definitions of stigma. Van Brakel (2006) shows that previous works focused on measurement have dealt with the following HIV stigma categories: (1) discrimination incidence, (2) attitude toward PLWHA, (3) institutional practices, (4) perceived stigma. After the literature search (see Appendix A for the summary), we adopt UNAIDS (2003)'s definition and its explanation to be most straightforward, inclusive of all four categories in the above, and relevant under our context: "a process of devaluation of people either living with or associated with HIV and AIDS". As fear is relatively understudied, we will devise our own working definition: "Reluctance or aversion to face the disease (even in isolation of social repercussions)".

III.2 Measurement of stigma

Bendell et al. (2003) summarizes corporate surveys and notes that stigma and prejudice to be the key barriers in acting on HIV/AIDS. Berger et al. (2001) cite foregoing papers and note that concerns with stigma is widespread among PLWHA: Being rejected and fearing rejection have often been cited as major stressors of having HIV. However, impacts of stigma is not clearly identified in the previous literature. This is because stigma is difficult to measure, and this makes it also difficult to establish the causal relationship on uptake.

In measuring stigma, previous studies have relied on descriptive assessment or self-reported feeling of stigma in the questionnaire, all of which are subjective data (MacQuarrie et al., 2009). Stigma is often measured with the HIV-related Stigma Scale of Berger et al. (2001). This 40-item tool has 4 sub (Likert) scales: personalized stigma, disclosure concerns, negative self-image, and concern over public attitudes toward PLWH.[*5] All items are answered using a 4-point Likert items (strongly disagree, disagree, agree, strongly agree).

While self-reported items and their scales are informative, they are ordinal in nature and cannot be used directly as covariates in estimation due to difficulty in interpersonal comparisons, as the latter requires cardinality. Even if we can measure stigma, it is considered to be endogenous to uptake decisions, so we cannot readily identify its causal impact. For example, a person who is very careful may consider the chance of being stigmatized by test taking to be large, at the same time he has a less reason to take tests, causing a negative correlation between stigma and regression residuals, which inflates the magnitude of estimated (presumably negative) stigma impacts. It is difficult to find variables that can influence stigma but not uptake, or an instrumental variable.

Moreover, subjective measures of stigma may not be necessary in knowing its causal impacts. As in our identification strategy, one can maintain an assumption of functional relationship between policy variables and stigma, then use variation of the former to infer the impacts of the latter.

[*5] Personalized stigma addressed the perceived consequences of other people knowing that the respondent has HIV, such as losing friends, feeling that people were avoiding him/ her, and regrets for having told some people. Disclosure concerns are related to controlling information, such as keeping one's HIV status secret, or worrying that others who knew the respondent's HIV status would tell. Negative self-image is feelings of shame and guilt, including feeling unclean, not as good as others, or like a bad person because of HIV. Concern over public attitudes toward PLWH includes what "most people" think about a person with HIV or what "most people" with HIV can expect when others learn they have HIV, and includes discrimination and employability.

III.3 Reported causal impacts of stigma

The impacts of stigma is considered to be negative on the uptake. First line of studies use subjective information. Herek et al. (2003) use US telephone interview data and find that more than a third of respondents indicated that uptake is not going to be affected by stigma. Simbayi et al. (2007) use Cape Town PLWHA data and find that 1/5 have lost a place to stay or job due to the HIV status, and internalized stigma is found to have significant impacts on cognitive-affective depression scores. Kalichman and Simbayi (2003), using Cape Town data, find that people who had not been tested have a high risk of being infected with HIV, as 28% of them had a history of being diagnosed with STDs and genital ulcers. This means that there is a group of high risk individuals who knowingly take risks but do not get tested. Kalichman and Simbayi (2003) interpret a cause of this rejection is due to stigma and endorse the promotion of confidentiality of testing, protection of human rights of PLWHA, among other things.[*6] In studying an informal settlement in South Africa, Mills (2006) shows ethnographically that HIV status can be treated with particular sign languages and social downward mobility, all of which keep individuals from seeking care at local clinics. In neighboring Botswana, Wolfe et al. (2008) suggests that 40% of patients on ART delayed testing, mostly due to stigma. These studies are suggestive yet make use of subjective information which limits its capacity to be accepted as scientific evidence.

Impacts of fears and stigma have rarely been examined empirically with objective data. An exception is Young and Bendavid (2010) who found from US out patient visit data a positive correlation between HIV testing and use of unrelated tests, and between HIV testing and HIV as a secondary reason for visit rather than first. They interpret their results that individuals seeking HIV tests seek a cover to avoid stigma. While we believe their interpretation is highly likely, as they note, it is a correlation not a causal relationship.

In a rare prospective study, Perry et al. (1991) use video sessions on 1,307 physically asymptomatic adults in the US and assessed their impacts on emotional distress scaled by five standardized distress measures at entry and 3 months later. They found that video sessions reduces emotional distress of HIV negative subjects but no impacts on HIV positive subjects, while stress prevention training reduced stresses on both seronegative and seropositive subjects. Simpson et al. (1998) offered HIV tests on pregnant women at antenatal clinics with randomized length of discussions with midwives and contents of leaflets. All treated arms have higher uptake rates between 31.6% to 37.0% compared to 5.5% of control arm, but there is no statistically significant difference among the treated arms. Young et al. (2007) have conducted a series of lab experiments on a group of undergraduate students at Stanford. Their study is of interest as it focuses on how non-stigmatized people react to HIV stigma when they are stigmatized. They found that adding unprotected sex, a source of stigma that

[*6] Our finding from the project is broadly in line with them, but goes further beyond that these two may not suffice.

being immoral, to a list of potential causes of disease reduces the likelihood of individuals requesting a test, which is considered to be due to stigmatization, although the sample size is small (36).[*7]

III.4 Causal impacts of fear

It is suggested that receiving results also becomes an impediment to know one's status. In a study measuring returns for STD test results to 258 at-risk adolescents who have voluntarily come to the clinic, or the self-selected sample, in Cleveland, US between 1997 and 1998, 58% choose not to return to be notified the results (Lazebnik et al., 2001). The returners are more likely to have had private health insurance, unprotected sex while using illegal drugs and alcohol, and previous attendance at the clinic only for HIV testing. This behaviour is consistent with hyperbolic discounting of Ainslie and Haslam (1992); Laibson (1997), or resultant procrastination.

IV Interventions and their results

IV.1 Measures to increase uptake

Following Perry et al. (1991), we have devised an arm of supportive information under which subjects are shown a five minute video encouraging HIV testing. In it, CEO of the company appears to show management's support to the tests and treatment, a doctor explains the disease and treatments, Company's non-discrimination policies and treatment supports through their Medical Services, and PLWHA colleagues on treatment recommend the tests. This arm is intended to reduce both fears and stigma of HIV tests. Also, following the current practice, we have tried the opt out arm where the default option is taking rather than not taking the test. By changing the default option, it is assumed that test taking stigma is reduced, because everyone else is considered to be taking the test. One needs to be careful in the distinction between current "opt out" policies of PICT and our opt out arm. The former contrasts hospital visitors who are and who are not offered a test. In our case, due to ethical reasons, we offer everyone a test, but do so in differentiated ways. What we contrast is employees who are offered a test with taking as the default with employees who are offered a test with not taking as the default. So our "treatment" is the same with PICT but the control is different. And the population will also be different, as hospital visitors have ailments while our sample do not. If we disregard the difference in population, we expect smaller impacts in our interventions than under PICT, because our control arm has been provided with stronger recommendations than PICT's control arm.

[*7] This is in line with *conjunction fallacy* that Tversky and Kahneman (1983) posited, as adding a cause decreased the chance, which is a violation of the probability axiom. In their experiments, fear is controlled to be the same between the case with and without unprotected sex as a potential cause of disease, because the disease they reveal to the subjects is the same.

We used subjective probabilities or subjective assessment of riskiness in studying their impacts on uptake, which is novel in the literature. As discussed in Appendix C, it allows self-perceived likelihood of risk and stigma to be directly used in regressions. The potential problem with subjective probabilities is that they can be misreported or misperceived. To cope with these problems, the risk assessment arm will allow nurses giving immediate feedback on each and every questions on past behavior.

Simpson et al. (1998) show that, for a group of pregnant women in UK, a direct offer of test increases the chance of uptake but a brief session with midwives does not in assessing the impacts of PICT over VCT. They also suggest that there are important differences by individual midwives to the extent they can motivate the uptake, or individual midwife effects. DVD viewing under supportive information can be viewed as a uniform, nondifferentiated way of conveying the information to the subjects. Risk assessment by the nurses are similar to what midwives did in Simpson et al. (1998), and, as we confirm below, we expect more variations by the nurses than under supportive information. By contrasting the impacts between supportive information and risk assessment arms, one can contrast the benefits of these two modes of motivation.

Noting fears can also be an impediment, as suggested in KAPB and Lazebnik et al. (2001); Ainslie and Haslam (1992); Laibson (1997), we have derived an arm to cope with procrastination of tests under delayed notification. Under this arm, before deciding on test taking, a subject is given an option to defer notification of results up to one week. This, in theory, can eliminate the immediate disutility of knowing the painful truth in the case of being infected, which can prompt test taking.

IV.2 Identification strategy

Given that we cannot directly measure both fears and stigma, our estimation strategy does not seek directly to separate their impacts. We will, by using interventions that are assumed to work differently on fears and stigma, try to interpret the estimated results to separate these two, however. For analytical convenience, we use the terms "fear" to refer to introspective feeling toward the disease itself apart from any interplay with the society, and "stigma" as anything related to infection that change their relationship with the society, but this is purely for convenience and we do not claim that we have successfully identified separate impacts of them on uptake.

Our identification strategy to measure impacts of fear and stigma is to hypothesize possible interventions that would reduce them, and measure the outcomes under each interventions. So the interpretation of our results is the joint hypothesises that these arms can reduce fears/stigma and can impact on uptake rates. We have offered environment that is intended to reduce them, and have measured its impacts on uptake and subsequent HIV detection rates. To be precise, whatever the factors that the environment brings in, we refer to them as "fear" reducing or "stigma" reducing factors, and interpret results as impacts of reduced fears and stigma. As explained in below, we have an instrument (supportive information arm) generated from experimental interventions that will supposedly reduce fears and stigma, and an instrument that is meant to reduce stigma alone (opt out arm). So we can obtain suggestive evidence on the differential impacts of stigma and fears by observing the difference between the estimates on opt out arm and supportive information arm.[*8] If only supportive information is statistically significant, it is inferred that fears cannot be dismissed as a deterrent. The rejection of these experimental arms is interpreted as rejection of joint hypothesis that the arm reduces fears/stigma and fears/stigma decreases uptake.

Estimates on subjective probability will reveal the correlations of fears and stigma with uptake.[*9] One should be careful not to interpret this as causal relationship. An excessively worrisome feeling may increase subjective probability, at the same time increasing fears and stigma that may lead to rejection of tests. This will inflate the magnitude of the estimate, and will overstate the impacts of subjective probability (that may lead to fears and stigma) on uptake.

IV.3 Design

We have combined HIV testing and intervention to MSP that is currently offered to most of employees at the production line. MSP is compulsory for employees with occupational health concerns. This is done primarily to avoid duplications in health care operations and minimize loss of employee time. It also had a benefit of masking employees from their HIV test taking choices, as it is indistinguishable for casual observers and colleagues between an employee just going for health checks and an employee receiving health checks and taking an HIV test.

Production lines are controlled in units called a "group", and employee substitution is managed by the group leaders. Group leaders are asked by the coordinator to release group members, and leaders substituted the posts of released members while they are at the clinic. Groups with fewer absence are given priority for employee release.

For administrative employees, we have offered division-wide health-day event called Health Counselling and Testing (HCT) that gives a chance to take HIV tests and checks for other chronic conditions (cholesterol, blood sugar, blood pressure). HCT is voluntary in nature and there is self-selection among the target in participation. We have also spared a capacity for walk-ins who would want to get tested for chronic conditions and HIV. This is reserved as our interventions were scheduled by areas (the unit used for plants and administrative departments), and we found it unethical to keep the employees in areas that

[*8] Another possible instrument for fears is the change in prognosis, plausibly due to development of new drugs or new treatment methods. An instrument for stigma is increased degree of confidentiality, concealment of symptoms, both of which can result from stricter implementation of privacy protection and changes in scope for clinical suppression of symptoms.

[*9] By including a subjective probability, we add a source of stigma and fears to the estimating equation. Under a reduced form interpretation, this is equivalent to adding a linear approximation of stigma and fears.

are scheduled at later months waited for their turn even when they feel like to be tested immediately.

According to the agreed on schedule, each area releases an employee one-by-one to the testing venue. All the testing venues are on site; Company's main, satellite, and mobile clinics for MSP eligible employees, and the conference rooms set up for HCT for MSP non-eligible employees. Walk-in employees are tested at the main and satellite clinics. Testing venues for each areas were chosen to minimize the travel distance and to control the workload of nurses. If the nearest clinic is too far, we used the mobile clinics. When we requested cooperation to the area managers, we also encouraged test taking promotions with their own initiatives.

At each clinic testing venue, an employee is asked to do all the routine health checks. Having finished them, he/she is taken to a room to be offered an HIV rapid test. On supportive information arm days, employees are shown a five minute long video that encourages testing. Workers are always given a pretest counselling after they decided to take tests. Then a rapid test is administered by a nurse and results are given. After the results are notified, post test counselling is given.[*10] Workers walk out of the room after it. We have asked nurses to give time for employees who reject the tests, so they will stay in the room long enough that no onlookers will know if employees have taken a test just by measuring the duration. At each HCT testing venue, the same procedure is followed, including the time taking considerations.

As we expect differences in employee release and uptake rates by area, it is necessary to introduce area fixed effects in estimation. This forced us to randomize arms daily to avoid the perfect collinearity between areas and arms. On each morning, a particular arm is announced and the announced arm is implemented in all the testing venue for the same day. Preparations for stationary for the next day's arm is done in the afternoon.

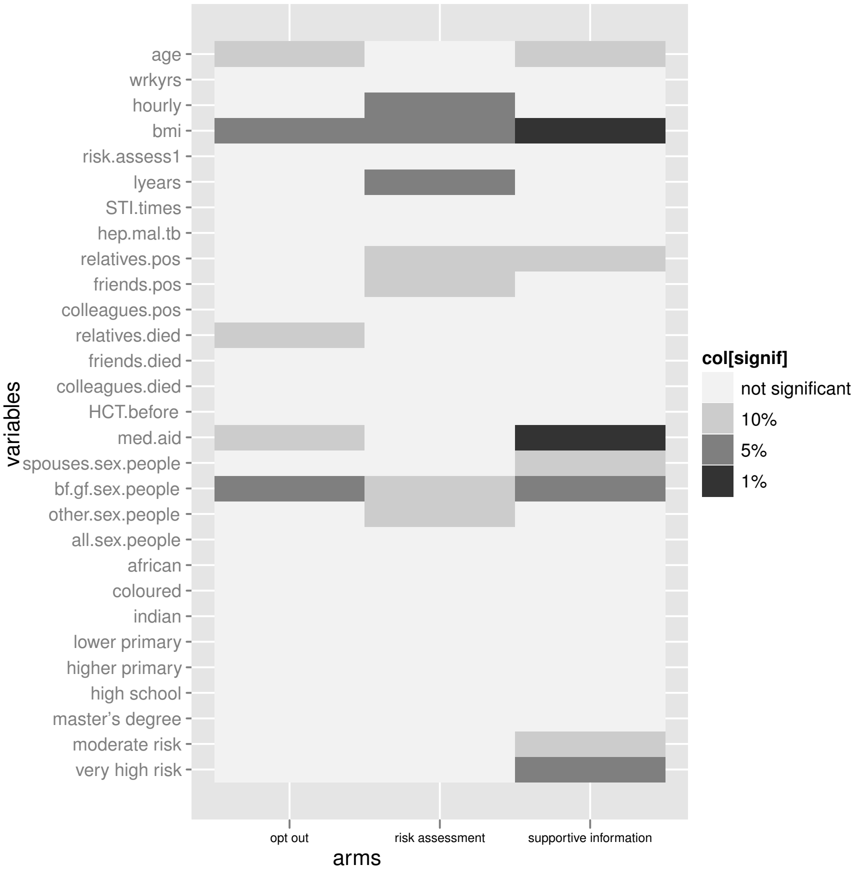
IV.4 Balance

We used the control arm in the initial "burn-in" period to train the nurses and receptionists getting used to the intervention protocol. However, based on the balance checks on the set of variates, we have found unignorable number of cases that are significantly different between each experimental arms and the control arm. This is possibly due to the fact that our control arm is concentrated at the beginning of the campaign which might have allowed to select a particular type of employees. We have thus decided to use delayed notification arm as the control, because it is spread over the entire period, and there are only 2 people who exercised the option of delayed notification, and all other 711 people disregarded it, hence can be considered as the control.[*11] In Figure 1, we have shown the balance tests for observable

[*10] For all the positive cases, we ran confirmatory testing using Eliza whose results are notified within a week's time.

[*11] Strictly speaking, delayed notification is a treatment so it can be different from the control. But if it is different, it is intended to be so in the way it promotes uptake, and the uptake rate should be no smaller than the control. So the bias introduced in the use of delayed notification as control should be underestimation of the impacts of other treatment arms.

Figure 1: Contrasting Characteristics between Arms



characteristics of employees. While there are some significant differences, most notably in BMI and number of sex partners in boy friends and girl friends, most of other characteristics are insignificantly different from each other. We add them as controls in the estimation.

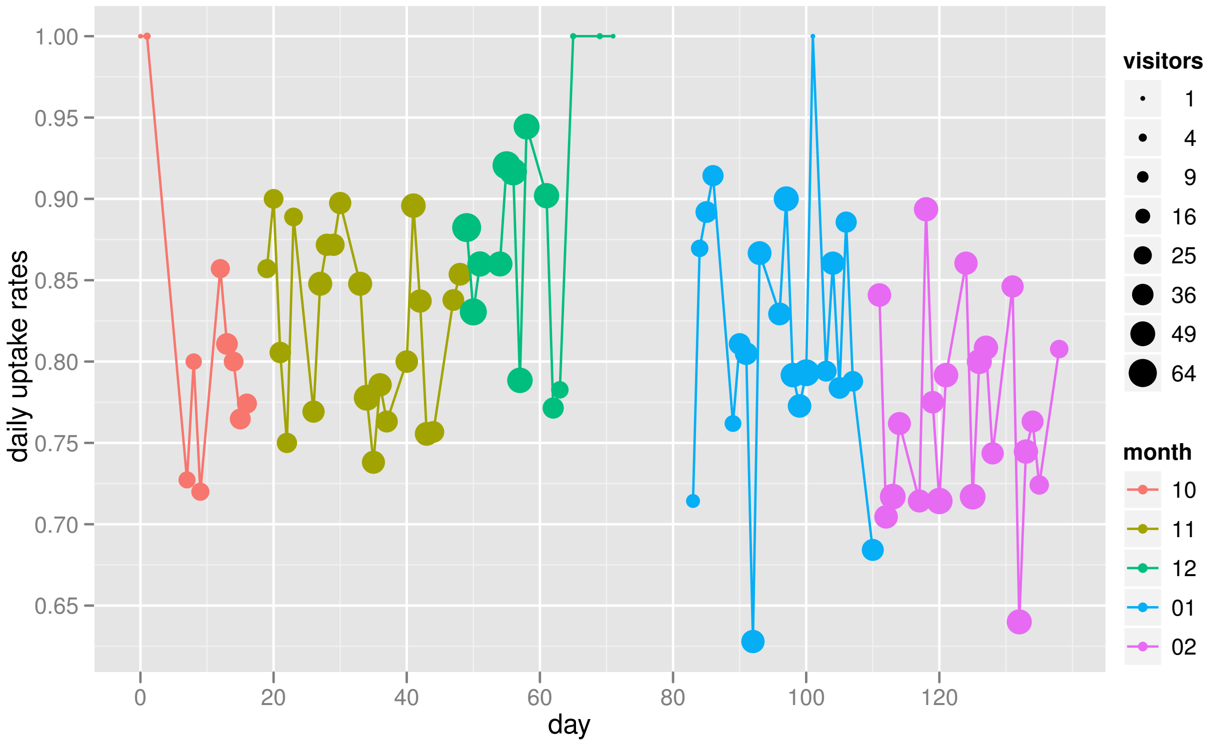
IV.5 Sample

Intervention began in October, 2010 and ended in February, 2011. Total of 3330 people were offered a chance to take HIV tests. Among which, 27 came as a walk-in which we dropped from our analysis. We further dropped 1 observation with missing route (either MSP or HCT), 13 observations possible HIV positive already on treatment[*12], 18 observation with missing ethnicity, 2 observations with missing hivtest. Then we are left with total of 3269 observations, among which 1767 are from MSP route. After dropping entire control arm, 507 observations, we have 2762 observations for our analysis.

Table A2 gives the descriptive statistics of the 2762 observations that we use in our analysis. In the descriptive statistics of Table A2, we have 52.1% in MSP and remaining 47.9% in HCT sample. Africans are the majority ethnic group with 61.4%, and the Colored are the smallest group at 4.6%. Median age is 37, with 40.4% is single, and sample is predominantly male with 80.2%. 54.5% are the hourly paid employees, and median years with the Company is 7.

[*12] Basing on the facts that they do not get tested but answer that they "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1. Since we were not allowed to ask directly the subject's HIV status, we need to infer if they already know that they are HIV positive with other questions.

FIGURE 2: DAILY UPTAKE RATES AND NUMBER OF VISITORS BY DAY



On average, the sample has median number of two affirmative answers to ten STD screening questions. The incidence of having PLWHA in relatives, friends, and colleagues are similar to the incidence of HIV/AIDS deaths. Median subjective probability of HIV infection is 10%, with the mean at 17.6%.

Regarding relationships, 24.2% reports the sexual relationship with multiple partners in the last 12 months, and 6.5% has partner concurrency. South African National AIDS Council (2010, Table 3.15) gives ratio of multiple sexual partnership in the last 12 months among the sampled individuals aged 15-49, significantly lower at 10.6% for national average and 10.2% for KuwaZulu Natal average. The information on partner concurrency is unique to this data set and there is no comparable information in other data set. Therefore it is difficult to evaluate this number,[*13] but we believe the mean ratio of individuals with partner concurrency to be also higher than KZN average. So we may be looking into potentially riskier population than the rest of KZN, which may be due to having more stable and better paid jobs that would make them more demanded in the dating markets.

IV.6 Uptake

We targeted 1860 in MSP and 2405 in HCT. Among which, 1767 (95.0%) in MSP and 1502 (62.5%) in HCT individuals participated to the respective medical program, total of 3269 after dropping walk-ins, cases suspected to be on treatment, and cases with missing observations. Since MSP is compulsory and HCT is voluntary, the low participation rate

[*13] South African National AIDS Council (2010, p.66) notes that having multiple partners includes the likelihood of partner overlap, although they do not explore the extent of partner overlap or partner concurrency.

Table 3: Uptake by Arms

	yes	no	uptake
control	401	106	0.791
delayed notification	575	138	0.806
opt out	543	133	0.803
risk assessment	518	109	0.826
supportive information	618	128	0.828
total	2655	614	0.812

Notes: 1. A ratio is a fraction of uptake in total.
2. A null hypothesis that all five ratios to be equal is not rejected with $p = 0.447$ using a χ^2 test. Other tests give similar results.

among HCT samples indicate significant self-selection to the medical program. This suggests that we are dealing with unknown population in HCT sample, as we have no way to infer the selection process. Out of 3269 individuals, 2655 or 81.2% of them have taken a test (Table 3). This is considered to be a major improvement from the unofficial estimate of 49% uptake rate of KAPB survey conducted in 2009, before the intervention (Arimoto et al., 2012). Daily uptake rates in Figure 2 vary by date, and follow an inverse-U type curve. This is likely to be induced by the hype toward the World AIDS Day on December 1st and its gradual tapering afterwards.

The uptake rates do not vary much by arms. As shown in Table 3, there is little difference in uptake rates between each experimental arms and the control arm. Using a chi-squared test, the null hypothesis that all proportions are equal is not rejected (p value .447). As an overall average treatment on the treated (ATT) estimator without any control covariates, we reject the impacts of interventions on uptake, indicating general ineffectiveness of each experimental arms in comparison to the control arm.

The uptake rates are found to vary by ethnicity, however. In Figure 3, we plot the mean uptake rates by arms and ethnicity, which we classify into Africans, Colored, Indians, and Whites and others.[*14] This shows that Indians are taking tests at above 95% rates under any arm, and Whites and others are also taking at high rates. Colored are showing relatively high uptake rates while Africans show the lowest uptake rates under all arms. Although variations between each experimental arms vis-a-vis the control arm are not uniform across ethnicity, we see a general small increase under supportive information over the control. This suggests that we can expect supportive information arm to yield small positive impacts after controlling the observables, and a better fit of estimation if we interact arms with ethnicity.

If we further divide the sample into MSP and HCT, we see that Africans in MSP sample have particularly low uptake rates. In Figure 4, we plotted the uptake rates for all arms and ethnicity by route. We see that HCT sample has high uptake rates across all ethnicity and arms, which is consistent with the fact that selection has already taken place at participation to HCT. In MSP sample, Indians and White-Others are recording high rates but Colored, and especially Africans have substantially lower rates. Indians are in particular showing a stable

[*14] Others are mainly Japanese.

Figure 3: Uptake Rates by Ethnicity and Arms

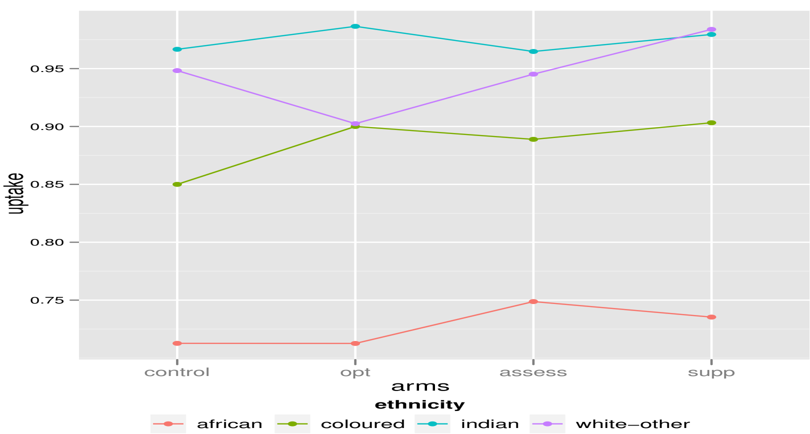
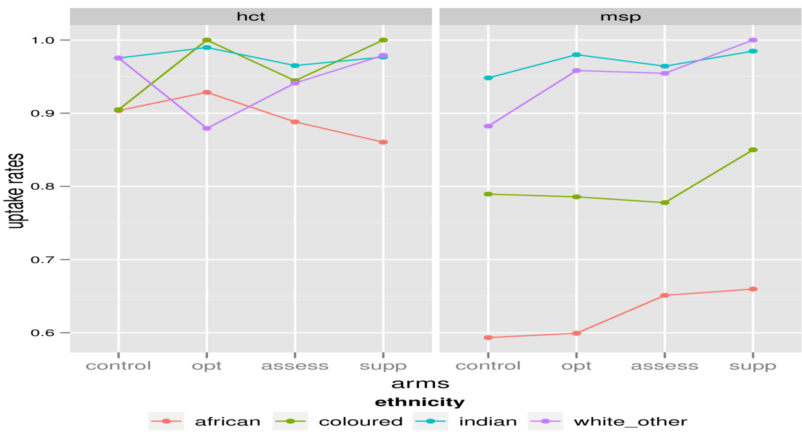


Figure 4: Uptake Rates by Ethnicity, Arms, and Route



pattern across arms and routes.*[15] In MSP, sample size of Colored are 50 while Africans are 671, it is clear that we need to work on increasing the uptake rates among the Africans. As the number of Colored are small and uptake is highly correlated with Africans, we integrate Colored and Africans in estimation to increase efficiency.*[16] In Figure 4, we see a weakly increasing pattern in all the ethnicity of MSP sample, indicating supportive information arm had the largest impacts. We do not observe such a pattern in HCT sample. These observations suggest that we would expect to find impacts of each arms among MSP sample but not in HCT sample.

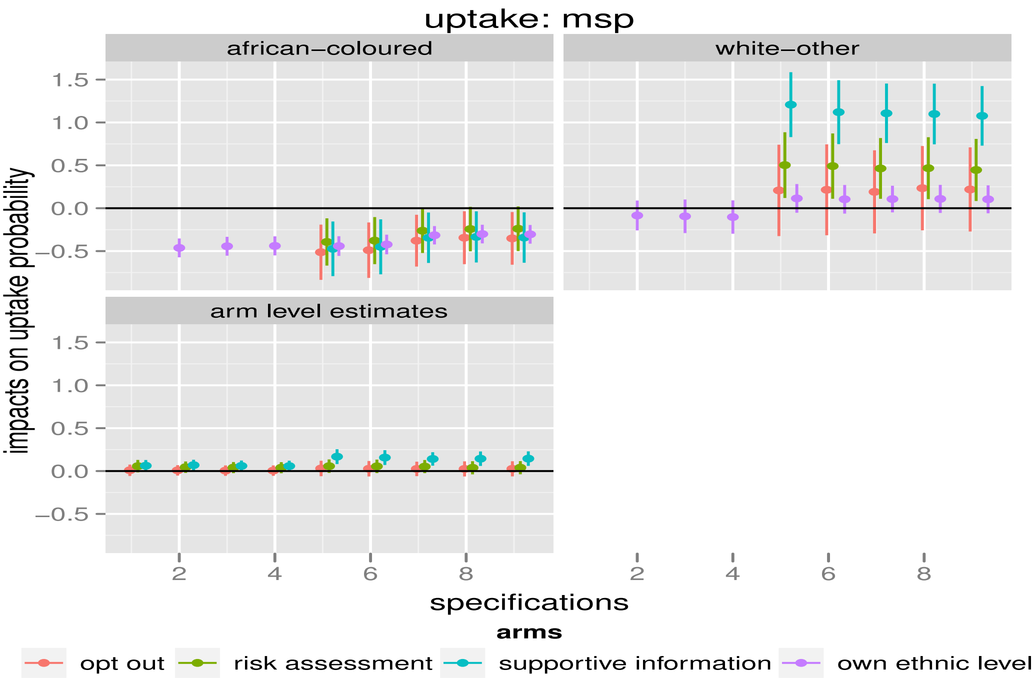
V Estimation

In this section, we estimate the uptake probability using probit models. We use as covariates the individual characteristics, work related characteristics, work area dummies, anthro-

*15 These are the perfect candidates for the choice of default in creating dummy variables in estimation.

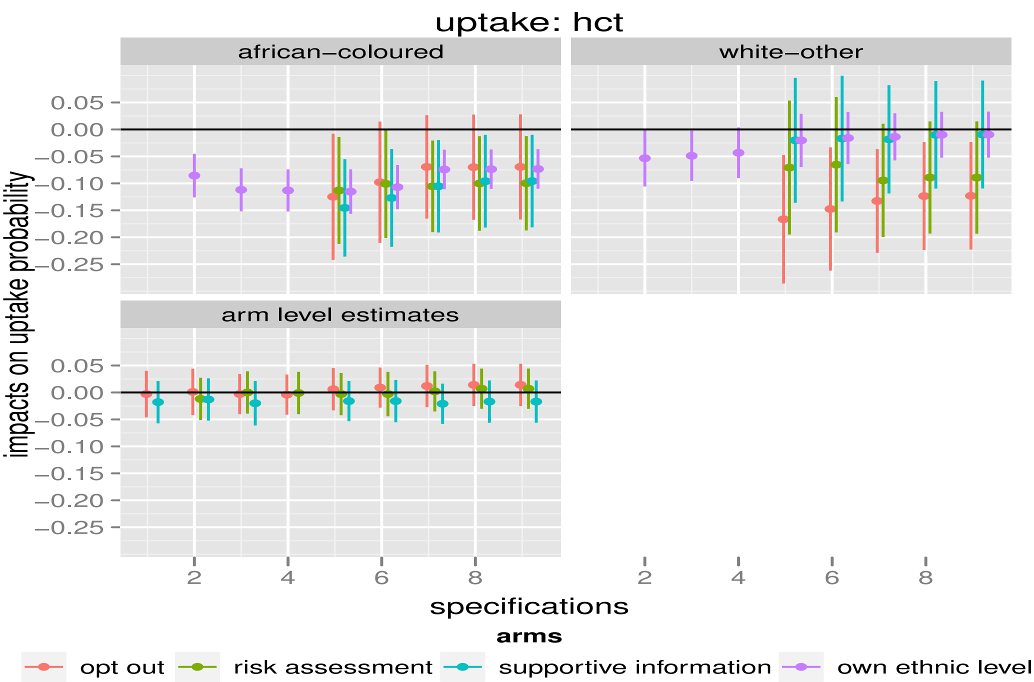
*16 We have tried separate grouping but wound up having grossly imprecise estimates for the Colored.

Figure 5: Cross Marginal Impacts of Each Arms and Ethnicity, MSP Sample



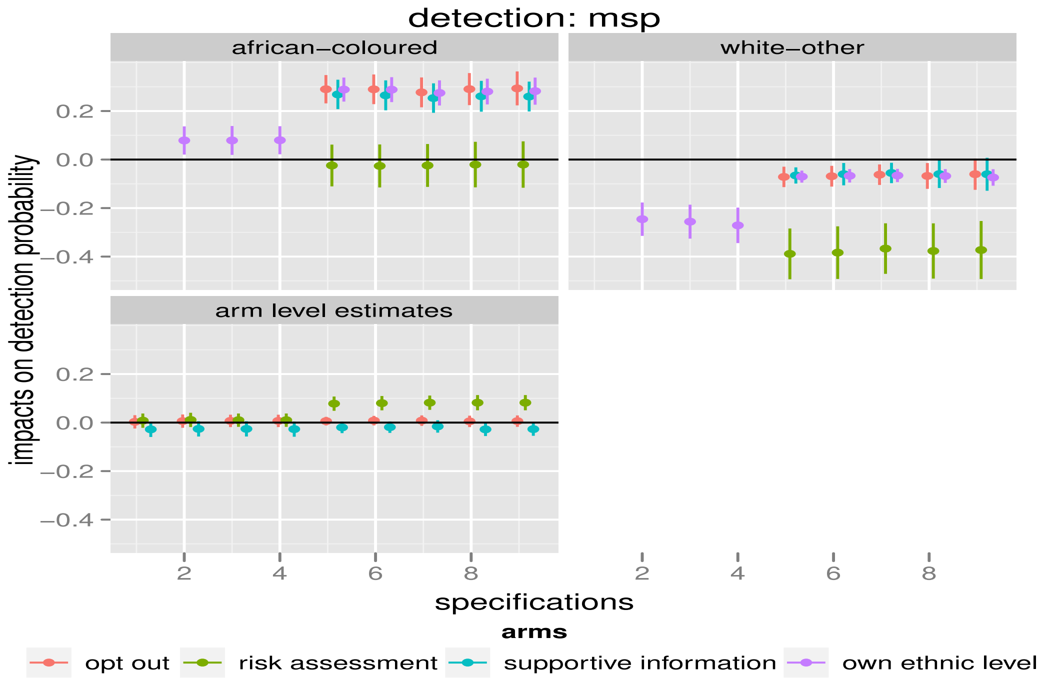
Notes
1. Vertical axis represents estimated marginal change in uptake probability, horizontal axis gives the regression specifications. Points give the point estimates under each regression specifications of respective arms, and bars indicate 95% confidence intervals.
2. Cluster robust standard errors are used. Clusters are area × date.
3. Under each experimental arms, estimates are computed by adding a level estimate with a cross estimate, for example for Africans-Colored under opt out arm, by $\beta_{\text{opt out} \times \text{africans / colored}} + \beta_{\text{africans / colored}}$. For the control arm, level estimates of ethnicity impacts, say, $\beta_{\text{africans / colored}}$, are presented.
4. Estimates of marginal impacts on uptake probabilities are computed by taking the average of probabilities $\frac{\partial p}{\partial x_{ij}} = \sum_{i=1}^{n} \frac{\phi(\beta' \mathbf{x}_i)\beta_j}{n}$. Standard errors are derived with delta method.
5. Default (omitted) ethnicity category is Indians.
6. MSP sample only. Sample dropped plausibly knowing HIV infected individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.

Figure 6: Cross Marginal Impacts of Each Arms and Ethnicity, HCT Sample



Notes See footnotes of Figure 5.

Figure 7: Cross Marginal Impacts of Each Arms and Ethnicity on HIV Detection, MSP Sample

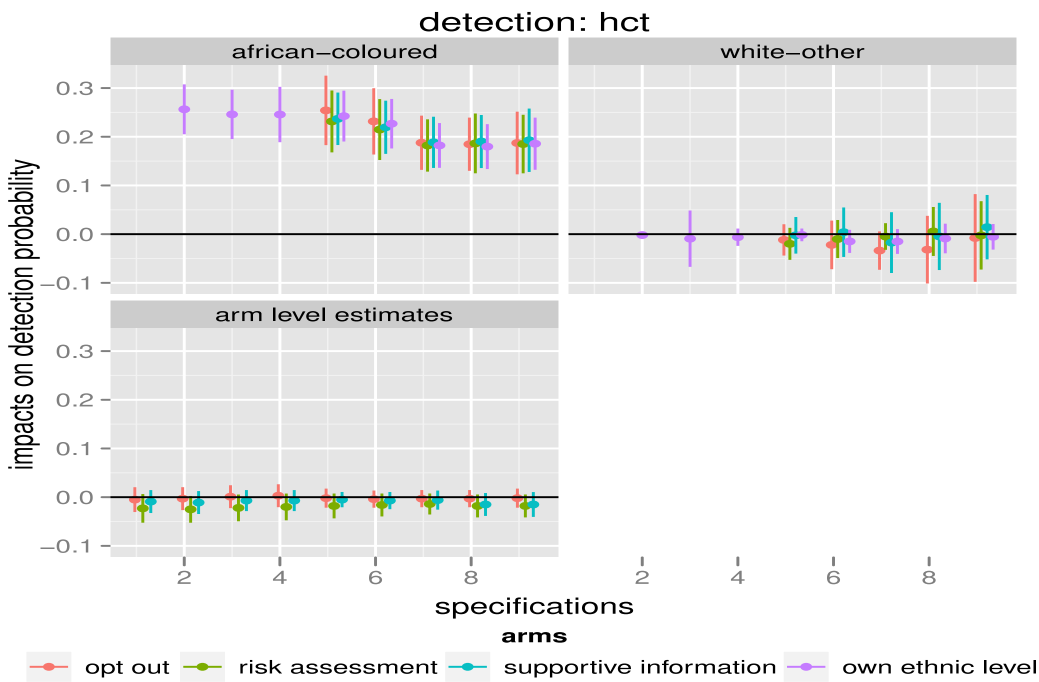


Notes 1. Vertical axis represents estimated marginal change in detection probability, horizontal axis gives the regression specifications. Points give the point estimates under each regression specifications of respective arms, and bars indicate 95% confidence intervals.

2. Detection binary variable takes the value of 1 if we observe HIV positive case, i.e., a subject takes a test and shows a seropositive result, 0 otherwise.

3. See footnotes of Figure 5.

Figure 8: Cross Marginal Impacts of Each Arms and Ethnicity on HIV Detection, HCT Sample



Notes See footnotes of Figure 7.

pometrics, risk related information, and subjective probability. Since the only covariates that are legitimately thought as exogenous are ethnicity, we treat other covariates as controls. As seen in the previous section, the impacts may vary by ethnicity, and subjective probability has predictive power of uptake. Hence we will incorporate these variates accordingly.

The results of estimated marginal effects on uptake probabilities are shown in Figure 5 for MSP sample and Figure 6 for HCT sample. Estimation results on which these figures base are presented in Table 4 and Table 5. Three panels show arm level estimates, Africans-Colored level estimates and cross estimates of Africans-Colored and arms, and Whites-Others level estimates and cross estimates of Whites-Others and arms. We compute the cross estimates by adding cross marginal effects and ethnicity level marginal effects, or $\beta_{\text{opt out} \times \text{africans / colored}} + \beta_{\text{africans / colored}}$ in the case of cross marginal effects of Africans-Colored under opt out arm.

As we have seen in the previous section, impact heterogeneity is visible by ethnicity and by route. In Figure 5, we confirm our exploratory analysis that supportive information in the MSP sample (arm level estimate with Indians as reference ethnicity) is weakly increasing the uptake rate as evidenced in the bottom left panel. Table 4 shows that supportive information has an average impact of pushing up the uptake probability by 6 to 17 percentage points, depending on the regression specifications. Whites and Others, in the top right panel, have particularly strong responses to supportive information than their responses under the control arm that their mean (marginal increase in) uptake probability almost reaches to 100%. They also show positive response to risk assessment that are weakly statistically significant in a few specifications. Thus, in relation to Simpson et al. (1998), Whites-Others in our sample seemed to have responded more strongly and more uniformly to a nondifferentiated and non-personalized inducement in DVD. This also applies to Indians to a weaker degree. Africans-Colored show lower uptake rates than Indians by 31 to 46 percentage points. All experimental arms on Africans-Colored have statistically insignificant marginal cross effects, showing the general ineffectiveness of each arms on Africans-Colored. This holds true for the supportive information arm when we evaluate its overall impacts on Africans-Colored by adding $\beta_{\text{supportive} \times \text{africans / colored}} + \beta_{\text{supportive}}$ as it becomes statistically not significant due to large standard errors on the cross estimates.

In the HCT sample, we observe that each arm has almost no marginal effects in their levels with Indians as the reference ethnicity. As shown in Table 5, level effects of Africans-Colored are negative and statistically significant in all specifications, yet their cross effects are statistically insignificant. Their relative uptake probabilities in ethnicity levels are smaller than the default ethnicity of Indians by 7 to 12 percentage points. This compares favorably with MSP sample whose ethnicity level estimates of Africans-Colored range from 31 to 46 percentage points at the margin. The difference between MSP sample estimates and HCT sample estimates may be due to the fact that HCT sample comprises of administrative employees whose educational attainment is relatively higher, and also that HCT is a selected sample who are more willing to take tests. White-Others show their relative uptake probabilities to be smaller than Indians, but only opt out arm has negative and statistically significant estimates.

In sum, joint hypothesises that our experimental arms can reduce fears and stigma, consequently can increase uptake, are rejected in all but in MSP White-Others under supportive information and risk assessments. As their opt out arm, intended to reduce stigma alone, did not give significant results, we cannot rule out that an additional component on fears and stigma that supportive information may have reduced have had some impacts. Delayed notification arm that is intended to reduce fears is not effective as there are only two subjects who exercised the delay option, hence the joint hypothesis of procrastination and fear as impediments is rejected. Thus we may leave fears and stigma to be behind the test rejection but not procrastination. Africans-Colored show consistently lower uptake rates than Indians under any arm, and no experimental arm can counter this.

It is difficult to understand why the responses differ by groups. We do, however, find two pairs of groups that show similar responses. First is Indians who show consistently high uptake rates regardless of arms and routes. Second is Africans and Colored who respond negatively (relative to Indians) under all arms, both in MSP and HCT routes. As HCT sample is more of white collar and MSP sample is blue collar, we expect the educational achievements, household background, and work style differ significantly. In fact, lower primary or less accounts for 21% and high school accounts for 25% in Africans-Colored MSP sample, these are 8% and 39%, respectively, for Africans-Colored HCT sample. Even after controlling for differences in educational achievements, Africans-Colored in MSP and HCT samples show the similar pattern in their responses relative to Indians. This leads us to a conjecture that the causes of test rejection by Africans-Colored may be rooted in their ethnic background.

Estimates on subjective probability are robustly negative on the uptake in both MSP and HCT samples. Point estimates show that a 10% increase in subjective probability is associated with a 3.3% reduction in uptake rates in MSP while this number is more than halved in HCT sample. In Table A3 and Table A4, subjective probabilities are positively correlated with infection probabilities, 13-14 percentage points in MSP and 9 percentage points in HCT sample. Therefore subjective probabilities have non-negligible informational contents on the true status.

Note that variates that can be associated with riskiness, such as single and STD times are negative and statistically significant in the specification (6) of HCT sample, or single is negative and statistically significant in the specification (6) of HCT sample, become insignificant once we use subjective probability. This implies that subjective probability has more direct and stronger association with unobservable riskiness than other variates, underscoring its usefulness as a risk marker.

Other suggestive results include negative estimates on BMI in MSP sample. They show that more obese individuals tend to reject the tests. This may be a reflection of general indifference toward health and/or general lack of HIV contraction risks in more obese individuals.

Finally, in Figure 7 and Figure 8, we plot the estimates and there confidence intervals on

Table 4: Uptake Probit, MSP Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	0.155***	1.379***	1.476***	1.463***	1.423***	1.567***	1.335***	1.360***	1.347***
	(0.026)	(0.190)	(0.209)	(0.215)	(0.217)	(0.238)	(0.236)	(0.312)	(0.310)
arm (optout)	0.009	0.008	0.005	0.005	0.030	0.027	0.025	0.025	0.026
	(0.034)	(0.031)	(0.031)	(0.031)	(0.046)	(0.046)	(0.043)	(0.045)	(0.045)
arm (assess)	0.057	0.045	0.040	0.039	0.057	0.055	0.052	0.038	0.039
	(0.037)	(0.034)	(0.033)	(0.033)	(0.040)	(0.040)	(0.039)	(0.039)	(0.039)
arm (supp)	0.062*	0.069**	0.060*	0.058*	0.168***	0.157***	0.141***	0.144***	0.145***
	(0.034)	(0.032)	(0.032)	(0.032)	(0.044)	(0.044)	(0.040)	(0.043)	(0.043)
african / colored		−0.463***	−0.444***	−0.439***	−0.441***	−0.423***	−0.315***	−0.301***	−0.304***
		(0.056)	(0.056)	(0.057)	(0.059)	(0.058)	(0.055)	(0.055)	(0.056)
white / other		−0.085	−0.094	−0.103	0.115	0.104	0.107	0.109	0.104
		(0.089)	(0.100)	(0.099)	(0.085)	(0.085)	(0.079)	(0.083)	(0.083)
age / 10		−0.432***	−0.445***	−0.431***	−0.429***	−0.455***	−0.348***	−0.361***	−0.364***
		(0.094)	(0.099)	(0.099)	(0.099)	(0.108)	(0.108)	(0.107)	(0.106)
$(\text{age} / 10)^2$		0.055***	0.056***	0.055***	0.055***	0.056***	0.044***	0.044***	0.044***
		(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
BMI / 10		−0.033	−0.027	−0.028	−0.030	−0.033*	−0.040**	−0.041**	−0.041**
		(0.021)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)
number of bf gf		−0.015	−0.013	−0.013	−0.013	0.002	0.006	0.002	0.002
		(0.014)	(0.014)	(0.014)	(0.014)	(0.020)	(0.020)	(0.020)	(0.019)
higher primary				−0.002	−0.001	−0.005	−0.011	−0.010	−0.012
				(0.034)	(0.034)	(0.034)	(0.034)	(0.035)	(0.035)
high school				0.021	0.023	0.016	0.003	−0.021	−0.026
				(0.039)	(0.039)	(0.039)	(0.038)	(0.040)	(0.040)
tertiary education				0.036	0.044	0.026	0.011	−0.053	−0.040
				(0.206)	(0.201)	(0.212)	(0.224)	(0.250)	(0.263)
arm (optout) * african / coloured					−0.072	−0.067	−0.063	−0.043	−0.047
					(0.158)	(0.158)	(0.149)	(0.153)	(0.153)
arm (optout) * white / other					0.093	0.111	0.084	0.125	0.115
					(0.258)	(0.257)	(0.238)	(0.244)	(0.244)
arm (assess) * african / coloured					0.048	0.045	0.053	0.058	0.065
					(0.142)	(0.140)	(0.134)	(0.135)	(0.136)
arm (assess) * white / other					0.388*	0.387*	0.357*	0.358*	0.342*
					(0.201)	(0.199)	(0.187)	(0.194)	(0.195)
arm (supp) * african / coloured					−0.032	−0.027	−0.029	−0.033	−0.038
					(0.155)	(0.155)	(0.144)	(0.147)	(0.146)
arm (supp) * white / other					1.093***	1.016***	1.000***	0.990***	0.973***
					(0.204)	(0.201)	(0.189)	(0.197)	(0.196)
multiple partners						−0.004	0.005	0.004	0.008
						(0.037)	(0.037)	(0.036)	(0.036)
other partners						0.068	0.054	0.045	0.043
						(0.048)	(0.048)	(0.047)	(0.047)
single						−0.064*	−0.048	−0.040	−0.041
						(0.034)	(0.033)	(0.033)	(0.033)
STD times						−0.011	−0.005	−0.004	−0.003
						(0.013)	(0.015)	(0.016)	(0.016)
STI screen						−0.013	−0.001	0.002	0.002
						(0.015)	(0.016)	(0.016)	(0.017)
TB screen						−0.011	−0.007	−0.006	−0.007
						(0.008)	(0.008)	(0.008)	(0.008)
subjective probability							−0.311***	−0.313***	−0.313***
							(0.043)	(0.043)	(0.043)
days since HCT began / 100								0.155	0.132
								(0.341)	(0.342)
$(\text{days since HCT began} / 100)^2$								−0.111	−0.100
								(0.144)	(0.145)
hourly paid workers								−0.039	−0.035
								(0.031)	(0.031)
years at Company								0.001	0.001
								(0.002)	(0.002)
HCT before									0.041
									(0.027)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.003	0.116	0.135	0.136	0.138	0.145	0.186	0.193	0.194
n	1439	1421	1421	1416	1416	1411	1321	1301	1300

Notes
1. Cluster robust standard errors in parenthesis. Clusters are area × date.
2. *, **,*** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. MSP sample only.
4. Area indicates the use of area fixed effects.

Table 5: Uptake Probit, HCT Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	0.202***	0.660***	0.622***	0.625***	0.638***	0.700***	0.623***	0.688***	0.688***
	(0.022)	(0.155)	(0.160)	(0.155)	(0.159)	(0.167)	(0.158)	(0.232)	(0.233)
arm (optout)	−0.003	0.001	−0.003	−0.004	0.006	0.009	0.012	0.014	0.014
	(0.022)	(0.022)	(0.019)	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
arm (assess)	−0.020	−0.012	0.000	−0.001	−0.003	−0.003	0.002	0.007	0.007
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.019)	(0.019)	(0.019)
arm (supp)	−0.018	−0.013	−0.020	−0.021	−0.016	−0.016	−0.021	−0.017	−0.017
	(0.020)	(0.020)	(0.021)	(0.021)	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)
african / colored		−0.086***	−0.112***	−0.113***	−0.115***	−0.107***	−0.074***	−0.074***	−0.073***
		(0.021)	(0.020)	(0.020)	(0.021)	(0.021)	(0.019)	(0.019)	(0.019)
white / other		−0.053**	−0.049**	−0.043*	−0.020	−0.016	−0.014	−0.010	−0.010
		(0.027)	(0.024)	(0.024)	(0.025)	(0.025)	(0.022)	(0.022)	(0.022)
age / 10		−0.214***	−0.197**	−0.188**	−0.199**	−0.221**	−0.192**	−0.191**	−0.190**
		(0.077)	(0.081)	(0.080)	(0.084)	(0.087)	(0.084)	(0.087)	(0.088)
$(\text{age} / 10)^2$		0.026**	0.024**	0.023**	0.024**	0.026**	0.022**	0.021*	0.021*
		(0.010)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
BMI / 10		−0.013	−0.009	−0.009	−0.008	−0.005	0.000	0.002	0.002
		(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
number of bf gf		0.005	−0.001	−0.001	−0.000	0.005	0.009	0.007	0.007
		(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.008)	(0.008)
higher primary				−0.038	−0.036	−0.031	−0.026	−0.027	−0.026
				(0.032)	(0.031)	(0.030)	(0.032)	(0.033)	(0.033)
high school				0.001	0.003	0.002	−0.001	−0.000	−0.000
				(0.034)	(0.034)	(0.031)	(0.033)	(0.036)	(0.036)
tertiary education				−0.006	0.002	0.003	0.001	0.003	0.003
				(0.040)	(0.039)	(0.036)	(0.037)	(0.040)	(0.039)
master's degree				−0.085	−0.077	−0.085*	−0.084*	−0.083	−0.083
				(0.054)	(0.052)	(0.051)	(0.050)	(0.052)	(0.051)
arm (optout) * african / coloured					−0.010	0.009	0.005	0.004	0.004
					(0.056)	(0.054)	(0.048)	(0.048)	(0.048)
arm (optout) * white / other					−0.146**	−0.132**	−0.119**	−0.114**	−0.114**
					(0.064)	(0.063)	(0.055)	(0.057)	(0.057)
arm (assess) * african / coloured					0.002	0.006	−0.031	−0.027	−0.026
					(0.049)	(0.048)	(0.043)	(0.044)	(0.044)
arm (assess) * white / other					−0.050	−0.050	−0.081	−0.079	−0.080
					(0.066)	(0.066)	(0.056)	(0.056)	(0.056)
arm (supp) * african / coloured					−0.030	−0.020	−0.031	−0.022	−0.022
					(0.047)	(0.047)	(0.044)	(0.044)	(0.044)
arm (supp) * white / other					0.000	−0.001	−0.005	−0.000	0.000
					(0.064)	(0.064)	(0.057)	(0.058)	(0.058)
multiple partners						0.021	0.020	0.023	0.022
						(0.024)	(0.027)	(0.026)	(0.026)
other partners						0.003	−0.001	−0.006	−0.006
						(0.032)	(0.029)	(0.029)	(0.029)
single						−0.043***	−0.031*	−0.028*	−0.028*
						(0.016)	(0.016)	(0.017)	(0.017)
STD times						−0.011**	−0.006	−0.005	−0.005
						(0.005)	(0.005)	(0.004)	(0.004)
STI screen						−0.001	−0.001	−0.002	−0.002
						(0.007)	(0.008)	(0.008)	(0.008)
TB screen						−0.006	−0.004	−0.003	−0.003
						(0.005)	(0.005)	(0.005)	(0.005)
subjective probability							−0.140***	−0.140***	−0.140***
							(0.025)	(0.024)	(0.024)
days since HCT began / 100								−0.226	−0.223
								(0.308)	(0.305)
$(\text{days since HCT began} / 100)^2$								0.114	0.112
								(0.131)	(0.130)
hourly paid workers								0.009	0.009
								(0.022)	(0.022)
years at Company								0.001	0.001
								(0.001)	(0.001)
HCT before									−0.003
									(0.017)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.003	0.074	0.182	0.198	0.214	0.235	0.31	0.314	0.314
n	1323	1320	1320	1315	1315	1313	1251	1236	1236

Notes

1. Cluster robust standard errors in parenthesis. Clusters are area × date.
2. *, **, *** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. Estimates show marginal impacts on uptake probabilities computed with $\frac{\partial p}{\partial x_{ij}} = \sum_{i=1}^{n} \frac{\phi(\boldsymbol{\beta}' \mathbf{x}_i)\beta_j}{n}$.
4. Standard errors are derived with delta method.
5. Default ethnicity category is Indians.
6. HCT sample only. Sample dropped plausibly knowing HIV infected individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.

detection. Detection binary variable takes the value of 1 if we observe HIV positive case, i.e., a subject takes a test and finds a seropositive result, 0 otherwise. Detection is of an interest to policy makers who want to know how many HIV positive cases can be found with certain interventions. As can be seen, riskier Africans-Colored group shows positive estimates. This suggests that if one gets the risky group, which can be found just by looking at the observable characteristics such as ethnicity and age, to take the tests, there is substantial reward in the newly found HIV positive cases. Furthermore, we find robust impacts of subjective probability on detection. This suggests that subjective probability has information contents on the true HIV status. Similarly, we find that number of boy friends and girl friends to be positively correlated with detection, even after adding subjective probability to the covariates. This reconfirms the general wisdom that having more number of sex partners can increase the risk of infection. These finding suggest that by using observables and simple questions on subjective probability on infection and number of sex parnters, we can increase the precision in targeting the most-at-risk populations (MARPS).

One also notes that estimates of risk assessment for MSP sample is lower than other arms for Africans-Colored and White-Others. One should recall that, in Figure 5, risk assessment for MSP sample is no less successful than other arms in inducing uptake. Then, smaller estimates in detection reveal that nurses may have been trying too hard to get the safer subjects to get tested for Africans-Colored and Whites-Others groups. As arm level estimates are positive and significant, the overall impacts of risk assessment were positive in detection, but, at the margin of Africans-Colored and Whites-Others groups, safe subjects have tested that lowered the rate of detecting the HIV positive cases. This is in line with Simpson et al. (1998)'s results that confirmed heterogeneity in midwives in the extent of motivating the individuals to get tested.

VI Conclusions

We have run experimental interventions in a large firm in South Africa. We combined HIV tests with existing medical check up programs to increase the uptake. Uptake rate increased dramatically, but not only under experimental arms but also under the control arm. By ethnicity, Africans and Colored are the groups that reject tests more. Indians are consistently showing high uptake rates. Whites and Others have generally high uptake rates but vary by the arms. By route, MSP sample is found to reject the test offers more often. HCT route has higher uptake rates, however, compliance to the check up is lower than MSP sample where the latter is compulsory to take the checks.

We have implemented four interventions: delayed notification, opt out, risk assessment, supportive information. Virtually no one exercised the option of delayed notification, so we used it as a control arm. Opt out resulted in robust negative impacts on uptake among Whites-Others in HCT sample. Risk assessment showed marginally significant positive impacts on Whites-Others in MSP sample. Supportive information increased the uptake of

Whites-Others by almost 100% at the margin. We thus find substantial heterogeneity in responses by ethnicity. Given that supportive information is intended to reduce fears and stigma, and opt out is intended to reduce stigma alone, statistically significant estimates on the former and insignificant estimates on the latter among Whites-Others are indicative of additional components in fears and stigma in the former arm may have had some impacts.

Generally, all experimental arms were ineffective in increasing the uptake of Africans and Colored. It is also shown that their responses are smaller than Indians (reference group) and smallest among all ethnic groups. This general aversion to tests among Africans is common in both MSP and HCT samples whose educational background differ significantly. We thus conjecture that factors related to their ethnic background to be the possible deterrents to tests.

We find robust and strong negative association of subjective probability of HIV infection with uptake. Subjective probability can be a useful risk marker in targeting the risky individuals. Among the takers of HIV tests, we find a positive correlation between infection and subjective probability. This indicates that there is a group of individuals who correctly expects their true status as HIV positive, yet rejects the tests. This pauses a threat to the containment of the disease. Similarly, we find that number of boy friends and girl friends to be positively correlated with infection and detection, even after adding subjective probability to the covariates. We recommend to ask subjective probabilities and number of sex partners in targeting the MARPS.

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A Definitions of stigma

Fear: Reluctance or aversion to face the disease (even in isolation of social repercussions) (our working definition).

Stigma: An attribute or a label that sets a person apart from others and links the labeled person to undesirable characteristics (Fortenberry et al., 2002).

Stigma: As a trait, a stigma is an attribute or characteristic that is viewed negatively by the culture or society. As an outcome, stigma occurs when the negative social meanings attached to the discrediting attribute become linked to the individual. With that linkage the person's social identity changes, resulting in less than full acceptance of the person in social interaction, identity engulfment (in which the trait becomes the defining aspect of the person, coloring all other information about him or her), and limitation of the opportunities that would otherwise be available (Berger et al., 2001, citing Goffman (1963)'s work).

HIV-related stigma and discrimination A process of devaluation of people either living with or associated with HIV and AIDS ... Discrimination follows stigma and is the unfair and unjust treatment of an individual based on his or her real or perceived HIV status (UNAIDS, 2003). If found to be HIV positive, one can expect "abandonment by spouse and/or family, social ostracism, job and property loss, school expulsion, denial of medical services, lack of care and support, and violence. These consequences, or fear of them, mean that people are less likely to come in for HIV testing, disclose their HIV status to others, adopt HIV preventive behaviour, or access treatment, care and support. If they do, they could lose everything (UNAIDS, 2007).

stigma exists if: when: "the elements of labelling, stereotyping, separation, status loss, and discrimination occur together in a power situation that allows them" (Link and Phelan, 2001).

B Standard errors of marginal effects in probit estimation

Probit marginal effect:

$$\frac{\partial \Pr[y=1]}{\partial x_{ij}} = \phi(\boldsymbol{\beta}'\mathbf{x}_i)\beta_j.$$

Given that we do not know which $\mathbf{x}_i$ to use, one can average over all observations. That is:

$$\frac{\partial \Pr[y=1]}{\partial x_{\cdot j}} = \bar{\phi}\beta_j = \beta_j \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N}.$$

Standard error of this marginal effects is obtained by delta method. Note that:

$$\mathcal{V}\left[a_j(\beta_j)\right] \xrightarrow{p} a_j'(\beta_i)^2\sigma^2_{\beta_j}.$$

Here,

$$a_j(\beta_j) = \beta_j \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N},$$

then

$$\frac{\partial a_j(\beta_j)}{\partial \beta_j} = \sum_{i=1}^{N} \frac{\phi'(\boldsymbol{\beta}'\mathbf{x}_i)\beta_j x_{ij} + \phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N} = \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)\beta_j x_{ij} + \phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N} = \sum_{i=1}^{N} \frac{1+\beta_j x_{ij}}{N}\phi(\boldsymbol{\beta}'\mathbf{x}_i).$$

So

$$a_j'(\beta_j)^2\sigma^2_{\beta_j} = \left[\sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)\beta_j x_{ij} + \phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N}\right]^2 \sigma^2_{\beta_j}.$$

If in a vector form, we will need to consider cross derivatives. Typical off diagonal elements are:

$$\frac{\partial a_j(\boldsymbol{\beta})}{\partial \beta_k} = \beta_j \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)x_{ik}}{N} = \sum_{i=1}^{N} \frac{\beta_j x_{ik}}{N}\phi(\boldsymbol{\beta}'\mathbf{x}_i).$$

In a vector form, the vector function is given as:

$$\boldsymbol{a}(\boldsymbol{\beta}) = \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_G \end{pmatrix} \bar{\phi}(\boldsymbol{\beta}) = \begin{bmatrix} a_1(\boldsymbol{\beta}) \\ \vdots \\ a_J(\boldsymbol{\beta}) \end{bmatrix}.$$

Its gradient is not symmetric (as functional forms differ):

$$\begin{aligned}
\boldsymbol{D} = \boldsymbol{\Delta}_{\boldsymbol{\beta}} \boldsymbol{a}(\boldsymbol{\beta}) &= \begin{bmatrix} \frac{\partial a_1(\beta)}{\partial \beta_1} & \frac{\partial a_1(\beta)}{\partial \beta_2} & \cdots & \frac{\partial a_1(\beta)}{\partial \beta_J} \\ \frac{\partial a_2(\beta)}{\partial \beta_1} & \frac{\partial a_2(\beta)}{\partial \beta_2} & \cdots & \frac{\partial a_2(\beta)}{\partial \beta_J} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\partial a_J(\beta')}{\partial \beta_1} & \frac{\partial a_J(\beta')}{\partial \beta_2} & \cdots & \frac{\partial a_J(\beta)}{\partial \beta_J} \end{bmatrix}, \\
&= \frac{1}{N} \sum_{i=1}^{N} \begin{bmatrix} 1+\beta_1 x_{i1} & \beta_1 x_{i2} & \cdots & \beta_1 x_{iJ} \\ \beta_2 x_{i1} & 1+\beta_2 x_{i2} & \cdots & \beta_2 x_{iJ} \\ \vdots & \vdots & \ddots & \vdots \\ \beta_J x_{i1} & \beta_J x_{i2} & \cdots & 1+\beta_J x_{iJ} \end{bmatrix} \phi(\boldsymbol{\beta}'\mathbf{x}_i), \\
&= \boldsymbol{I}_J \bar{\phi} + \boldsymbol{\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)\mathbf{x}_i'}{N}.
\end{aligned}$$

So asymptotic covariance of $\boldsymbol{a}(\boldsymbol{\beta})$ is $\boldsymbol{D}\mathcal{V}[\boldsymbol{\beta}]\boldsymbol{D}'$.

For a linear combination of parameters, say, $\beta_j + \beta_k = \boldsymbol{g}'\boldsymbol{\beta}$ with $g_j = g_k = 1$ and other elements are zero, we have:

$$c(\boldsymbol{\beta}) = \frac{\partial \Pr[y=1]}{\partial x_{\cdot j}} + \frac{\partial \Pr[y=1]}{\partial x_{\cdot k}} = \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)(\beta_j+\beta_k)}{N} = \boldsymbol{g}'\boldsymbol{\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N}$$

The asymptotic variance of this linear combination of parameters is given by taking a derivative for all parameters. Its typical element $m \neq j$ and $m \neq k$ is given by:

$$\frac{\partial c}{\partial \beta_m} = \boldsymbol{g}'\boldsymbol{\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)x_{im}}{N},$$

and for element j (or k):

$$\frac{\partial c}{\partial \beta_j} = g_j \bar{\phi} + \boldsymbol{g}'\boldsymbol{\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)x_{ij}}{N}.$$

In a set of linear combinations, we have $\boldsymbol{G\beta}$ to derive their asymptotic variances where $\boldsymbol{G}$ is a $G \times J$ matrix. Then we have

$$\boldsymbol{c}(\boldsymbol{\beta}) = \begin{pmatrix} \boldsymbol{g}_1'\boldsymbol{\beta} \\ \vdots \\ \boldsymbol{g}_G'\boldsymbol{\beta} \end{pmatrix} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N} = \boldsymbol{G\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)}{N} = \boldsymbol{G\beta}\bar{\phi} = \boldsymbol{G}\boldsymbol{a}(\boldsymbol{\beta}).$$

Its gradient is given as

$$\boldsymbol{D}_G = \boldsymbol{\Delta}_{\boldsymbol{\beta}} \boldsymbol{c}(\boldsymbol{\beta}) = \begin{bmatrix} \frac{\partial(\boldsymbol{g}_1' \boldsymbol{a}(\boldsymbol{\beta}))}{\partial \beta_1} & \cdots & \frac{\partial(\boldsymbol{g}_1' \boldsymbol{a}(\boldsymbol{\beta}))}{\partial \beta_J} \\ \vdots & \vdots & \vdots \\ \frac{\partial(\boldsymbol{g}_G' \boldsymbol{a}(\boldsymbol{\beta}))}{\partial \beta_1} & \cdots & \frac{\partial(\boldsymbol{g}_G' \boldsymbol{a}(\boldsymbol{\beta}))}{\partial \beta_J} \end{bmatrix}$$

$$= \frac{1}{N} \sum_{i=1}^{N} \left[\begin{pmatrix} g_{11} & \cdots & g_{1J} \\ \vdots & & \vdots \\ g_{G1} & \cdots & g_{GJ} \end{pmatrix} + \begin{pmatrix} \boldsymbol{g}_1' \boldsymbol{\beta} x_{i1} & \cdots & \boldsymbol{g}_1' \boldsymbol{\beta} x_{iJ} \\ \vdots & \ddots & \vdots \\ \boldsymbol{g}_G' \boldsymbol{\beta} x_{i1} & \cdots & \boldsymbol{g}_G' \boldsymbol{\beta} x_{iJ} \end{pmatrix} \right] \phi(\boldsymbol{\beta}' \mathbf{x}_i),$$

$$= \frac{1}{N} \sum_{i=1}^{N} \left[\boldsymbol{G} + \begin{pmatrix} g_{11} & \cdots & g_{1J} \\ \vdots & & \vdots \\ g_{G1} & \cdots & g_{GJ} \end{pmatrix} \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_J \end{pmatrix} \begin{pmatrix} x_{i1} & \cdots & x_{iJ} \end{pmatrix} \right] \phi(\boldsymbol{\beta}' \mathbf{x}_i),$$

$$= \boldsymbol{G} \left(\bar{\phi} + \boldsymbol{\beta} \sum_{i=1}^{N} \frac{\phi(\boldsymbol{\beta}' \mathbf{x}_i) \mathbf{x}_i'}{N} \right).$$

Then its asymptotic covariance matrix is given by $\boldsymbol{D}_G \mathcal{V}[\boldsymbol{\beta}] \boldsymbol{D}_G'$.

When evaluating the differential impacts of arms by ethnicity, we need to compare if ethnicity impacts may differ under each arm. So for Africans, for example, average impact of opt out is given by $\beta_{\text{africans} \times \text{opt out}} + \beta_{\text{africans}}$.

C Descriptive statistics

In controlling for the riskiness of each respondents, we asked a series of queries about past risky behaviours. In addition, we asked how they evaluate their risk of infection. We asked:

> What do you think the chances are that you are infected with HIV? Please choose one from scale of 0 to 10 and circle the chosen number. “0” means “no likelihood” and “10” means “certain”.

Use of subjective probability from survey questions is discussed and encouraged in Manski (2004). Subjective probabilities, rather than Lickert scales oft used in other literature, has an advantage of being comparable intra- and inter-personally, thereby allowing to be used directly in estimation. Disadvantage is the possibility of misunderstanding of probability concept by the respondents. However, as we have explained the meaning of scales to all subjects, we believe such a possibility is minimal.

D Detailed Estimated Results and Robustness Checks

Table 4, Table 5, Table A3, Table A4, Table A5, Table A6 show estimated results of uptake MSP, uptake HCT, infection MSP, infection HCT, detection MSP, detection HCT, respectively. Infection probits use only HIV test taker sample and the regressand takes the value of 1 if found to be HIV positive, 0 otherwise. Detection probit estimates the incidence of detecting HIV positive cases, where the regressand takes the value of 1 if tested and infected, 0 otherwise. Detection probit may be of interest to policy makers who wants to know at what rate one can find HIV positive cases under certain interventions.

Table A1: Variable Description

short	questions
uptake	HIV test
infection	Rapid test result
age / 10	Age / 10
$(\text{age} / 10)^2$	(Age / 10) squared
BMI / 10	BMI / 10
number of bf gf	Extramarital parters, BF, GF: How many people did you have sex with?
multiple partners	indicator if there is more than 1 sex partner
other partners	indicator if there is a sex partner other than spouse, boyfriend, girlfriend
single	indicator if number of spousal sex parnter is zero
STD times	How many times in the past 10 years have you had a sexually transmitted infection such as gonorrhoea, syphilis, genital herpes, genital warts, genital ulcers, clamidia?
STI screen	Number of affirmatives to STI screening questions
TB screen	Number of affirmatives to TB screening questions
subjective probability	What do you think the chances are that you are infected with HIV? Part 1
days since HCT began / 100	Days / 100 since the start of HCTI
$(\text{days since HCT began} / 100)^2$	days squared
hourly paid workers	What is your grade level? Hourly (yes) / Salaried (no)?
years at Company	Years worked
HCT before	Have you ever taken an HIV counseling and testing before?
gender (female = 1)	Sex
correct on life year question	indicator if correct to "life years of PLWHA" question
relatives positive	Relatives: Are HIV positive?
friends positive	Friends/Neighbours: Are HIV positive?
colleagues positive	Colleagues: Are HIV positive?
relatives died	Relatives: Have died of HIV/AIDS?
friends died	Friends/Neighbours: Have died of HIV/AIDS?
colleagues died	Colleagues: Have died of HIV/AIDS?

Infection probit estimates show Africans and Colored are more likely to be infected than Indians, Whites and Others are less likely to be infected than Indians. Tertiary education is strongly negatively associated with infection probability. Estimates on elapsed period since the launch of the promotion is positive, indicating that, as the days pass, more number of riskier individuals have taken the tests. We note positive estimates on risk assessment and negative estimates on supportive information which suggest that we have picked up, riskier Indians under the former and less risker Indians under the latter. Nevertheless, risk assessment picked up less risky individuals among Africans and Colored, and Whites and Others. So it is not particularly effective for the risky population. The arm of supportive information picked up even further less risky Africans and Colored, so it is also not effective in attracting the risky group. As suggested in the exploratory analysis, subjective probability is positively correlated with the infection probability.

In Figure A1, we plot the uptake rates by nurse and ethnicity of subjects. All nurses are African females. We observe small variations in uptake rates among Indians and White-Others by nurse, but variations are considerable among the Africans. This implies that nurse's individual contribution can be large, and we may need to take it into considerations when selecting and training the nurses.

In Table A7 and Table A8, we show the estimated uptake probit results using the nurse fixed effects in place of area fixed effects. We cannot use the both fixed effects simultaneously in the

Table A2: Descriptive Statistics

variables	min	25%	median	75%	max	mean	std	0s	NAs	n
uptake	0.000	1.000	1.000	1.000	1.000	0.816	0.387	508	0	2762
infection	0.000	0.000	0.000	0.000	1.000	0.043	0.202	2155	511	2762
african / colored	0.000	0.000	1.000	1.000	1.000	0.660	0.474	940	0	2762
indian	0.000	0.000	0.000	0.000	1.000	0.241	0.428	2097	0	2762
white / other	0.000	0.000	0.000	0.000	1.000	0.100	0.299	2487	0	2762
hct	0.000	0.000	0.000	1.000	1.000	0.479	0.500	1439	0	2762
msp	0.000	0.000	1.000	1.000	1.000	0.521	0.500	1323	0	2762
lower primary or less	0.000	0.000	0.000	0.000	1.000	0.120	0.325	2421	11	2762
higher primary	0.000	0.000	0.000	1.000	1.000	0.446	0.497	1525	11	2762
high school	0.000	0.000	0.000	1.000	1.000	0.377	0.485	1715	11	2762
tertiary education	0.000	0.000	0.000	0.000	1.000	0.052	0.221	2609	11	2762
master's degree	0.000	0.000	0.000	0.000	1.000	0.006	0.078	2734	11	2762
age / 10	0.100	2.900	3.700	4.600	6.500	3.771	1.031	0	5	2762
$(\text{age} / 10)^2$	0.010	8.410	13.690	21.160	42.250	15.285	8.193	0	5	2762
multiple partners	0.000	0.000	0.000	0.000	1.000	0.242	0.428	2094	0	2762
other partners	0.000	0.000	0.000	0.000	1.000	0.065	0.247	2582	0	2762
single	0.000	0.000	0.000	1.000	1.000	0.404	0.491	1646	0	2762
STD times	0.000	0.000	0.000	0.000	20.000	0.289	0.967	2349	7	2762
STI screen	0.000	2.000	2.000	2.000	10.000	2.011	0.801	185	4	2762
TB screen	0.000	0.000	0.000	0.000	10.000	0.574	1.290	2127	4	2762
subjective probability	0.000	0.000	0.100	0.300	1.000	0.176	0.258	1298	155	2762
days since HCT began / 100	0.590	0.870	1.290	1.520	1.750	1.192	0.362	0	0	2762
$(\text{days since HCT began} / 100)^2$	0.348	0.757	1.664	2.310	3.062	1.552	0.861	0	0	2762
hourly paid workers	0.000	0.000	1.000	1.000	1.000	0.545	0.498	1243	32	2762
years at Company	0.000	4.000	7.000	19.000	40.000	11.083	9.450	1	9	2762
HCT before	0.000	0.000	1.000	1.000	1.000	0.747	0.435	697	2	2762
BMI / 10	−1.345	0.166	0.484	0.847	8.893	0.549	0.565	0	3	2762
gender (female = 1)	0.000	0.000	0.000	0.000	1.000	0.198	0.399	2208	9	2762
correct on life year question	0.000	0.000	1.000	1.000	1.000	0.698	0.459	835	0	2762
relatives positive	0.000	0.000	0.000	1.000	1.000	0.257	0.437	2033	24	2762
friends positive	0.000	0.000	0.000	0.000	1.000	0.229	0.420	2113	23	2762
colleagues positive	0.000	0.000	0.000	0.000	1.000	0.107	0.309	2446	23	2762
relatives died	0.000	0.000	0.000	1.000	1.000	0.263	0.440	2011	35	2762
friends died	0.000	0.000	0.000	0.000	1.000	0.210	0.408	2150	39	2762
colleagues died	0.000	0.000	0.000	0.000	1.000	0.117	0.322	2411	31	2762

Notes: 1. Based on the sample using delayed notification as the control. Following observations are dropped: individuals with route, ethnicity, test taking information is missing, individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.

same regression as they are highly collinear and standard errors of nurse effects become very large. The estimated results do not differ from our main results and show their robustness.

E Organizational concerns

Company consists of three layers of employees; executives, salaried employees, and hourly paid employees. By the job type, former two correspond to administrative positions, and the hourly paid employees are production employees. In a manufacturing firm, HIV testing has an immediate impact on production, because it takes employees away from the production line.

In each production area, a daily production target is given. If there is a testing, general

Table A3: Infection Probit, MSP Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	−0.171***	−0.504***	−0.531***	−0.540***	−0.825***	−0.791***	−1.101***	−1.296***	−1.289***
	(0.013)	(0.149)	(0.156)	(0.160)	(0.176)	(0.183)	(0.200)	(0.259)	(0.262)
arm (optout)	0.003	0.007	0.009	0.009	0.010	0.013	0.013	0.010	0.010
	(0.020)	(0.019)	(0.018)	(0.018)	(0.013)	(0.014)	(0.014)	(0.015)	(0.015)
arm (assess)	0.006	0.009	0.009	0.009	0.098***	0.098***	0.093***	0.096***	0.095***
	(0.021)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)	(0.022)	(0.023)
arm (supp)	−0.045**	−0.042*	−0.042*	−0.042*	−0.027*	−0.027*	−0.019	−0.036*	−0.035*
	(0.022)	(0.022)	(0.022)	(0.022)	(0.016)	(0.016)	(0.017)	(0.019)	(0.019)
african / colored		0.122***	0.119***	0.120***	0.384***	0.380***	0.328***	0.338***	0.340***
		(0.038)	(0.039)	(0.038)	(0.035)	(0.037)	(0.033)	(0.036)	(0.038)
white / other		−0.312***	−0.323***	−0.342***	−0.087***	−0.081***	−0.076***	−0.078***	−0.083***
		(0.046)	(0.047)	(0.048)	(0.016)	(0.020)	(0.020)	(0.020)	(0.024)
age / 10		0.116	0.110	0.109	0.110	0.081	0.046	0.046	0.042
		(0.075)	(0.075)	(0.078)	(0.079)	(0.084)	(0.083)	(0.086)	(0.087)
$(\text{age} / 10)^2$		−0.014	−0.013	−0.013	−0.013	−0.010	−0.005	−0.006	−0.005
		(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
BMI / 10		−0.001	−0.001	−0.002	−0.001	−0.001	−0.005	−0.006	−0.006
		(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)
number of bf gf		0.017**	0.016**	0.016**	0.016**	0.017*	0.021**	0.020**	0.021**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.008)
higher primary				0.008	0.007	0.011	−0.001	0.001	−0.001
				(0.023)	(0.024)	(0.024)	(0.024)	(0.026)	(0.027)
high school				0.008	0.006	0.009	−0.005	−0.002	0.001
				(0.026)	(0.026)	(0.026)	(0.026)	(0.028)	(0.029)
tertiary education				−0.330***	−0.348***	−0.327***	−0.347***	−0.359***	−0.383***
				(0.068)	(0.068)	(0.067)	(0.071)	(0.072)	(0.074)
arm (optout) * african / coloured					−0.003	−0.002	0.003	0.009	0.005
					(0.028)	(0.027)	(0.027)	(0.033)	(0.034)
arm (optout) * white / other					0.005	0.000	0.040	0.047	0.055
					(0.028)	(0.028)	(0.039)	(0.054)	(0.057)
arm (assess) * african / coloured					−0.406***	−0.406***	−0.360***	−0.372***	−0.375***
					(0.061)	(0.061)	(0.062)	(0.066)	(0.065)
arm (assess) * white / other					−0.400***	−0.396***	−0.318***	−0.325***	−0.316***
					(0.062)	(0.062)	(0.056)	(0.068)	(0.068)
arm (supp) * african / coloured					−0.042	−0.046	−0.047	−0.054*	−0.060*
					(0.029)	(0.030)	(0.029)	(0.032)	(0.032)
arm (supp) * white / other					0.009	0.007	0.031	0.031	0.035
					(0.027)	(0.032)	(0.035)	(0.045)	(0.047)
multiple partners						−0.005	−0.034	−0.033	−0.035
						(0.022)	(0.023)	(0.023)	(0.023)
other partners						−0.006	0.004	0.008	0.007
						(0.027)	(0.027)	(0.027)	(0.026)
single						−0.016	−0.023	−0.020	−0.019
						(0.024)	(0.024)	(0.024)	(0.023)
STD times						0.004	−0.003	−0.004	−0.005
						(0.005)	(0.004)	(0.004)	(0.004)
STI screen						0.013*	0.006	0.006	0.005
						(0.007)	(0.008)	(0.008)	(0.009)
TB screen						0.003	0.005	0.004	0.004
						(0.004)	(0.004)	(0.004)	(0.004)
subjective probability							0.139***	0.142***	0.140***
							(0.031)	(0.032)	(0.033)
days since HCT began / 100								0.345	0.367*
								(0.212)	(0.207)
$(\text{days since HCT began} / 100)^2$								−0.137	−0.148*
								(0.091)	(0.089)
hourly paid workers								−0.005	−0.008
								(0.016)	(0.016)
years at Company								0.001	0.001
								(0.001)	(0.001)
HCT before									−0.028
									(0.017)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.016	0.115	0.135	0.136	0.142	0.153	0.22	0.233	0.241
n	1017	1014	1014	1010	1010	1008	976	961	961

Notes
1. Cluster robust standard errors in parenthesis. Clusters are area × date.
2. *, **,*** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. MSP taker sample only.

Table A4: Infection Probit, HCT Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	−0.121***	−0.555***	−0.512***	−0.498***	−0.494***	−0.512***	−0.373***	−0.455***	−0.448***
	(0.008)	(0.088)	(0.098)	(0.100)	(0.099)	(0.106)	(0.097)	(0.167)	(0.170)
arm (optout)	−0.005	−0.005	0.001	0.003	−0.002	−0.004	−0.002	−0.003	−0.001
	(0.014)	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)	(0.009)	(0.012)	(0.012)
arm (assess)	−0.024	−0.026*	−0.023	−0.020	−0.020	−0.020	−0.012	−0.014	−0.013
	(0.016)	(0.015)	(0.015)	(0.015)	(0.014)	(0.013)	(0.011)	(0.012)	(0.011)
arm (supp)	−0.009	−0.010	−0.005	−0.005	−0.003	−0.004	0.000	−0.007	−0.007
	(0.013)	(0.012)	(0.012)	(0.012)	(0.010)	(0.009)	(0.010)	(0.013)	(0.013)
african / colored		0.272***	0.263***	0.263***	0.260***	0.240***	0.180***	0.180***	0.177***
		(0.028)	(0.028)	(0.032)	(0.029)	(0.027)	(0.026)	(0.027)	(0.029)
white / other		−0.002	−0.006	0.001	0.001	−0.013	−0.012	−0.004	0.001
		(0.002)	(0.028)	(0.011)	(0.007)	(0.012)	(0.013)	(0.013)	(0.012)
age / 10		0.098**	0.090**	0.084*	0.084*	0.094**	0.048	0.037	0.041
		(0.039)	(0.044)	(0.044)	(0.044)	(0.048)	(0.044)	(0.045)	(0.045)
$(\text{age} / 10)^2$		−0.011**	−0.010*	−0.010*	−0.010*	−0.010*	−0.005	−0.003	−0.003
		(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
BMI / 10		−0.001	−0.004	−0.004	−0.004	−0.008	−0.006	−0.005	−0.006
		(0.012)	(0.012)	(0.012)	(0.012)	(0.010)	(0.010)	(0.011)	(0.011)
number of bf gf		0.004	0.002	0.002	0.002	−0.004	−0.009	−0.008	−0.007
		(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.007)	(0.007)
higher primary				0.009	0.009	0.009	−0.001	0.002	0.006
				(0.018)	(0.019)	(0.018)	(0.016)	(0.018)	(0.016)
high school				−0.016	−0.016	−0.015	−0.027	−0.022	−0.017
				(0.021)	(0.021)	(0.021)	(0.019)	(0.021)	(0.019)
tertiary education				−0.234***	−0.234***	−0.214***	−0.186***	−0.187***	−0.185***
				(0.030)	(0.030)	(0.029)	(0.039)	(0.040)	(0.041)
master's degree				−0.005	−0.005	0.049	0.026	0.024	0.023
				(0.030)	(0.030)	(0.041)	(0.038)	(0.039)	(0.037)
arm (optout) * african / coloured					0.014	0.006	0.003	0.011	0.001
					(0.026)	(0.025)	(0.016)	(0.027)	(0.034)
arm (optout) * white / other					0.002	0.000	−0.026	−0.018	−0.017
					(0.028)	(0.030)	(0.035)	(0.048)	(0.056)
arm (assess) * african / coloured					−0.007	−0.003	0.014	0.023	0.011
					(0.027)	(0.027)	(0.021)	(0.027)	(0.030)
arm (assess) * white / other					−0.019	0.013	0.017	0.028	0.007
					(0.017)	(0.027)	(0.022)	(0.022)	(0.043)
arm (supp) * african / coloured					−0.007	−0.007	0.012	0.017	0.008
					(0.017)	(0.016)	(0.013)	(0.022)	(0.029)
arm (supp) * white / other					0.000	0.026	−0.003	0.009	0.004
					(0.016)	(0.026)	(0.036)	(0.036)	(0.027)
multiple partners						0.000	−0.001	−0.002	−0.004
						(0.013)	(0.012)	(0.012)	(0.013)
other partners						−0.056**	−0.053***	−0.054***	−0.058**
						(0.024)	(0.020)	(0.020)	(0.023)
single						0.030**	0.020*	0.017	0.012
						(0.012)	(0.012)	(0.012)	(0.012)
STD times						0.010**	0.006*	0.005	0.005
						(0.004)	(0.003)	(0.003)	(0.004)
STI screen						0.001	0.003	0.003	0.003
						(0.004)	(0.004)	(0.004)	(0.004)
TB screen						0.000	−0.002	−0.003	−0.002
						(0.003)	(0.003)	(0.003)	(0.003)
subjective probability							0.095***	0.096***	0.093***
							(0.025)	(0.025)	(0.025)
days since HCT began / 100								0.175	0.187
								(0.170)	(0.173)
$(\text{days since HCT began} / 100)^2$								−0.076	−0.080
								(0.070)	(0.071)
hourly paid workers								0.020	0.021
								(0.015)	(0.014)
years at Company								−0.001	−0.001
								(0.001)	(0.001)
HCT before									−0.025**
									(0.012)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.008	0.203	0.254	0.271	0.271	0.316	0.414	0.425	0.445
n	1234	1231	1231	1226	1226	1224	1170	1156	1156

Notes
1. Cluster robust standard errors in parenthesis. Clusters are area × date.
2. *, **, *** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. Estimates show marginal impacts on infection probabilities computed with $\frac{\partial p}{\partial x_{ij}} = \sum_{i=1}^{n} \frac{\phi(\beta' \mathbf{x}_i)\beta_j}{n}$.
4. Standard errors are derived with delta method.
5. Default ethnicity category is Indians.
6. HCT taker sample only. Sample dropped plausibly knowing HIV infected individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.

Table A5: Detection Probit, MSP Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	-0.147^{***}	-0.340^{***}	-0.349^{***}	-0.352^{***}	-0.574^{***}	-0.545^{***}	-0.831^{***}	-0.968^{***}	-0.965^{***}
	(0.009)	(0.105)	(0.108)	(0.111)	(0.120)	(0.126)	(0.139)	(0.180)	(0.183)
arm (optout)	0.003	0.006	0.007	0.007	0.006	0.008	0.008	0.005	0.006
	(0.014)	(0.014)	(0.013)	(0.013)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)
arm (assess)	0.008	0.011	0.010	0.010	0.078^{***}	0.080^{***}	0.082^{***}	0.082^{***}	0.082^{***}
	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)
arm (supp)	-0.028^{*}	−0.026	−0.026	-0.027^{*}	-0.020^{*}	−0.019	−0.016	-0.028^{**}	-0.027^{*}
	(0.016)	(0.016)	(0.016)	(0.016)	(0.012)	(0.012)	(0.013)	(0.014)	(0.014)
african / colored		0.079^{***}	0.079^{***}	0.080^{***}	0.288^{***}	0.288^{***}	0.275^{***}	0.280^{***}	0.282^{***}
		(0.030)	(0.030)	(0.029)	(0.025)	(0.026)	(0.026)	(0.027)	(0.028)
white / other		-0.246^{***}	-0.256^{***}	-0.271^{***}	-0.070^{***}	-0.067^{***}	-0.066^{***}	-0.068^{***}	-0.074^{***}
		(0.035)	(0.036)	(0.037)	(0.013)	(0.014)	(0.014)	(0.015)	(0.017)
age / 10		0.059	0.053	0.052	0.052	0.033	0.014	0.010	0.009
		(0.053)	(0.053)	(0.055)	(0.056)	(0.059)	(0.061)	(0.063)	(0.065)
$(\text{age} / 10)^2$		−0.007	−0.006	−0.006	−0.006	−0.004	−0.002	−0.002	−0.001
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
BMI / 10		−0.002	−0.002	−0.002	−0.002	−0.002	−0.006	−0.006	−0.006
		(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)	(0.010)
number of bf gf		0.011^{**}	0.010^{**}	0.010^{**}	0.010^{**}	0.013^{*}	0.016^{**}	0.015^{**}	0.015^{**}
		(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
higher primary				0.005	0.004	0.005	−0.000	0.001	−0.000
				(0.017)	(0.017)	(0.017)	(0.019)	(0.020)	(0.020)
high school				0.005	0.004	0.005	−0.001	−0.002	−0.000
				(0.019)	(0.019)	(0.019)	(0.021)	(0.022)	(0.023)
tertiary education				-0.321^{***}	-0.336^{***}	-0.340^{***}	-0.326^{***}	-0.347^{***}	-0.341^{***}
				(0.040)	(0.041)	(0.042)	(0.043)	(0.045)	(0.045)
arm (optout) * african / coloured					0.001	0.001	0.002	0.010	0.011
					(0.016)	(0.017)	(0.017)	(0.018)	(0.019)
arm (optout) * white / other					−0.001	−0.002	0.003	0.000	0.014
					(0.017)	(0.020)	(0.020)	(0.023)	(0.030)
arm (assess) * african / coloured					-0.313^{***}	-0.314^{***}	-0.299^{***}	-0.301^{***}	-0.303^{***}
					(0.044)	(0.045)	(0.045)	(0.047)	(0.048)
arm (assess) * white / other					-0.318^{***}	-0.317^{***}	-0.301^{***}	-0.309^{***}	-0.299^{***}
					(0.047)	(0.048)	(0.045)	(0.050)	(0.055)
arm (supp) * african / coloured					−0.020	−0.023	−0.021	−0.019	−0.022
					(0.018)	(0.019)	(0.019)	(0.019)	(0.017)
arm (supp) * white / other					0.005	0.007	0.010	0.008	0.013
					(0.021)	(0.025)	(0.021)	(0.029)	(0.035)
multiple partners						−0.006	−0.021	−0.022	−0.025
						(0.017)	(0.017)	(0.018)	(0.018)
other partners						0.003	0.012	0.014	0.015
						(0.020)	(0.020)	(0.020)	(0.020)
single						−0.018	−0.019	−0.016	−0.015
						(0.017)	(0.018)	(0.017)	(0.017)
STD times						0.003	−0.002	−0.001	−0.002
						(0.003)	(0.004)	(0.004)	(0.004)
STI screen						0.007	0.007	0.007	0.006
						(0.005)	(0.005)	(0.005)	(0.005)
TB screen						0.001	0.001	0.001	0.001
						(0.003)	(0.004)	(0.004)	(0.004)
subjective probability							0.052^{***}	0.052^{***}	0.056^{***}
							(0.017)	(0.017)	(0.017)
days since HCT began / 100								0.275^{*}	0.296^{*}
								(0.162)	(0.160)
$(\text{days since HCT began} / 100)^2$								-0.115^{*}	-0.124^{*}
								(0.068)	(0.068)
hourly paid workers								−0.007	−0.009
								(0.012)	(0.012)
years at Company								0.001	0.001
								(0.001)	(0.001)
HCT before									-0.024^{*}
									(0.013)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.013	0.072	0.098	0.098	0.103	0.112	0.142	0.151	0.16
n	1439	1421	1421	1416	1416	1411	1321	1301	1300

Notes
1. Cluster robust standard errors in parenthesis. Clusters are area $\times$ date.
2. *, **, *** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. MSP sample only.

Table A6: Detection Probit, HCT Sample, Marginal Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	−0.116***	−0.506***	−0.462***	−0.447***	−0.444***	−0.460***	−0.335***	−0.412***	−0.430***
	(0.008)	(0.081)	(0.091)	(0.093)	(0.093)	(0.099)	(0.091)	(0.151)	(0.157)
arm (optout)	−0.005	−0.003	0.001	0.003	−0.002	−0.004	−0.003	−0.003	−0.002
	(0.013)	(0.012)	(0.012)	(0.012)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
arm (assess)	−0.023	−0.025*	−0.022	−0.020	−0.018	−0.016	−0.014	−0.018	−0.018
	(0.015)	(0.014)	(0.014)	(0.014)	(0.013)	(0.012)	(0.011)	(0.012)	(0.012)
arm (supp)	−0.009	−0.011	−0.007	−0.007	−0.005	−0.007	−0.006	−0.015	−0.015
	(0.012)	(0.012)	(0.011)	(0.011)	(0.008)	(0.009)	(0.010)	(0.012)	(0.013)
african / colored		0.256***	0.246***	0.246***	0.242***	0.227***	0.182***	0.180***	0.186***
		(0.026)	(0.026)	(0.029)	(0.027)	(0.026)	(0.023)	(0.023)	(0.027)
white / other		−0.002	−0.009	−0.006	−0.002	−0.015	−0.015	−0.009	−0.005
		(0.002)	(0.030)	(0.009)	(0.007)	(0.012)	(0.013)	(0.016)	(0.013)
age / 10		0.079**	0.071*	0.063	0.063	0.070	0.021	0.010	0.019
		(0.036)	(0.041)	(0.042)	(0.042)	(0.046)	(0.044)	(0.045)	(0.045)
$(\text{age} / 10)^2$		−0.009*	−0.008	−0.007	−0.007	−0.007	−0.001	0.001	−0.000
		(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
BMI / 10		−0.001	−0.004	−0.004	−0.004	−0.006	−0.002	−0.001	−0.002
		(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)
number of bf gf		0.005	0.003	0.002	0.002	−0.003	−0.005	−0.004	−0.004
		(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.007)
higher primary				0.008	0.008	0.010	−0.001	0.002	0.006
				(0.016)	(0.017)	(0.017)	(0.017)	(0.018)	(0.016)
high school				−0.015	−0.015	−0.013	−0.024	−0.018	−0.013
				(0.020)	(0.020)	(0.020)	(0.020)	(0.022)	(0.021)
tertiary education				−0.217***	−0.217***	−0.201***	−0.182***	−0.185***	−0.195***
				(0.028)	(0.028)	(0.028)	(0.037)	(0.039)	(0.041)
master's degree				0.000	0.001	0.007	0.010	0.013	0.022
				(0.024)	(0.024)	(0.024)	(0.020)	(0.024)	(0.024)
arm (optout) * african / coloured					0.012	0.005	0.006	0.005	0.001
					(0.021)	(0.020)	(0.016)	(0.019)	(0.026)
arm (optout) * white / other					−0.010	−0.007	−0.019	−0.023	−0.002
					(0.018)	(0.023)	(0.022)	(0.033)	(0.046)
arm (assess) * african / coloured					−0.011	−0.012	−0.000	0.007	−0.001
					(0.022)	(0.022)	(0.016)	(0.021)	(0.024)
arm (assess) * white / other					−0.018	0.005	0.010	0.014	0.003
					(0.018)	(0.025)	(0.019)	(0.027)	(0.039)
arm (supp) * african / coloured					−0.006	−0.007	0.006	0.010	0.007
					(0.015)	(0.014)	(0.014)	(0.018)	(0.028)
arm (supp) * white / other					−0.001	0.019	−0.002	0.004	0.020
					(0.019)	(0.027)	(0.031)	(0.033)	(0.035)
multiple partners						0.002	0.003	0.002	−0.000
						(0.012)	(0.012)	(0.012)	(0.012)
other partners						−0.052**	−0.045**	−0.045**	−0.051**
						(0.021)	(0.018)	(0.018)	(0.020)
single						0.026**	0.018	0.015	0.011
						(0.011)	(0.011)	(0.011)	(0.012)
STD times						0.008**	0.005	0.004	0.003
						(0.004)	(0.003)	(0.004)	(0.004)
STI screen						0.002	0.004	0.004	0.004
						(0.004)	(0.003)	(0.003)	(0.003)
TB screen						−0.001	−0.003	−0.004	−0.003
						(0.003)	(0.003)	(0.003)	(0.003)
subjective probability							0.062***	0.062***	0.063***
							(0.018)	(0.017)	(0.017)
days since HCT began / 100								0.169	0.200
								(0.168)	(0.173)
$(\text{days since HCT began} / 100)^2$								−0.072	−0.084
								(0.069)	(0.071)
hourly paid workers								0.017	0.017
								(0.015)	(0.014)
years at Company								−0.001	−0.001
								(0.001)	(0.001)
HCT before									−0.029**
									(0.011)
area	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.009	0.189	0.24	0.255	0.255	0.293	0.346	0.356	0.382
n	1323	1320	1320	1315	1315	1313	1251	1236	1236

Notes
1. Cluster robust standard errors in parenthesis. Clusters are area × date.
2. *, **,*** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. Estimates show marginal impacts on detection probabilities computed with $\frac{\partial p}{\partial x_{ij}} = \sum_{i=1}^{n} \frac{\phi(\boldsymbol{\beta}'\mathbf{x}_i)\beta_j}{n}$.
4. Standard errors are derived with delta method.
5. Default ethnicity category is Indians.
6. HCT sample only. Sample dropped plausibly knowing HIV infected individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.

Table A7: Uptake Probit, MSP Sample, Marginal Effects, Nurse Fixed Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	0.155***	1.357***	1.513***	1.458***	1.417***	1.623***	1.343***	1.377***	1.330***
	(0.026)	(0.196)	(0.259)	(0.264)	(0.266)	(0.266)	(0.254)	(0.327)	(0.327)
arm (optout)	0.009	0.014	0.012	0.011	0.044	0.025	0.024	0.023	0.031
	(0.034)	(0.031)	(0.031)	(0.031)	(0.046)	(0.044)	(0.041)	(0.042)	(0.042)
arm (assess)	0.057	0.050	0.043	0.043	0.052	0.033	0.032	0.016	0.030
	(0.037)	(0.034)	(0.033)	(0.034)	(0.042)	(0.040)	(0.038)	(0.038)	(0.037)
arm (supp)	0.062*	0.067**	0.059*	0.057*	0.189***	0.171***	0.149***	0.145***	0.150***
	(0.034)	(0.032)	(0.031)	(0.031)	(0.043)	(0.041)	(0.038)	(0.041)	(0.041)
african / colored		−0.463***	−0.454***	−0.449***	−0.449***	−0.453***	−0.333***	−0.319***	−0.315***
		(0.060)	(0.059)	(0.060)	(0.062)	(0.058)	(0.053)	(0.054)	(0.054)
white / other		−0.082	−0.101	−0.111	0.092	0.071	0.064	0.068	0.084
		(0.093)	(0.093)	(0.092)	(0.085)	(0.082)	(0.076)	(0.080)	(0.079)
age / 10		−0.441***	−0.425***	−0.413***	−0.411***	−0.468***	−0.345***	−0.336***	−0.331***
		(0.090)	(0.093)	(0.093)	(0.093)	(0.100)	(0.100)	(0.101)	(0.101)
$(\text{age} / 10)^2$		0.056***	0.054***	0.053***	0.053***	0.058***	0.042***	0.040***	0.040***
		(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
higher primary				0.003	0.003	0.002	−0.017	−0.012	−0.010
				(0.035)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
high school				0.027	0.027	0.024	−0.001	−0.022	−0.023
				(0.039)	(0.039)	(0.039)	(0.037)	(0.038)	(0.038)
tertiary education				0.129	0.139	0.113	−0.002	−0.081	−0.079
				(0.191)	(0.189)	(0.192)	(0.176)	(0.183)	(0.187)
arm (optout) * african / coloured					−0.119	−0.047	−0.048	−0.020	−0.037
					(0.172)	(0.162)	(0.149)	(0.147)	(0.147)
arm (optout) * white / other					0.046	0.118	0.088	0.131	0.120
					(0.263)	(0.255)	(0.235)	(0.241)	(0.241)
arm (assess) * african / coloured					−0.003	0.064	0.061	0.072	0.080
					(0.153)	(0.140)	(0.130)	(0.129)	(0.132)
arm (assess) * white / other					0.134	0.203	0.169	0.170	0.258
					(0.227)	(0.217)	(0.197)	(0.200)	(0.195)
arm (supp) * african / coloured					−0.120	−0.050	−0.050	−0.045	−0.053
					(0.165)	(0.155)	(0.139)	(0.140)	(0.141)
arm (supp) * white / other					1.077***	1.128***	1.001***	0.980***	0.967***
					(0.212)	(0.202)	(0.187)	(0.193)	(0.193)
multiple partners						0.007	0.020	0.016	0.016
						(0.026)	(0.026)	(0.026)	(0.026)
other partners						0.068	0.047	0.046	0.042
						(0.047)	(0.046)	(0.047)	(0.047)
single						−0.057*	−0.033	−0.029	−0.032
						(0.030)	(0.029)	(0.030)	(0.030)
STD times						−0.010	−0.004	−0.003	−0.002
						(0.012)	(0.015)	(0.015)	(0.015)
STI screen						−0.015	0.002	0.002	0.003
						(0.015)	(0.016)	(0.017)	(0.017)
TB screen						−0.006	−0.004	−0.004	−0.005
						(0.007)	(0.007)	(0.007)	(0.007)
subjective probability							−0.332***	−0.330***	−0.332***
							(0.043)	(0.042)	(0.042)
days since HCT began / 100								0.108	0.112
								(0.326)	(0.331)
$(\text{days since HCT began} / 100)^2$								−0.089	−0.089
								(0.136)	(0.138)
hourly paid workers								−0.030	−0.026
								(0.027)	(0.027)
years at Company								0.001	0.001
								(0.002)	(0.002)
HCT before									0.044*
									(0.025)
BMI / 10									−0.040**
									(0.019)
nurse	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.003	0.111	0.133	0.133	0.135	0.145	0.195	0.203	0.208
n	1439	1436	1436	1431	1431	1423	1332	1312	1311

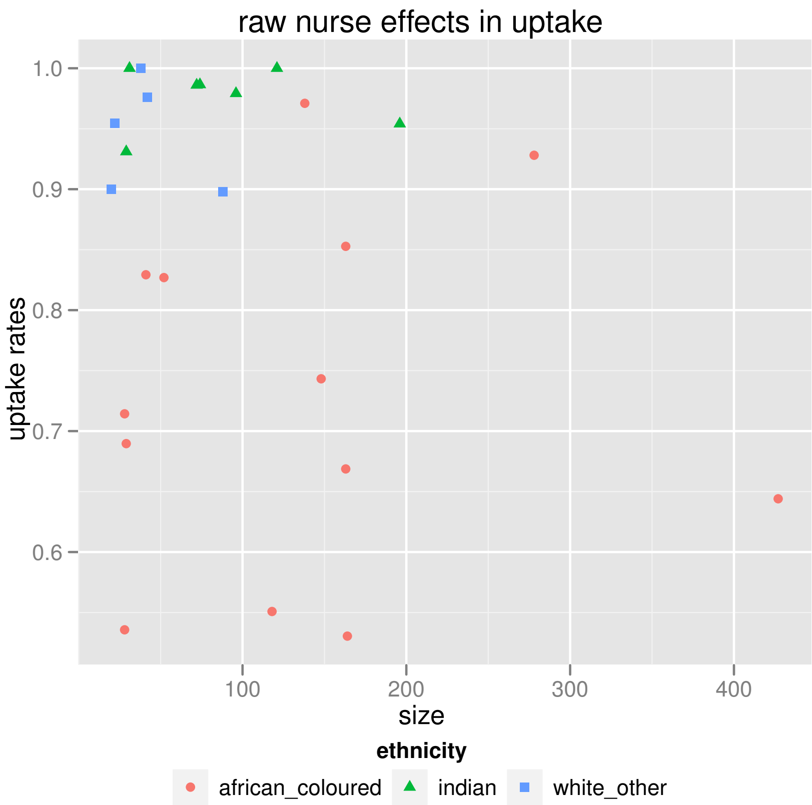
Notes
1. Cluster robust standard errors in parenthesis. Clusters are nurse × date.
2. *, **, *** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. MSP sample only.

Table A8: Uptake Probit, HCT Sample, Marginal Effects, Nurse Fixed Effects

covariates	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Intercept)	0.202***	0.684***	1.089***	1.104***	1.104***	1.146***	1.073***	0.989***	1.001***
	(0.022)	(0.160)	(0.175)	(0.166)	(0.163)	(0.165)	(0.159)	(0.181)	(0.184)
arm (optout)	−0.003	0.000	−0.007	−0.006	0.007	0.010	0.007	0.010	0.009
	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)
arm (assess)	−0.020	−0.013	−0.009	−0.010	−0.011	−0.010	−0.008	−0.004	−0.005
	(0.020)	(0.020)	(0.018)	(0.018)	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)
arm (supp)	−0.018	−0.013	−0.018	−0.017	−0.015	−0.017	−0.019	−0.021	−0.021
	(0.020)	(0.020)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)	(0.022)	(0.021)
african / colored		−0.084***	−0.092***	−0.095***	−0.094***	−0.089***	−0.054***	−0.057***	−0.057***
		(0.020)	(0.019)	(0.018)	(0.020)	(0.020)	(0.018)	(0.019)	(0.019)
white / other		−0.052**	−0.051**	−0.045*	−0.021	−0.017	−0.012	−0.005	−0.005
		(0.026)	(0.025)	(0.024)	(0.027)	(0.028)	(0.024)	(0.023)	(0.024)
age / 10		−0.227***	−0.199**	−0.190**	−0.199**	−0.227***	−0.190**	−0.191**	−0.191**
		(0.079)	(0.081)	(0.078)	(0.079)	(0.082)	(0.078)	(0.085)	(0.086)
(age / 10)^2		0.028***	0.024**	0.023**	0.024**	0.026**	0.022**	0.021*	0.020*
		(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
higher primary				−0.041	−0.044	−0.034	−0.032	−0.019	−0.019
				(0.034)	(0.032)	(0.031)	(0.033)	(0.034)	(0.035)
high school				−0.019	−0.024	−0.017	−0.016	0.002	0.002
				(0.034)	(0.033)	(0.031)	(0.032)	(0.036)	(0.036)
tertiary education				−0.028	−0.028	−0.016	−0.019	0.003	0.003
				(0.039)	(0.037)	(0.035)	(0.035)	(0.040)	(0.040)
master's degree				−0.112**	−0.114**	−0.112**	−0.111**	−0.091*	−0.091*
				(0.054)	(0.054)	(0.054)	(0.051)	(0.052)	(0.052)
arm (optout) * african / coloured					−0.032	−0.013	−0.015	−0.011	−0.010
					(0.058)	(0.056)	(0.049)	(0.050)	(0.051)
arm (optout) * white / other					−0.146**	−0.133**	−0.124**	−0.123**	−0.120**
					(0.067)	(0.068)	(0.059)	(0.060)	(0.060)
arm (assess) * african / coloured					−0.012	−0.004	−0.044	−0.039	−0.038
					(0.048)	(0.047)	(0.043)	(0.045)	(0.045)
arm (assess) * white / other					−0.043	−0.041	−0.072	−0.075	−0.074
					(0.070)	(0.071)	(0.063)	(0.062)	(0.062)
arm (supp) * african / coloured					−0.039	−0.032	−0.043	−0.035	−0.035
					(0.049)	(0.050)	(0.045)	(0.045)	(0.045)
arm (supp) * white / other					0.013	0.020	0.007	0.008	0.010
					(0.071)	(0.073)	(0.064)	(0.064)	(0.064)
multiple partners						0.052***	0.053**	0.051**	0.050**
						(0.020)	(0.022)	(0.023)	(0.022)
other partners						0.004	−0.007	−0.009	−0.009
						(0.033)	(0.030)	(0.030)	(0.030)
single						−0.039***	−0.025*	−0.025*	−0.026*
						(0.014)	(0.014)	(0.015)	(0.015)
STD times						−0.011**	−0.006	−0.007	−0.007
						(0.005)	(0.005)	(0.005)	(0.005)
STI screen						−0.004	−0.001	−0.003	−0.003
						(0.007)	(0.007)	(0.007)	(0.007)
TB screen						−0.005	−0.004	−0.003	−0.003
						(0.005)	(0.005)	(0.005)	(0.005)
subjective probability							−0.138***	−0.138***	−0.137***
							(0.025)	(0.025)	(0.025)
days since HCT began / 100								0.076	0.073
								(0.210)	(0.209)
(days since HCT began / 100)^2								−0.028	−0.027
								(0.088)	(0.088)
hourly paid workers								0.028	0.028
								(0.019)	(0.019)
years at Company								0.002	0.002
								(0.001)	(0.001)
HCT before									−0.009
									(0.016)
BMI / 10									0.003
									(0.011)
nurse	no	no	yes	yes	yes	yes	yes	yes	yes
pseudo R^2	0.003	0.071	0.16	0.172	0.189	0.216	0.275	0.281	0.282
n	1323	1321	1319	1314	1314	1312	1250	1235	1234

Notes
1. Cluster robust standard errors in parenthesis. Clusters are nurse × date.
2. *, **, *** indicate statistical significance at 10%, 5%, 1% levels, respectively.
3. Estimates show marginal impacts on uptake probabilities computed with $\frac{\partial p}{\partial x_{ij}} = \sum_{i=1}^{n} \frac{\phi(\boldsymbol{\beta}' \mathbf{x}_i)\beta_j}{n}$.
4. Standard errors are derived with delta method.
5. Default ethnicity category is Indians.
6. HCT sample only. Sample dropped plausibly knowing HIV infected individuals who are not tested but answers "know about my status", tested positive in prevalence study, and own subjective probability of infection is 1.
7. Nurse fixed effects are used in place of area fixed effects.

Figure A1: Coefficient of Variations of Uptake by Nurse and Ethnicity



Notes 1. Coefficient of variations in uptake by nurse-ethnicity combination.
2. Nurses-ethnicity with less than 20 subjects are discarded due to small sample.

managers (GMs) of areas must organize a plan to substitute the employees that are taken off from the production line. Some areas are chronically short of employees, and have faced a greater difficulty in releasing employees for testing. We have asked each area GMs to accommodate testing, and allocated dates that will not interfere with their daily production targets. GMs assigned coordinators from their area to manage the employee movements while maintaining production flows.

Even when the GMs can figure out the plans, production is subject to demand changes and supplier shocks, so daily production target varies by day and may not be foreseen well in advance. This makes it difficult to share a definitive plan for HIV testing with the health care providers. For example, there were major strikes by the port and public transportation employees in 2010 which put an enormous strain on production line, and have resulted in reducing the number of employees who can be taken off. In light o this, we have tried to diversify the burden and risks by bunching neighboring areas. When one area faces unforeseen employee shortage, as they often do, the neighboring area is asked to release extra employees, so the employee release target is achieved.

While we received an approval to run the interventions from CEO at the onset, we still had to get an approval from the board members. Company Medical Services and IDE research team have formed a task force to plan the interventions. The task force drafted intervention plans that are seamlessly connected with existing infrastructure and health programs, and explained them repeatedly to managerial personnel.

The task force has asked the trade unions to work with us to accommodate and promote testing. We received supports from their representatives right from the beginning. Shop stewards (union representatives) were particularly concerned with confidentiality of testing and equal treatment among their member employees, which we promised to maintain.

From KAPB study, we knew that Company Medical Services has a reputation of keeping individual information confidential. We confirmed with lawyers that Company MS maintains the privilege to record the HIV related information of all employees, so we can ask names and offer a test, but at the same time Company MS is bound by doctor-patient privilege and will be legally punished if information is submitted to any other personnel inside and outside of Company. So all information related to individual identity is stripped by Company MS before we receive the data set.

In a hope to boost the uptake in short period of time, Company hired EAP service providers to implement the interventions. Through them, Company hired nurses and receptionists. Company also leased in mobile clinic units and other equipments. IDE research team has provided protocols and other documentations. Data was captured by EAP and information related to individual identity was deleted by Company MS before being sent to IDE research team.