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Changes in HIV risk behavior and seroincidence among clients presenting for repeat HIV counseling and testing in Moshi, Tanzania

Suzanne P. Fiorillo, MSPH[1,†], **Keren Z. Landman, MD**[1,†], **Alison C. Tribble, MD**[1], **Antipas Mtalo**[3], **Dafrosa K. Itemba**[3], **Jan Ostermann, PhD**[4,5], **Nathan M. Thielman, MD, MPH**[1,5], and **John A. Crump, MB, ChB, DTM&H**[1,2,5,6,7]

[1]Division of Infectious Diseases and International Health, Department of Medicine, Duke University Medical Center, Durham, North Carolina, USA

[2]Department of Pathology, Duke University Medical Center, Durham, North Carolina, USA

[3]Kikundi cha Wanawake Kilimanjaro Kupambana na UKIMWI (KIWAKKUKI; Women Against AIDS in Kilimanjaro), Moshi, Tanzania

[4]Center for Health Policy, Duke University, Durham, North Carolina, USA

[5]Duke Global Health Institute, Duke University, Durham, NC, USA

[6]Kilimanjaro Christian Medical Centre, Moshi, Tanzania

[7]Kilimanjaro Christian Medical College, Tumaini University, Moshi, Tanzania

Abstract

While HIV counseling and testing (HCT) has been considered an HIV preventive measure in Africa, data are limited describing behavior changes following HCT. This study evaluated behavior changes and estimated HIV seroincidence rate among returning HCT clients. Repeat and one-time testing clients receiving HCT services in Moshi, Tanzania were identified. Information about sociodemographic characteristics, HIV behaviors and testing reasons were collected, along with HIV testing. 6,727 clients presented at least once for HCT; 1,235 (18.4%) were HIV seropositive, median age was 29.7 years and 3,712 (55.3%) were women. 1,382 repeat and 4,272 one-time testers were identified. Repeat testers were more likely to be male, older, married or widowed, and testing because of unfaithful partner or new sexual partner. One-time testers were more likely to be students and testing due to illness. At second test, repeat testers were more likely to report that partners had received HIV testing, not have concurrent partners, not suspect partners have HIV, and have partners who did not have other partners. Clients who intended to change behaviors after the first test were more likely to report having changed behaviors by remaining abstinent (OR 2.58; $p<0.0001$) or using condoms (OR 2.00; $p=0.006$) at the second test. HIV seroincidence rate was 1.49 cases/100 person-years. Clients presenting for repeat HCT reported some reduction of risky behavior, improved knowledge of sexual practices and HIV serostatus of their partners. Promoting behavior change through HCT should continue to be a focus of HIV prevention efforts in sub-Saharan Africa.

Corresponding author: John A. Crump, MB, ChB, DTM&H, Associate Professor of Medicine and Pathology, Division of Infectious Diseases and International Health, Department of Medicine, Duke University Medical Center, Box 102359, Durham, NC 27710, United States of America. Tel 919-684-2660 Fax 919-684-8902 john.crump@duke.edu.
[†]Suzanne P. Fiorillo and Keren Z. Landman contributed equally to this work.

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Keywords

Tanzania; HIV; behavior; incidence; diagnosis

Introduction

HIV Counseling and Testing (HCT) has been promoted as an HIV prevention strategy in sub-Saharan Africa. By focusing on individualized counseling using knowledge of HIV status, HCT aims to motivate people to change behaviors in order to prevent HIV transmission (Luo, 2000). With increased access to antiretroviral therapy (ART) in developing countries, HCT also provides a means to identify HIV infection early (Voluntary HIV-1 Counseling and Testing Efficacy Study Group, 2000) and to facilitate entry into treatment programs (Van de Perre, 2000). However, for treatment programs to be sustainable there must be reduction in HIV incidence (Stover *et al*, 2008).

Although HCT has been considered a preventive measure against HIV infection in sub-Saharan Africa, behavior changes following HCT are not completely understood. With the scale-up of access to ART and testing services, more people are taking advantage of HCT services with many returning for repeat testing. Studies in developed countries have found that returning HCT clients are often at the highest risk for HIV infection and have not reduced their sexual risk behavior in response to counseling and testing (Phillips *et al.*, 1995, Norton *et al.*, 1997, Fernyak *et al.*, 2002, MacKellar *et al.*, 2002). Furthermore, there is some evidence that clients may actually be more likely to acquire HIV soon after receiving the results of a seronegative HIV test (MacKellar *et al.*, 2002). Studies in sub-Saharan Africa have shown reduced risky behavior, such as reduction of the number of partners and increases in condom use, are most pronounced among testers who are HIV-seropositive or who are in serodiscordant partnerships. However, there has been little evidence to suggest that HCT outside these groups have successfully changed HIV risk behavior (Sherr *et al.*, 2007, Arthur *et al.*, 2007, Cremin *et al.*, 2010, Allen *et al.*, 1992, Kamenga *et al.*, 1991, Weinhard *et al.*, 1999, Denison *et al.*, 2008, Turner *et al.*, 2009). Several studies have looked at trends towards reduced risky behavior among seronegative testers and some have found increased risk behavior over time in this population (Sherr *et al.*, 2007, Cremin *et al.*, 2010, Matovu *et al.*, 2007)

The purpose of this study was to evaluate the sociodemographic characteristics, HIV risk behaviors and reasons for testing in a cohort of men and women presenting at a HCT center in Moshi, Tanzania. Since a large proportion of this cohort returned for recommended repeat testing (Tanzania Ministry of Health, 2005) we evaluated differences between these clients and clients who tested only once. We also studied returning HCT clients who previously tested HIV-seronegative and had reported history of sexual activity to evaluate changes in sexual risk behavior. HIV seroincidence rate was determined in repeat testers.

Methods

Study location

Participants were recruited at a freestanding HCT center operated by Kikundi cha Wanawake Kilimanjaro Kupambana na UKIMWI (KIWAKKUKI; Women Against AIDS in Kilimanjaro). KIWAKKUKI, founded in 1990, is a women-led organization providing home-based care, counseling, education, and HCT services in the Kilimanjaro Region. Initially, KIWAKKUKI was the main provider of HCT services, although other providers began testing services before the study ended. Clients were initially charged 1,000 Tanzanian shillings (US $0.95; 2003 exchange rate), but testing became free in May 2004

(Thielman *et al.*, 2006). This was followed in September 2004 by expanding access to free antiretroviral therapy (ART) provided through the Tanzanian government (Shorter *et al.*, 2009). KIWAKKUKI saw an average of 13 clients each weekday (Thielman *et al.*, 2006). Data collection was between November 2003 and January 2008.

HIV counseling and testing procedures

Consecutive clients 18 years and older presenting for HCT were invited to participate. Although the refusal rate was not consistently reported during the study period when measured it was always <5%. Presenting clients received confidential pretest counseling, including risk assessment and reduction planning with a trained, Tanzanian Kiswahili-speaking counselor. All counseling and testing was done according to the Tanzanian Ministry of Health National AIDS Control Programme guidelines (Tanzania Ministry of Health, 2005). After informed consent was obtained, counselors administered a structured questionnaire. The questionnaire obtained data on sociodemographic characteristics, reasons for testing, HIV risk behavior, HIV testing history, and planned behavior changes after testing (Thielman *et al.*, 2006). Client response was recorded on paper by the counselor.

After pretest counseling and questionnaire completion, a blood sample was obtained for HIV testing. HIV antibody testing was performed on whole blood using Capillus (Trinity Biotech, Bray, Wicklow, Ireland) and Determine (Abbott Laboratories, Abbott Park, IL, USA) rapid HIV antibody tests. If test results were discordant, a blood sample was tested with ELISA (Vironostika Uni-Form II plus O Ab, BioMerieux, Durham, NC, USA). If the ELISA was seronegative, no additional testing was done. If the ELISA was positive, a Western blot (Genetic Systems HIV-1 Western Blot kit, Bio-Rad, Hercules, CA, USA) was done to confirm the result (Mayhood *et al.*, 2008). Clients received HIV results in approximately 30 minutes. Clients who tested seropositive were referred to care and treatment centers (CTCs) and encouraged to have sexual partners and children tested. If seronegative, clients received post-test counseling focusing on HIV prevention. Clients were encouraged to return for repeat testing 3 and 6 months after the initial test according to national guidelines.

Data collection

We identified ‘repeat testers’ as those who were seen at KIWAKKUKI at least twice during the study period and tested HIV seronegative at their first test. If repeat testers tested more than two times, data from their first and second tests were used. ‘One-time testers’ were identified as those who presented at KIWAKKUKI once during the study period and reported not having previously tested at KIWAKKUKI or any other testing center.

Estimation of HIV seroincidence was determined among repeat testers. An HIV seroconverter was defined as a repeat tester who had a seronegative initial HIV test and a seropositive HIV test at the second visit. The period of observation was the interval between tests. Seroincidence is reported as number of infections per 100 person-years (PY).

Statistical analysis

Paper questionnaire data and HIV results were entered using Epi Info 2002 or Epi Info 3.3 (Center for Disease Control and Prevention, Atlanta, GA, USA) or Teleform 9.0 (Cardiff, Visa, CA, USA). Data were validated by randomly sampling 10% of the questionnaires, with an acceptable error rate of <1 error per 5 forms. During the study, the questionnaire was modified 5 times to improve data quality. Consequently, some behavior variables were not collected for all clients. Actual missing data due to client non-response was <0.5% for each variable.

For determining differences between repeat testers and one-time testers, data on sociodemographic information, reasons for HIV testing and HIV risk behaviors from the first test of repeat testers were compared to the same data from one-time testers. HIV risk behaviors changes and planned behavior changes were compared between first and second HCT encounters among repeat testers. Repeat testing clients' intended changes in risk behaviors reported at the first test were compared to risk behaviors reported at the second test. A stratified analysis using Mantel-Haenszel chi-square test (Mantel and Haenszel, 1959) was undertaken in order to adjust for potential confounding. The p-values were based on two-tailed test results and a p-value ≤0.05 was used to define statistical significance. All analyses were performed using SAS, version 9.2 (SAS Institute, Cary, NC, USA).

Research ethics

Ethical approval was granted by Kilimanjaro Christian Medical Centre Ethics Committee, Tanzania National Institutes for Medical Research Ethics Committee, and Duke University Institutional Review Board. All participants provided informed consent and were given the written consent document in Kiswahili.

Results

Characteristics

During the study period (4 years; 2 months), 6,727 clients presented one or more times at KUWAKKUKI for a total of 8,682 HCT encounters. Among clients, 5,345 (79.5%) had one HCT encounter and 1,382 (20.5%) had 2 or more encounters. The median number of encounters was 1 (range 1–6). At the first HCT, 1,235 (18.4%) clients were HIV seropositive. Women were significantly more likely to test HIV seropositive than men (OR 3.15; 95% CI 2.74, 3.63). The median age was 29.7 (range 18.0–87.3) years, 3,712 (55.3%) were women and 3,108 (47.2%) lived in urban Moshi (population 144,336) whereas the rest lived in rural villages (population 1,236,713) (Tanzania National Bureau, Statistics, 2002) in the Kilimanjaro Region. Among clients, 1,382 were identified as "repeat testers" and 4,272 were identified as "one-time testers". (Table 1) Among repeat testers, 1,296 (93.8%) reported at least one lifetime sexual partner.

Differences between repeat testers and one-time testers

Differences in sociodemographic characteristics, HIV risk behaviors and reasons for testing were evaluated between repeat testers and one-time testers. Repeat testers at their first test were more likely to be male, older, married, testing because of suspicion of an unfaithful partner, or having a new sexual partner ($p<0.01$ for each variable). One-time testers were more likely to be students, widowed, testing due to illness, having a sexual partner who had died or having multiple partners ($p<0.02$ for each variable). HIV risk behaviors and reasons for testing were adjusted for possible confounding by sex and age. (Table 2)

HIV risk behavior changes between first and second tests for repeat testers

Compared to their first test, repeat testers at their second test were more likely to report having partners who tested for HIV, not have had concurrent sexual partners, not suspect partners are HIV-infected, not have had partners who are known to have other partners and to have used condoms in the past month ($p<0.04$ for each variable). There was no difference in abstinence during the past year between tests ($p=0.16$) (Table 3).

Before learning the results of their HIV test, all clients reported what behaviors they planned to change in the event of either a seropositive or a seronegative HIV test result. We compared intended behavior changes at the first HCT with behaviors reported by repeat clients at their second HCT. There were no differences in plans to change behavior between

the first and second HCT for repeat testers (Table 3). However, planned intentions to change behavior at the first test were compared to the specific behavior at the second test. Clients who planned to remain abstinent after the first test if receiving a seronegative test were more likely to have remained abstinent by the second test compared to clients who did not plan to remain abstinent (OR 2.58; p<0.0001). Clients who planned to use condoms after the first test if receiving a seronegative test were more likely to have used condoms by the second test compared to clients who did not plan to use condoms (OR 2.00; p=0.003) (Table 4).

HIV seroincidence rate

All repeat testers were HIV seronegative at their first test and 7 repeat testers had seroconverted by their second test. The median time between the first and second tests was 94 (range 24–1,920) days. Repeat testers contributed 468.43 person-years (PY) of follow-up between their first and second tests. Thus, the HIV seroincidence rate among repeat testers was estimated at 1.49 infections per 100 PY (95% CI; 0.39, 2.60).

Discussion

This study provides evidence that initially HIV-seronegative clients presenting for repeat HCT demonstrated some reduction in risky behavior but were also more knowledgeable about their partner's risk behaviors at the second test. Although partner's risk behaviors are not in the control of the client, knowing the partner's behaviors may influence the client's perception of their risk and intention to change risky behavior. By the second HCT, repeat testers were more likely to report that partners were tested for HIV and less likely to have concurrent sexual partners. They were also more likely to not suspect a partner has HIV and know that their partner does not have other partners. There were no differences in planned behavior change between the first and second tests for abstinence, using condoms and reducing the number of partners. However, clients planning to be abstinent or use condoms at the first test were more likely to report that they adhered to this behavior by the second test then those who did not plan to change behavior. Together, this provides some evidence that clients who returned for recommended follow-up HCT were more likely to have changed their own behavior and were more knowledgeable about their partners risk behaviors, both which could reduce risk for HIV infection.

Previously we have described characteristics of one-time testers (Shorter *et al.*, 2009). However, significant differences in sociodemographic characteristics and reasons for testing were observed between one-time testers and repeat testing clients. Repeat testers were more likely to be older, male, married, testing because of new sexual partner or suspected an unfaithful partner. One-time testers were more likely to be widowed or testing because of an illness. This suggests that repeat testers may test more often after any perceived possibility of HIV exposure whereas one-time testers are more likely to test only after a singular life event, such as being widowed, triggers concern they may be HIV infected. Consistent with our previous finding (Shorter *et al.*, 2009, Chu *et al.*, 2005, Landman *et al*, 2008), we also found that women were less likely to test repeatedly and had higher HIV seroprevalence then men. It was suggested that women use HCT as a point of entry for seeking care and treatment and are more likely to present for HCT when they have an illness or are symptomatic (Shorter *et al.*, 2009). Women may be more likely to seek HCT long after a specific exposure when they begin to experience an illness or symptoms whereas men are more likely to seek HCT sooner and more frequently after any potential exposure (Shorter *et al.*, 2009).

We did not find differences in behavioral risk factors between repeat and one-time testers. Previous studies (Norton *et al.*, 1997, Fernyak *et al.*, 2002, MacKellar *et al*, 2002) have found that repeat testers reported more risky behavior than first time testers, although these

studies were done in developed countries in different study populations. A study in Uganda (Matovu *et al.*, 2007) also found that HIV-seronegative repeat testers were less likely to reduce their sexual risk behaviors following repeated HCT. However, HCT populations, regardless of repeat or one-time testing, have reported higher risk behaviors than in the general population (Chu *et al.*, 2005).

Although we found differences between repeat and one-time testers, we are unable to ascertain whether the same behavior changes observed in repeat testers would have also been observed in one-time testers if we had been able to measure their behavior at a later time. These groups were similar in terms of HIV risks behaviors but it is unknown whether one-time testers also changed their behavior after receiving HCT. In this study, follow-up HCT was recommended to all clients. However, only 20% sought repeat testing. It may be suggested that clients who follow recommendations to return for testing are those who also follow counseling advice to change behavior.

Even with some reduction in risky behavior evident in repeat testers, HIV seroincidence in this cohort was 1.49 cases per 100 person-years of follow-up, remaining relatively high compared to similar cohorts. HIV seroincidence among HCT cohorts, reported as cases per 100 person-years of follow-up, was 1.21 in Harare, Zimbabwe (Corbett *et al.*, 2007), 1.4 in Rakai, Uganda (Matovu *et al.*, 2007), 1.3 in Nairobi, Kenya (Oyugi *et al.*, 2009), and 0.69 and 1.04 among men and women, respectively, in Chiang Mai, Thailand (Kawichai *et al.*, 2004). The high HIV seroincidence in this group suggests further efforts in prevention are still needed. However, HIV seroprevalence in this HCT cohort was 18.4%, more than twice as high as the overall HIV seroprevalence in Tanzania of 8.8% in 2005 (UNAIDS, 2004). Therefore it is likely that seroincidence rates in our study population reflect a group at higher than average risk for HIV infection that should not be extrapolated to the general population.

There are several limitations in this study. The cohort was comprised of people who self-selected for testing likely due to their perception of higher personal risk and the results may not be generalized to the entire population. This study also relied on self-reporting of information to counselors, which could result in inaccurate estimation of behaviors due to social desirability bias. This may be more evident when clients returned for repeat testing as they were already familiar with counseling procedures and knew the socially acceptable response to questionnaires. It is also possible that some HCT clients were misclassified as one-time testers as they may have received further HCT at another testing site or after the study period ended. Finally, since one-time testers did not return for repeat testing, we do not know if they changed their behavior after receiving initial HCT.

In conclusion, we found that clients presenting for repeat HCT reported reducing risky behavior and improved knowledge of the sexual practices and HIV serostatus of their partners. It was promising to see that clients who planned to change their behavior after the first test were more likely to report that they adhered to this change at the second test. Unfortunately, clients who did not plan to change their behavior after the first test, did not report behavior change at the second test. Therefore, a goal of HCT should be to provide counseling to help all clients make their own decisions to successfully change their behavior, specifically targeting clients who may not feel behavior change is necessary. Women should be the target of HCT efforts and continued reinforcement is needed to engage them in HIV education before they are sexually active and their risk increases. The high HIV seroincidence rate in this and other cohorts of repeat HCT clients in sub-Saharan Africa, despite repeatedly receiving HIV education, suggests a need to aggressively tailor education and prevention interventions for this particular high risk group. Finally, the impact of HCT on HIV prevention among HIV-seronegative clients in sub-Saharan Africa requires

further study and the effect of repeat testing beyond the initial repeat test needs to be explored as recommendations for regular retesting are rolled out (Waters *et al*, 2011). The continued assessment of HIV knowledge and promotion of behavior change is essential.

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Table 1

Baseline characteristics of all clients presenting at KIWAKKUKI Centre, Moshi, Tanzania, 2003–2008, n=6,727

	n	(%)
Gender		
Men	3,000	(44.7)
Women	3,712	(55.3)
Age median (range) years	29.7	(18.0 – 87.3)
Residence		
Urban	3,108	(47.2)
Rural	3,482	(52.8)
HIV seroprevalence		
Total	1,235	(18.4)
Men	292	(9.7)
Women	942	(25.4)
Number of HCT encounters		
1 test only	5,345	(79.5)
2 tests	833	(12.4)
3 tests	530	(7.9)
4 tests	16	(0.2)
5 tests	1	(<0.1)
6 tests	2	(<0.1)
One-time testers †	4,272	(63.5)
Repeat testers	1,382	(20.5)

Missing data (n): 15 (gender); 18 (age); 137 (residence)

† One-time testers were HCT-naïve and received HCT only once during the study period

Table 2

Client Characteristics, reasons for testing and HIV risk behaviors for repeat testers and one-time testers (%) at KIWAKKUKI Centre, Moshi, Tanzania, 2003–2008

	Repeat Testers (n=1,382)		One Time Testers (n=4,272)		p-value
	n	(%)	n	(%)	
Sociodemographic characteristics					
Gender					
Men	645	(46.7)	1,820	(42.7)	0.01
Women	737	(53.3)	2,441	(57.3)	
Age					
>30 years	722	(52.2)	2,031	(47.7)	0.003
≤30 years	660	(47.8)	2,230	(52.3)	
Residence					
Urban	620	(45.5)	1,959	(46.9)	0.34
Rural	744	(54.5)	2,215	(53.1)	
Occupation					
Business	381	(27.6)	1,208	(28.3)	0.61
Farming	337	(24.4)	896	(21.0)	0.01
Salaried worker	188	(13.6)	563	(13.2)	0.69
Skilled worker	136	(9.8)	391	(9.2)	0.44
Unskilled worker	111	(8.0)	283	(6.6)	0.07
Student	92	(6.7)	380	(8.9)	0.01
Other	137	(9.9)	551	(12.9)	0.003
Education					
Secondary or higher	420	(30.5)	1,369	(32.2)	0.24
Primary	959	(69.5)	2,888	(67.8)	
Marital Status					
Single	660	(47.8)	2,118	(49.6)	0.24
Divorced/Separated	131	(9.5)	393	(9.2)	0.76
Cohabitating	99	(7.2)	382	(8.9)	0.04
Married	376	(27.2)	931	(21.8)	<0.0001

	Repeat Testers (n=1,382)		One Time Testers (n=4,272)		p-value
	n	(%)	n	(%)	
Widowed	116	(8.4)	448	(10.5)	0.02
Religion					
Catholic	578	(41.8)	1,628	(38.1)	0.01
Muslim	237	(17.2)	902	(21.1)	0.001
Protestant	511	(37.0)	1,555	(36.4)	0.70
Other	56	(4.0)	175	(4.1)	0.94
Reasons for testing †					
Illness	149	(10.8)	937	(22.0)	<0.0001
Suspect unfaithful sexual partner	555	(40.2)	1,514	(35.5)	0.0006
Sexual partner died	114	(8.3)	466	(10.9)	0.002
New sexual partner	85	(21.3)	245	(15.1)	0.003
Multiple sexual partners	286	(20.7)	980	(23.0)	0.01
Premarriage	292	(21.1)	868	(20.4)	0.26
Preconception	55	(4.0)	167	(3.9)	0.79
HIV Risk Behaviors †					
Partner died	160	(12.6)	571	(14.7)	0.02
Partner(s) tested for HIV	227	(20.4)	607	(17.7)	0.06
Suspect partner(s) have HIV	109	(17.3)	349	(15.7)	0.49
Having concurrent sexual partners	166	(14.6)	471	(13.8)	0.70
Condom use past month	66	(14.5)	216	(13.8)	0.52
Had partner with other partners	367	(32.5)	1,096	(32.1)	0.76

Missing data (n): 11 (gender); 11 (age); 116 (residence); 64 occupation; 18 (education; 18 (marital status); 12 (religion); 5 (illness); 12 (died); 13 (unfaithful partner); 18 (new partner); 14 multiple partners); 13 (premarriage); 18 (preconception)

† All variables adjusted for sex and age

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Table 3

Changes in HIV risk behavior from the first and second HIV tests among previously sexually active repeat HCT clients in Moshi, Tanzania, 2003–2008

	First test		Second test		
	n	(%)	n	(%)	p-value †
Behavior change / Partner Knowledge					
Partner(s) have tested for HIV	210	(20.7)	332	(32.7)	<0.0001
Do not have concurrent sexual partners	792	(83.3)	853	(89.7)	<0.0001
Do not suspect partner(s) have HIV	510	(82.7)	556	(90.1)	0.0001
Have partner(s) who do not have other partners	622	(66.0)	686	(72.7)	0.001
Have used condom in past month	56	(15.3)	77	(21.0)	0.04
Abstinent past year	181	(31.3)	203	(35.1)	0.16
Planned behavior change					
Will remain abstinent					
If test seropositive	826	(64.0)	868	(67.2)	0.07
If test seronegative	574	(44.5)	583	(45.2)	0.66
Will use condoms					
If test seropositive	249	(19.3)	242	(18.8)	0.63
If test seronegative	263	(20.4)	262	(20.3)	0.88
Will reduce partners					
If test seropositive	298	(23.1)	325	(25.2)	0.21
If test seronegative	295	(22.9)	330	(25.6)	0.11

† Adjusted for sex and age

Table 4

Intention to reduce risky behavior at first test and actual behavior change at the second test among previous sexually active repeat HCT clients, 2003–2008

	Odds Ratio †	95% CI	P-value
Planned abstinence after 1st test			
Had not remained abstinent prior to 2nd test	1.00 (ref)		
Remained abstinent prior to 2nd test	2.58	1.89, 3.53	<0.0001
Planned condom use after 1st test			
Had not used condoms prior to 2nd test	1.00 (ref)		
Used condoms prior to 2nd test	2.00	1.28, 3.14	0.003

OR: Odds ratio, 95% CI: 95% confidence internal

† Adjusted for sex and age