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The contribution of antenatal care to the coverage and correlates of HIV testing among adults in Zimbabwe 2005–06

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Summary

Expanding the availability, utilization and coverage of HIV testing services is a critical step towards primary prevention and successful delivery of antiretroviral therapy (ART) in Zimbabwe. We used data from the Zimbabwe Demographic and Health Survey (2005–2006) to examine the coverage and correlates of recent HIV testing (HIV testing, <24 months preceding the survey) among HIV-positive and HIV-negative adults. We estimated the relative contribution of HIV testing in both the antenatal care (ANC) setting and non-ANC settings. Uptake of recent HIV testing was 14.4% among women and 11.1% among men, with HIV testing in ANC accounting for 42.3% and 10.3% of all recent testing among women and men, respectively. In the multivariate analyses, recent pregnancies and being aware of ART were independent correlates after controlling for demographic and socioeconomic variables. HIV testing in ANC was an important contributor to HIV testing coverage in Zimbabwe by reaching not only pregnant women but also their partners.

Keywords

HIV testing; adult; screening; antenatal care; coverage; PMTCT; Zimbabwe; Africa

INTRODUCTION

Expanding the availability, utilization and ultimately coverage of HIV testing services is a critical step towards ensuring access to HIV/AIDS services, including primary prevention, prevention of mother-to-child transmission (PMTCT), antiretro-viral therapy (ART), management of HIV-related illnesses, tuberculosis control, home-based care and psychosocial support.^{1–8} For HIV-positive individuals, an HIV diagnosis is a necessary first step to accessing care and treatment, and an opportunity to reinforce safer sex practices to prevent onward transmission. A timely diagnosis can help ensure that ART is initiated when its clinical benefits are greatest^{9–11} and the reduction in viral load associated with treating large numbers of diagnosed individuals is considered as an important public health strategy to control the epidemic.¹² Although the evidence has been mixed, for HIV-negative individuals HIV testing also presents an opportunity to provide counselling and information that could result in behavioural change that reduces the risk of acquiring HIV infection.^{6,13,14} With the scale up of HIV/AIDS services in sub-Saharan Africa, HIV testing has become

available in a wide range of service points, including standalone voluntary counselling and testing (VCT) sites and antenatal care (ANC) clinics. Of increasing importance is the provider-initiated testing in ANC, tuber-culosis (TB), sexually transmitted infection (STI) clinics, inpatient and outpatient wards. VCT has also been implemented in mobile, community and home-based settings.¹⁵

In Zimbabwe, the National AIDS Policy and National Strategic Framework was launched in 1999 and an AIDS levy (3% of all taxable income) was introduced to fund HIV/AIDS services.¹⁶ However due to ongoing political and economic turmoil, scale up of HIV/AIDS services did not begin in earnest until 2005 when Zimbabwe was awarded funds towards its round 1 proposal to the Global Fund to Fight AIDS, TB and malaria.¹⁶ In 2005–2006, there were seven HIV testing facilities per 100,000 adult population, which translated to one VCT and one ANC testing facility in each of the 60 districts.¹⁶ ART coverage was still very low at 5–8% of those in need, even based on ART eligibility of CD4 count <200 cells/mm.^{3,17} Indeed, 46% of ART services were provided via private clinics.¹⁶ Service fees for testing, care and treatment for HIV/AIDS in public health facilities were still common, except in symptomatic patients.¹⁸ ANC coverage (i.e. percentage of pregnant women who access ANC during their pregnancy), however, was high at over 95%,¹⁶ providing an important opportunity for pregnant women and potentially their partners to be tested for HIV.

Coverage and correlates of HIV testing have been examined in Zimbabwe^{6,19} and elsewhere,^{14,20–22} with most studies focusing on subgroups, such as high-risk groups, young people and pregnant women, or specific regions of the country. Importantly, the relative contribution of HIV testing in ANC as part of PMTCT programmes to overall HIV testing coverage has not been well described, both among female and male partners of pregnant women attending ANC. This paper aims to describe the coverage and correlates of recent HIV testing at both ANC and non-ANC settings among HIV-positive and HIV-negative adults at the national level using the Zimbabwe Demographic Health Survey (ZDHS) of 2005–2006.

METHODS

Data

We used the data from the 2005–2006 ZDHS, a population-based cross-sectional survey conducted by the Central Statistical Office and the Measure DHS Program.²³ The ZDHS was designed to provide data on nationally and provincially representative demographic and health indicators. HIV testing was performed in each household among women and men who were present at the time of interview and consented to an HIV test. Details of the study sample selection process have been described elsewhere.²³

Study population

Out of the 9870 eligible women aged between 15 and 49 years, 8761 were interviewed and 7484 consented to an HIV test. Similarly, out of 8762 eligible men aged between 15 and 54 years, 7175 were interviewed and 5555 consented to an HIV test. This analysis is restricted to those who consented to an HIV test.

Measures

The outcome of interest was recent HIV testing defined as a self-reported HIV test that occurred 0–24 months prior to the interview. Three key predictors were considered: recent pregnancy, HIV status and awareness of ART. HIV status was assessed by blood specimens collected during the interview. All samples were tested on the first assay test, an enzyme-linked immunosorbent assay (ELISA), Vironostika HIV Uni-Form II Plus O (BioMerieux,

Geneva, Switzerland). A negative result on this test was considered negative. All positives were subjected to a second ELISA test (AniLab Systems, Vantaa, Finland), and a confirmatory test, Genetic Systems New LAV Blot I (a Western blot by Bio-Rad, Marnes-la-Coquette, France), was performed to resolve discordant results.²³ Recent pregnancy was defined as a self-reported pregnancy that occurred 0–24 months prior to the interview. Awareness of ART was assessed from the response to the following question: ‘Have you heard of drugs to help HIV-infected people to live longer?’ Demographic, socioeco-nomic, knowledge and attitudes, risk and barrier variables were examined as control variables in multivariate analyses. Comprehensive knowledge of HIV/AIDS and accepting attitudes towards people living with HIV and AIDS (PLWHA) are composite measures recommended by UNAIDS guide-lines.²⁴ Comprehensive knowledge of HIV/AIDS was constructed from responding positively to three questions about whether: (a) a person can reduce the risk of getting HIV by always using condoms during sex; (b) a person can reduce the risk of getting HIV by having just one uninfected, faithful partner; and (c) a healthy-looking person can have HIV; and rejecting the two most common local misconceptions about HIV transmission or prevention, including that (a) HIV can be transmitted by mosquito bites and (b) a person can become infected by sharing food with a person who has HIV. Accepting attitudes towards PLWHA were also constructed using the UNAIDS guidelines, based on positive responses to the following questions about whether the respondent: (a) is willing to care for a family member with HIV in the respondent’s home, (b) would buy fresh vegetables from a shopkeeper who has HIV, (c) thinks that a female teacher with HIV and is not sick should be allowed to continue teaching; and (d) would not want to keep secret that a family member got infected with HIV.

Data analysis

Statistical analyses were performed using SAS software version 9.2 (SAS, Cary, NC, USA). All variables were categorized and analysed using Rao–Scott χ^2 test. Variables with P values, <0.25 in the bivariate analyses were included in the multiple logistic regression models.²⁵ Gender-specific multiple logistic regression analyses were performed to determine whether the key predictors were independently associated with the outcome. For women, three separate models were fit: (1) all women, (2) pregnant women and (3) non-pregnant women, to examine the difference in the effects of the key predictors on recent HIV testing by recent pregnancy status. For men, one model was fit for all and a separate model was fit for men who were part of a couple (i.e. married men and men living with a partner; 1983 men), specifically to examine the effect of recent pregnancy of the partner. After dropping collinear variables, variables for the final model were selected based on statistical significance ($P \leq 0.05$) and contribution to the model goodness of fit using the AIC statistic.²⁶ The key variables and age were kept in the models even with non-significant results. The hierarchical sampling structure of the ZDHS was accommodated with use of survey procedures in SAS that applied ZDHS survey weights and adjusted the standard errors thereby accounting for clustering within the DHS sample.

RESULTS

Coverage of recent HIV testing

HIV prevalence was 21.1% (95% confidence interval [CI], 19.5–22.5%) among women (age 15–49) and 14.8% (95% CI, 13.3–15.9%) among men (age 15–54). Sixteen percent of women were pregnant in the past two years, and 95% of them reported having visited an ANC at least once during their pregnancy. Uptake of recent HIV testing was 14.4% (95% CI, 13.3–15.6%) among women and 11.1% (95% CI, 9.9–12.2%) among men. About 25.7% (95% CI, 24.1–27.3%) of the women and 17.7% (95% CI, 16.2–19.1%) of the men reported ever having an HIV test (both non-ANC and ANC). Among women, 39.0% (95% CI, 35.6–

42.4%) of those who had a recent pregnancy had an HIV test compared with only 9.9% (95% CI, 8.8–10.9%) among those who did not have a recent pregnancy. Recent HIV testing in the ANC setting accounted for 42.3% (95% CI, 39.3–45.2%) of all recent HIV testing among women: 44.1% (95% CI, 40.7–47.6%) for HIV-negative and 36.4% (95% CI, 30.1–42.3%) for HIV-positive women.

Among men with a co-habiting partner, those whose partner had a recent pregnancy were more likely to have a recent HIV test than those whose partner did not have a recent pregnancy: 13.4% (95% CI, 9.7–17.1%) versus 9.0% (95% CI, 7.3–10.7%), respectively. Furthermore, among men with a recently pregnant partner, HIV-positive men were more likely to have a recent HIV test (20.0%; 95% CI, 10.6–29.4%) versus 11.9% (95% CI, 8.2–15.7%). Recent HIV testing in the ANC setting accounted for 10.3% (95% CI, 7.9–12.7%) of all recent HIV testing among men: 9.0% (95% CI, 6.5–11.5%) for HIV-negative men and 16.3% (95% CI, 9.2–23.5%) for HIV-positive men.

Correlates of HIV testing: bivariate analysis

The bivariate associations of individual-level characteristics and HIV testing in the last 24 months for women are shown in Table 1. Recent pregnancy, younger age (15–39 years of age), urban residence, higher completed education, higher household wealth index, having accepting attitudes towards PLWHA, having comprehensive knowledge about HIV/AIDS, being aware of ART, and knowing someone who has AIDS were significantly and positively associated with recent HIV testing. HIV status and being a victim of physical abuse were not significantly associated with having a recent HIV test. Having never been married, never having had sex, and not having a lifetime sexual partner were associated with a lower likelihood of having a recent HIV test. Recent pregnancy status qualitatively changed correlates for recent HIV testing. Among women without a recent pregnancy, HIV status was significantly and positively associated with a recent HIV test. HIV status was not significantly associated with recent HIV testing among women with a recent pregnancy.

The bivariate associations of individual level characteristics and recent HIV testing for men are shown in Table 2. Younger age (20s and 30s), living in urban areas, having completed higher education, having a higher household wealth index, having accepting attitudes towards PLWHA, having comprehensive knowledge about HIV/AIDS, being aware of ART and knowing someone who has AIDS were significantly and positively associated with recent HIV testing. HIV status, higher number of lifetime partners and living in a household with a chronically ill person or with a death after chronic illness in the last 12 months were not significantly associated with having a recent HIV test. Having never been married and never having had sex as well as being married and living together with a partner were associated with a lower likelihood of having a recent HIV test. Restricting the analysis to men in a couple, recent pregnancy status of their partner, age group 30–39, urban residence, higher completed education, higher household wealth index and being aware of ART were significantly and positively associated with a recent HIV test.

Correlates of HIV testing: multivariate analysis

Among all women, recent pregnancy and awareness of ART were independent positive correlates of recent HIV testing after controlling for other significant covariates, including age, marital status, highest completed education, household wealth index and knowing someone who has AIDS (Table 3). HIV status was not independently associated with recent HIV testing. The two stratified models by recent pregnancy status showed awareness of ART as independently positively correlated with recent HIV testing among women without a recent pregnancy but not among women with a recent pregnancy. HIV status was not significantly associated with recent HIV testing among women with or without a recent

pregnancy. Among women who had a recent pregnancy, having a higher household wealth index and having accepting attitudes towards PLWHA were the only significant positive covariates. For women who did not have a recent pregnancy, being 20–24 years of age, having a higher completed education, higher household wealth index, having higher number of lifetime sexual partners, being aware of ART and knowing someone who has AIDS had a higher likelihood of having a recent HIV test (Table 3).

Among all men, awareness of ART was independently and positively correlated with recent HIV testing controlling for other significant covariates, including age, marital status, highest completed education, household wealth index and knowing someone who has AIDS. HIV status was not independently associated with recent HIV testing. Among men in a couple, men whose partner had a recent pregnancy had a higher likelihood of having a recent HIV test, controlling for other significant covariates, including age and household wealth index. HIV status and awareness of ART were not significant correlates among men in a couple (Table 3).

DISCUSSION

Women with a recent pregnancy were substantially more likely to have a recent HIV test, which is likely due to the availability of HIV testing in the ANC setting. That recent HIV testing in the ANC setting accounted for 42.3% of all recent HIV testing among women suggests that for women, ANC was an important entry point for HIV testing in Zimbabwe in 2003–2006. This finding is intuitive and has been suggested as the reason for the disproportionately higher numbers of women than men testing for HIV27 and accessing HIV care and ART in sub-Saharan Africa.^{28, 29} Furthermore, HIV testing in ANC may eliminate some of the traditional barriers to HIV testing.²¹ In our analysis, education and HIV risk behaviour were not associated with recent HIV testing among women with a recent pregnancy in the ANC setting, as was found for women without a recent pregnancy. Since coverage of ANC is extremely high in Zimbabwe at over 95%, most women, regardless of their level of education, visit an ANC at least once during their pregnancy. When HIV testing coverage in ANC is also high, this increases the chance of pregnant women being offered and receiving an HIV test. Notably, household wealth index remained a significant correlate of HIV testing after controlling for other potential con-founders for all adults, including women with a recent pregnancy. This is possibly due to the fact that at the time of the survey, service fees were still common for HIV-related services, including HIV testing, offered both within and outside of public health institutions.³⁰

The association of recent pregnancy with testing coverage is also evident among male partners of women with a recent pregnancy, particularly those who are HIV positive. Recent HIV testing in the ANC setting accounted for 10.3% of all recent HIV testing among men. As shown in Uganda before,^{31, 32} this finding may suggest the impact of promoting male partner testing in the PMTCT programme in Zimbabwe. The impact that HIV testing in the ANC setting has had in increasing HIV testing among male partners is critical in light of studies that have found that couples testing can lead to earlier initiation of ART,^{28, 32–34} which is one way to help mitigate the substantial problem of early mortality associated with late ART initiation in the region.^{10, 35}

Still, recent HIV testing coverage among women with a recent pregnancy (39.0%) and their male partners (13.4%) was relatively low despite the availability of VCT in the ANC setting. This is likely reflective of the early stages of scale up of HIV testing services in Zimbabwe between 2005 and 2006, and of the fact that HIV testing was still largely offered only as part of VCT (i.e. as opposed to provider-initiated or opt-out testing). Indeed, the vast majority of women with a recent pregnancy who reported not receiving an HIV test at the ANC also

reported that the test was not offered to them (97.3%). These missed opportunities appear to be independent of age, residence, household wealth index and education and may represent systemic or structural barriers to HIV testing among pregnant women attending ANC, beyond those correlates described in the present analysis. However, the available data did not permit a more thorough examination of potential explanations for why some women were not offered HIV testing. A comparison of ZDHS data from 1999 and 2005–2006 revealed a doubling of the proportion of respondents who confirmed ever having an HIV test (12.2–25.7% for women and 9.2–17.7% for men).³⁶ In the younger age groups (15–19 and 20–24), the testing coverage more than doubled in the same period.³⁶ An opt-out testing strategy in the ANC setting was rolled out after a successful evaluation of the strategy in two rural districts in Zimbabwe.^{37, 38} It is thus expected that HIV testing coverage will increase in the years after the ZDHS 2005–2006 as this strategy is implemented nationwide.³⁹ Awareness of ART was an important correlate of HIV testing for both women and men. This finding is consistent with the concomitant increase in treatment availability and HIV testing in Zimbabwe.²⁷ It suggests that widespread availability of treatment could encourage individuals to get tested for HIV. Based on past investigations,^{22, 40, 41} we hypothesized that HIV-positive individuals are more likely to seek an HIV test due to a higher likelihood of having engaged in high-risk behaviour and/or being symptomatic. In the present analysis, HIV status was not significantly associated with recent HIV testing.

Our analysis has a number of strengths, including the use of a nationally representative sample to obtain national estimates of coverage and correlates of recent HIV testing in Zimbabwe during the early phase of scale up of HIV/AIDS-related activities. The sample was large and allowed for insightful stratified analyses with good precision of HIV testing coverage by HIV status as well as recent pregnancy. Finally, the present analysis focused on a recent HIV testing rather than ever having an HIV test to capture the coverage of HIV testing during the recent scale up of HIV/AIDS services in Zimbabwe. Moreover, the covariates examined for HIV testing were respondent characteristics assessed at the time of the interview. We limited the time span of HIV testing because current characteristics may not be appropriate correlates of HIV testing that occurred more than two years ago.²⁰

There are some limitations to our analysis, which reflect those inherent to cross-sectional studies. The ZDHS survey is a cross-sectional survey and causality cannot be inferred for any of the findings.⁴² Furthermore, data were collected through self-report. To the extent that study participants misreported, either intentionally or inadvertently, our results may be biased. However, data collection in the 2005–2006 ZDHS was done in private in order to facilitate truthful reporting and minimize intentional misreporting. Additionally, we did not examine non-individual level characteristics, such as contextual level factors, that may be correlated with the outcome. We plan to utilize multilevel models to investigate this in the future. Finally, the outcome measure, having a recent HIV test, did not capture the receipt of the test result by the individual. As such it is not a measure of self-knowledge of HIV status. While an overwhelming majority of those who had a recent HIV test reported also receiving the test result in our sample (85.7% among women, 88.4% among men), correlates of uptake and receipt of test result would probably be different.

Those with an unknown HIV status were excluded from the bivariate and multivariate analyses because HIV status was a covariate of interest. This group includes those who were absent during the collection of blood specimens and those who refused to be tested.³⁶ We compared the characteristics of this population with those with known HIV status. Those with unknown HIV status were comparable on most variables, including coverage of recent HIV testing (15.2% for women and 14.5% for men) and proportion with a recent pregnancy (13.8%). The most notable difference was that those with an unknown HIV status tended to come from urban areas. We assessed whether correlates of HIV testing differed from

interviewees whose HIV status was known. In a sensitivity analysis, including those with an unknown HIV status did not change the correlates for recent HIV testing found in the multiple logistic regression models described earlier.

HIV testing of women with a recent pregnancy and their partners in the ANC was an important contributor to recent HIV testing coverage in Zimbabwe in the early phase of HIV care and treatment scale up. It appears to have been a critical strategy to remove traditional barriers to HIV testing, such as education and stigma associated with HIV risk behavior. Further, in our analysis, awareness of ART was an important correlate for recent HIV testing while HIV status was not.

HIV testing coverage among adults, as measured by the proportion having a recent HIV test was still relatively low in Zimbabwe in 2003–05, given the very high background HIV prevalence. Strategies to increase testing among all groups of adults, particularly women and men not associated with a pregnancy are needed. Continued scale up of ART provision and the move toward routine HIV testing in some settings in the years after the survey are expected to result in an expansion in HIV testing coverage. Increasing HIV testing coverage in ANC could result in substantial increases in HIV testing coverage for all Zimbabweans.

REFERENCES

1. Grinstead OA, Gregorich SE, Choi KH, Coates T. Positive and negative life events after counselling and testing: the Voluntary HIV-1 Counselling and Testing Efficacy Study. *AIDS*. 2001; 15:1045–52. [PubMed: 11399987]
2. Hogan DR, Salomon JA. Prevention and treatment of human immunodeficiency virus/acquired immunodeficiency syndrome in resource-limited settings. *Bull World Health Organ*. 2005; 83:135–43. [PubMed: 15744406]
3. Maman S, Mbwapo J, Hogan NM, Kilonzo GP, Sweat M. Women's barriers to HIV-1 testing and disclosure: challenges for HIV-1 voluntary counselling and testing. *AIDS Care*. 2001; 13:595–603. [PubMed: 11571006]
4. Painter TM. Voluntary counseling and testing for couples: a high-leverage intervention for HIV/AIDS prevention in sub-Saharan Africa. *Soc Sci Med*. 2001; 53:1397–411. [PubMed: 11710416]
5. Sherr, L. Counselling and HIV testing: ethical dilemmas in HIV and AIDS. In: Bennett, RCE., editor. *Testing Screening and Confidentiality*. Oxford University Press; Oxford: 1999. p. 39-60.
6. Sherr L, Lopman B, Kakowa M, et al. Voluntary counselling and testing: uptake, impact on sexual behaviour, and HIV incidence in a rural Zimbabwean cohort. *AIDS*. 2007; 21:851–60. [PubMed: 17415040]
7. Stall RD, Hays RB, Waldo CR, Ekstrand M, McFarland W. The Gay '90s: a review of research in the 1990s on sexual behavior and HIV risk among men who have sex with men. *AIDS*. 2000; 14(Suppl. 3):S101–14. [PubMed: 11086853]
8. Sweat M, Gregorich S, Sangiwa G, et al. Cost-effectiveness of voluntary HIV-1 counselling and testing in reducing sexual transmission of HIV-1 in Kenya and Tanzania. *Lancet*. 2000; 356:113–21. [PubMed: 10963247]
9. Emery S, Neuhaus JA, Phillips AN, et al. Major clinical outcomes in antiretroviral therapy (ART)-naïve participants and in those not receiving ART at baseline in the SMART study. *J Infect Dis*. 2008; 197:1133–44. [PubMed: 18476292]
10. Lawn SD, Harries AD, Anglaret X, Myer L, Wood R. Early mortality among adults accessing antiretroviral treatment programmes in sub-Saharan Africa. *AIDS*. 2008; 22:1897–908. [PubMed: 18784453]
11. Severe P, Juste MA, Ambroise A, et al. Early versus standard antiretroviral therapy for HIV-infected adults in Haiti. *N Engl J Med*. 2010; 363:257–65. [PubMed: 20647201]
12. WHO. *Rapid Advice: Antiretroviral Therapy for HIV Infection in Adults and Adolescents*. WHO; Geneva: 2009.

13. Cremin I, Nyamukapa C, Sherr L, et al. Patterns of self-reported behaviour change associated with receiving voluntary counselling and testing in a longitudinal study from Manicaland, Zimbabwe. *AIDS Behav.* 2010; 14:708–15. [PubMed: 19623481]
14. Obermeyer CM, Osborn M. The utilization of testing and counseling for HIV: a review of the social and behavioral evidence. *Am J Public Health.* 2007; 97:1762–74. [PubMed: 17761565]
15. Rabkin M. Lessons from Africa. *JAIDS.* 2010; 55(Suppl. 2):S141–3. [PubMed: 21406985]
16. WHO. Zimbabwe Country Profile 2005. WHO; Geneva: 2005.
17. Ministry of Health and Child Welfare RoZ. Guidelines for Antiretroviral Therapy in Zimbabwe. Harare; Ministry of Child Health and Welfare: 2003.
18. Chikolorele P. User Fees a Stumbling Block. *The Standard.* 2010
19. Sambisa, W. AIDS Stigma and Uptake of HIV Testing in Zimbabwe. USAID; Calverton, MD: 2008.
20. Siziya S, Muula AS, Rudatsikira E, Mataya RH. Correlates of HIV testing among women in Malawi: results from the 2006 Multiple Indicator Cluster Survey. *Trop Med Int Health.* 2008; 13:1351–6. [PubMed: 18803613]
21. Tenkorang EY, Owusu GA. Correlates of HIV testing among women in Ghana: some evidence from the Demographic and Health Surveys. *AIDS Care.* 2010; 22:296–307. [PubMed: 20390509]
22. Ziraba AK, Madise NJ, Kimani JK, et al. Determinants for HIV testing and counselling in Nairobi urban informal settlements. *BMC Public Health.* 2011; 11:663. [PubMed: 21861898]
23. Central Statistics Office MII. Final Country Report: Zimbabwe Demographic Health Survey. Macro International Inc.; Harare: 2007.
24. UNAIDS. United Nations General Assembly Special Session on HIV/AIDS Monitoring the Declaration of Commitment on HIV/AIDS: Guidelines on Construction of Core Indicators. UNAIDS; Geneva: 2005.
25. Hosmer, DW.; Lemeshow, S. *Applied Logistic Regression.* Wiley; New York: 1989.
26. SAS Institute I. SAS/STAT® 9.2 User's Guide The SURVEYLOGISTIC Procedure (Book Excerpt). 2008.
27. WHO. Toward Universal Access: Scaling up Priority HIV/AIDS Interventions in the Health Sector Progress Report 2010. WHO; Geneva: 2010.
28. Braitstein P, Boulle A, Nash D, et al. Gender and the use of antiretroviral treatment in resource-constrained settings: findings from a multicenter collaboration. *J Womens Health (Larchmt).* 2008; 17:47–55. [PubMed: 18240981]
29. Nash D, Wu Y, Elul B, Hoos D, El Sadr W. Program-level and contextual-level determinants of low-median CD4+ cell count in cohorts of persons initiating ART in eight sub-Saharan African countries. *AIDS.* 2011; 25:1523–33. [PubMed: 21750418]
30. Morin SF, Khumalo-Sakutukwa G, Charlebois ED, et al. Removing barriers to knowing HIV status: same-day mobile HIV testing in Zimbabwe. *J Acquir Immune Defic Syndr.* 2006; 41:218–24. [PubMed: 16394855]
31. Gage AJ, Ali D. Factors associated with self-reported HIV testing among men in Uganda. *AIDS Care.* 2005; 17:153–65. [PubMed: 15763711]
32. Katz DA, Kiarie JN, John-Stewart GC, Richardson BA, John FN, Farquhar C. Male perspectives on incorporating men into antenatal HIV counseling and testing. *PLoS One.* 2009; 4:e7602. [PubMed: 19881884]
33. Rabkin, M. High Patient Retention Rates in Multinational HIV/AIDS Treatment Programs: The Columbia University Mother-to-child Plus Experience; Conference on Retroviruses and Opportunistic Infections; Boston, MA. 22-25 February 2005; 2005.
34. Farquhar C, Kiarie JN, Richardson BA, et al. Antenatal couple counseling increases uptake of interventions to prevent HIV-1 transmission. *J Acquir Immune Defic Syndr.* 2004; 37:1620–6. [PubMed: 15577420]
35. Ford N, Calmy A, Hurst S. When to start antiretroviral therapy in resource-limited settings: a human rights analysis. *BMC Int Health Hum Rights.* 2010; 10:6. [PubMed: 20356356]
36. Central Statistics Office MII. Final Country Report Zimbabwe Demographic Health Survey. Macro International Inc.; Harare: 2000.

37. Mugore L, Engelsmann B, Ngoro T, Dabis F, Perez F. An assessment of the understanding of the offer of routine HIV testing among pregnant women in rural Zimbabwe. *AIDS Care*. 2008; 20:660–6. [PubMed: 18576167]
38. Perez F, Zvandaziva C, Engelsmann B, Dabis F. Acceptability of routine HIV testing ('opt-out') in antenatal services in two rural districts of Zimbabwe. *J Acquir Immune Defic Syndr*. 2006; 41:514–20. [PubMed: 16652062]
39. Bolu OO, Allread V, Creek T, et al. Approaches for scaling up human immunodeficiency virus testing and counseling in prevention of mother-to-child human immunodeficiency virus transmission settings in resource-limited countries. *Am J Obstet Gynecol*. 2007; 197(Suppl.):S83–9. [PubMed: 17825654]
40. Mitchell S, Cockcroft A, Lamothe G, Andersson N. Equity in HIV testing: evidence from a cross-sectional study in ten Southern African countries. *BMC Int Health Hum Rights*. 2010; 10:23. [PubMed: 20836859]
41. Phanuphak P, Muller O, Sarangbin S, Sittitai W. Knowledge, attitudes and behaviour among HIV-positive and HIV-negative clients of a confidential HIV counselling and testing centre in Thailand. *AIDS*. 1994; 8:1315–9. [PubMed: 7802986]
42. Rothman, KJ.; Greenland, S.; Lash, TL. *Modern Epidemiology*. 3 rd edn. Wolters Kluwer Health/ Lippincott Williams & Wilkins; Philadelphia: 2008.

Table 1

Bivariate associations of individual-level characteristics and self-reported HIV testing in the last 24 months, women (15-49)

	n	All women (7484)		Pregnant in the last 24 months (1176)		Not pregnant in the last 24 months (6308)	
		Percentage tested	OR (95% CI)	Tested n (%)	OR (95% CI)	Tested n (%)	OR (95% CI)
HIV testing, including PMTCT, in the last 24 months							
HIV status and demographic variables							
HIV status							
HIV +	1571	258 (16.4)	1.2 (0.99-1.5)	96 (40.9)	1.1 (0.7-1.7)	163 (12.2)	1.4 (1.1-1.7)
HIV −	5913	823 (13.9)	1	363 (38.5)	1	460 (9.3)	1
Pregnant in the last 24 months							
Yes	1176	459 (39.0)	5.8 (5.0-6.8)	-	-	-	-
No	6308	623 (9.9)	1	-	-	-	-
Age							
15-19	1813	211 (11.6)	1.6 (1.3-2.1)	78 (42.6)	2.0 (0.9-4.8)	133 (8.1)	1.2 (0.9-1.6)
20-24	1627	322 (19.8)	3.1 (2.3-4.0)	165 (40.1)	1.9 (0.8-4.1)	157 (12.9)	2.0 (1.5-2.6)
25-29	1237	211 (17.0)	2.6 (1.9-3.4)	104 (37.6)	1.6 (0.7-3.7)	107 (11.1)	1.7 (1.2-2.4)
30-39	1729	257 (14.9)	2.2 (1.6-2.9)	103 (37.1)	1.6 (0.7-3.7)	155 (10.6)	1.6 (1.2-2.2)
40-49	1078	80 (7.4)	1	8 (26.7)	1	72 (6.9)	1
50-54	NA	-	-	-	-	-	-
Marital status							
Never married							
Never had sex	1516	125 (8.2)	0.4 (0.3-0.6)	-	-	125 (8.2)	0.5 (0.4-0.7)
Ever had sex	462	79 (17.0)	1	20 (27.9)	1	59 (15.0)	1
Married/living together	4358	714 (16.4)	0.96 (0.7-1.3)	398 (39.6)	1.7 (0.9-3.1)	317 (9.4)	0.6 (0.4-0.8)
Widowed/divorced/separated	1148	163 (14.3)	0.8 (0.6-1.1)	42 (41.0)	1.8 (0.8-3.8)	122 (11.7)	0.7 (0.5-1.1)
Residence							
Capital, large city	1119	233 (20.8)	1.9 (1.6-2.4)	80 (61.2)	3.0 (1.9-4.8)	153 (15.5)	2.4 (1.9-3.1)
Small city/town	1556	275 (17.7)	1.6 (1.3-1.9)	80 (47.0)	1.7 (1.2-2.5)	195 (14.1)	2.2 (1.7-2.8)
Countryside	4809	573 (11.9)	1	299 (34.1)	1	274 (7.0)	1
Socioeconomic variables							
Highest completed education level							

	<i>n</i>	All women (7484)		Pregnant in the last 24 months (1176)		Not pregnant in the last 24 months (6308)	
		Percentage tested	OR (95% CI)	Tested n (%)	OR (95% CI)	Tested n (%)	OR (95% CI)
None/primary	2823	254 (9.0)	1	134 (28.8)	1	120 (5.1)	1
Secondary	4466	771 (17.3)	2.1 (1.7-2.6)	312 (45.2)	2.0 (1.5-2.7)	459 (12.2)	2.6 (2.1-3.2)
Higher	195	56 (28.7)	4.1 (2.6-6.3)	12 (65.4)	4.7 (1.7-13.2)	43 (24.7)	6.1 (3.7-10.1)
Wealth index							
Poorest	1385	123 (8.9)	1	70 (21.9)	1	53 (5.0)	1
Poorer	1332	141 (10.6)	1.2 (0.9-1.6)	77 (32.7)	1.7 (1.2-2.5)	64 (5.9)	1.2 (0.8-1.7)
Middle	1386	197 (14.2)	1.7 (1.3-2.2)	108 (46.6)	3.1 (2.0-4.8)	89 (7.7)	1.6 (1.1-2.3)
Richer	1640	274 (16.7)	2.1 (1.6-2.6)	112 (47.2)	3.2 (2.2-4.6)	162 (11.6)	2.5 (1.8-3.4)
Richest	1742	347 (19.9)	2.6 (2.0-3.2)	93 (59.9)	5.3 (3.3-8.7)	254 (16.0)	3.7 (2.8-4.9)
<i>Knowledge and attitudes</i>							
Attitudes towards PLWHA							
Accepting	1964	366 (18.6)	1.5 (1.3-1.8)	157 (51.3)	2.0 (1.5-2.6)	209 (12.6)	1.5 (1.2-1.8)
Not accepting	5520	716 (13.0)	1	302 (34.7)	1	414 (8.9)	1
Comprehensive knowledge about HIV/AIDS							
Yes	3867	608 (15.7)	1.2 (1.1-1.5)	256 (42.0)	1.3 (1.0-1.7)	352 (10.8)	1.2 (1.0-1.6)
No	3617	473 (13.1)	1	202 (35.8)	1	271 (8.9)	1
Awareness of ART *							
Yes	4411	786 (17.8)	1.9 (1.6-2.2)	322 (45.4)	1.8 (1.3-2.6)	464 (12.5)	2.1 (1.7-2.6)
No	2913	296 (10.1)	1	137 (31.1)	1	156 (6.4)	1
Knows someone who has AIDS [†]							
Yes	2912	488 (16.8)	1.3 (1.1-1.5)	180 (39.9)	1.0 (0.7-1.4)	308 (12.5)	1.6 (1.3-1.9)
No	4423	593 (13.4)	1	279 (39.9)	1	314 (8.4)	1
Chronic illness or death in household in the last 12 months							
Yes	806	120 (14.9)	1.0 (0.8-1.3)	42 (41.8)	1.1 (0.8-1.7)	79 (11.1)	1.2 (0.9-1.6)
No	6678	961 (14.4)	1	417 (38.7)	1	544 (9.7)	1
<i>Risk</i>							
Number of lifetime sexual partners							
Zero	1518	125 (8.2)	0.5 (0.4-0.6)	-	-	125 (8.2)	0.8 (0.7-1.1)
One	3899	613 (15.7)	1	316 (39.6)	1	297 (9.6)	1

	All women (7484)		Pregnant in the last 24 months (1176)		Not pregnant in the last 24 months (6308)	
	n	Percentage tested	OR (95% CI)	Tested n (%)	OR (95% CI)	Tested n (%)
Two	1300	214 (16.5)	1.1 (0.8-1.3)	98 (39.3)	0.9 (0.6-1.4)	116 (11.1)
Three to nine	750	124 (16.6)	1.1 (0.8-1.4)	44 (36.5)	0.9 (0.6-1.4)	80 (12.7)
Ten and above	-	-	-	-	-	-
Do not know/missing	17			2		15
<i>Barrier</i>						
Experienced physical abuse in the last 12 months [‡]						
Yes (often or sometimes)	1230	171 (13.9)	0.9 (0.7-1.1)	84 (30.9)	0.65 (0.5-0.9)	87 (9.1)
No	3000	472 (15.7)	1	236 (40.9)	1	236 (9.7)

P < 0.05 (bold)

OR, odds ratio; CI, confidence interval; PMTCT, prevention of mother-to-child transmission; PLWHA, people living with HIV and AIDS; ART, antiretroviral therapy

^{*} *N* changes to 7324

[‡] *N* changes to 7335

[‡] *N* changes to 4231

Table 2
Bivariate associations of individual-level characteristics and self-reported HIV testing in the last 24 months, men (15-54)

	Men (15-54) 5555			
	All men (5555)		Men in couple (1983)	
	<i>n</i>	Tested, <i>n</i> (%)	OR (95% CI)	Tested, <i>n</i> (%)
HIV testing, Inc PMTCT, in the last 24 months	5555	614 (11.1)		199 (10.1)
<i>HIV status and demographic variables</i>				
HIV status				
HIV +	811	104 (12.8)	1.2 (0.9-1.6)	48 (10.8)
HIV -	4744	510 (10.8)	1	151 (9.8)
Pregnant in the last 24 months (partner)				
Yes	-	-	-	63 (13.4)
No	-	/	-	137 (9.0)
Age				
15-19	1554	97 (6.3)	0.7 (0.4-1.0)	1 (30.4)
20-24	1122	166 (14.8)	1.7 (1.2-2.5)	14 (8.6)
25-29	822	124 (15.1)	1.8 (1.2-2.6)	62 (14.0)
30-39	1147	150 (13.1)	1.5 (1.1-2.2)	76 (10.0)
40-49	677	61 (9.1)	1	40 (9)
50-54	233	16 (6.9)	0.7 (0.4-1.3)	7 (4.9)
Marital status				
Never married				
Never had sex	1443	97 (6.7)	0.4 (0.3-0.6)	-
Ever had sex	1267	183 (14.5)	1	-
Married/living together	2572	290 (11.3)	0.75 (0.6-0.9)	-
Widowed/divorced/separated	273	44 (16.0)	1.1 (0.75-1.7)	-
Residence				
Capital, large city	895	140 (15.6)	2.2 (1.7-2.8)	42 (15.2)
Small city/town	1127	200 (17.8)	2.6 (2.0-3.3)	54 (15.9)
Countryside	3533	274 (7.8)	1	103 (7.5)
<i>Socioeconomic variables</i>				

	Men (15-54) 5555				Men in couple (1983)			
	All men (5555)							
	n	Tested, n (%)	OR (95% CI)		Tested, n (%)	OR (95% CI)		
Highest completed education level								
None/primary	1669	95 (5.7)	1		39 (5.5)		1	
Secondary	3616	457 (12.6)	2.4 (1.9-3.0)		143 (12.5)		2.5 (1.7-3.7)	
Higher	270	62 (22.8)	4.9 (3.4-7.1)		17 (14.2)		2.8 (1.5-5.3)	
Wealth index								
Poorest	913	49 (5.4)	1		13 (2.9)		1	
Poorer	993	74 (7.4)	1.4 (0.9-2.1)		34 (8.1)		2.9 (1.5-5.5)	
Middle	1033	91 (8.8)	1.7 (1.1-2.6)		30 (9.7)		3.6 (1.8-6.9)	
Richer	1469	189 (12.9)	2.6 (1.8-3.9)		71 (14.6)		5.6 (3.1-10.3)	
Richest	1147	211 (18.4)	4.0 (2.7-5.7)		52 (15.5)		6.1 (3.3-11.3)	
<i>Knowledge and attitudes</i>								
Attitudes towards PLWHA								
Accepting	1777	230 (12.9)	1.3 (1.1-1.6)		81 (11.2)		1.2 (0.9-1.7)	
Not accepting	3778	384 (10.1)	1		119 (9.4)		1	
Comprehensive knowledge about HIV/AIDS [†]								
Yes	2503	317 (12.7)	1.3 (1.1-1.6)		101 (11.4)		1.3 (0.9-1.8)	
No	3052	297 (9.7)	1		98 (9.0)		1	
Awareness of ART [*]								
Yes	3645	489 (13.4)	2.2 (1.7-2.8)		161 (12.1)		2.0 (1.5-2.6)	
No	1877	125 (6.6)	1		39 (6.0)		1	
Knows someone who has AIDS								
Yes	2729	373 (13.7)	1.7 (1.4-2.0)		114 (10.9)		1.2 (0.9-1.7)	
No	2787	239 (8.6)	1		85 (9.2)		1	
Chronic illness or death in household in the last 12 months								
Yes	576	80 (13.8)	1.3 (0.99-1.8)		25 (14.6)		1.6 (0.9-2.7)	
No	4979	534 (10.7)	1		175 (9.6)		1	
<i>Risk</i>								
Number of lifetime sexual partners								
Zero	1443	97 (6.7)	0.5 (0.4-1.8)		-		-	

Men (15-54) 5555					
		All men (5555)		Men in couple (1983)	
	<i>n</i>	Tested, <i>n</i> (%)	OR (95% CI)	Tested, <i>n</i> (%)	OR (95% CI)
One	707	84 (11.9)	1	27 (11.2)	1
Two	743	92 (12.3)	1.0 (0.7-1.5)	34 (9.5)	0.8 (0.5-1.5)
Three to nine	2021	250 (12.4)	1.0 (0.8-1.4)	104 (9.9)	0.9 (0.6-1.3)
Ten and above	579	79 (13.7)	1.2 (0.8-1.7)	26 (9.0)	0.8 (0.4-1.5)
Do not know/missing	63	63		43	
<i>Barrier</i>					
Experienced physical abuse in the last 12 months					
Yes (often+sometimes)	-	-	-	-	-
No	-	-	-	-	-

P = 0.05 (bold)

OR, odds ratio; CI, confidence interval; PMTCT, prevention of mother-to-child transmission; PLWHA, people living with HIV and AIDS; ART, antiretroviral therapy

* *N* changes to 5522

[†] *N* changes to 5516

Table 3
Multivariate associations of individual-level characteristics and self-reported HIV testing in the last 24 months

<i>HIV status and demographic variables</i>					
	All women (n = 7484)	Pregnant in the last 24 months (n = 1176)	Not pregnant in the last 24 months (n = 6308)	All men (n = 5555)	Men in couple (n = 1983)
HIV status					
HIV +	1.2 (0.95-1.5)	1.0 (0.7-1.6)	1.2 (0.97-1.6)	1.1 (0.8-1.5)	1.1 (0.8-1.7)
HIV -	1	1	1	1	1
Pregnant in the last 24 months					
Yes	6.6 (5.5-7.9)	-	-	-	1.7 (1.2-2.4)
No	1	-	-	-	1
Age					
15 - 19	1.7 (1.2-2.4)	1.7 (0.6-4.5)	1.4 (0.96-2.2)	0.8 (0.5-1.4)	7.2 (0.7-72.2)
20-24	1.7 (1.2-2.2)	1.5 (0.6-3.7)	1.6 (1.1-2.1)	1.4 (0.9-2.2)	1.0 (0.5-2.1)
25-29	1.3 (0.9-1.8)	1.2 (0.5-3.1)	1.3 (0.9-1.9)	1.6 (1.0-2.4)	1.9 (1.1-3.1)
30-39	1.2 (0.9-1.7)	1.3 (0.5-3.3)	1.1 (0.8-1.6)	1.3 (0.9-1.9)	1.2 (0.8-1.9)
40-49	1	1	1	1	1
50-54	-	-	-	0.8 (0.5-1.5)	0.6 (0.3-1.3)
Marital status					
Never married					
Never had sex	0.6 (0.4-0.9)	-	-	0.6 (0.4-0.8)	-
Ever had sex	1	-	-	1	-
Married/living together	1.1 (0.8-1.5)	-	-	0.8 (0.5-1.0)	-
Widowed/divorced/separated	1.3 (0.9-1.9)	-	-	1.2 (0.7- 1.9)	-
Residence					
Capital, large city	-	-	-	-	-
Small city/town	-	-	-	-	-
Countryside	-	-	-	-	-
Highest completed education level					
None/primary	1	-	1	1	-
Secondary	1.5 (1.3-1.9)	-	1.8 (1.4-2.3)	1.6 (1.2-2.1)	-
Higher	2.8 (1.7-4.4)	-	3.2 (1.8-5.4)	2.1 (1.4-3.2)	-

	All women (n = 7484)	Pregnant in the last 24 months (n = 1176)	Not pregnant in the last 24 months (6308)	All men (n = 5555)	Men in couple (n = 1983)
Wealth index					
Poorest	1	1	1	1	1
Poorer	1.3 (0.9-1.7)	1.6 (1.1-2.4)	1 (0.7-1.5)	1.2 (0.8-1.8)	3.0 (1.5-5.8)
Middle	1.8 (1.3-2.4)	2.8 (1.8-4.4)	1.3 (0.9-1.9)	1.4 (0.9-2.1)	3.8 (1.9-7.5)
Richer	2.1 (1.6-2.7)	2.9 (2.0-4.3)	1.6 (1.1-2.3)	1.8 (1.2-2.6)	5.8 (3.1-10.7)
Richest	2.9 (2.2-3.8)	4.9 (3.0-8.1)	2.1 (1.5-3.0)	2.4 (1.6-3.6)	7.1 (3.8-13.2)
<i>Knowledge and attitudes</i>					
Attitudes towards PLWHA					
Accepting	-	1.7 (1.3-2.2)	-	-	-
Not accepting	-	1	-	-	-
Comprehensive knowledge about HIV/AIDS					
Yes	-	-	-	-	-
No	-	-	-	-	-
Awareness of ART *					
Yes	1.4 (1.2-1.7)	-	1.4 (1.1-1.8)	1.5 (1.1-2.0)	-
No	1	-	1	1	-
Knows someone who has AIDS †					
Yes	1.2 (1.0-1.4)	-	1.3 (1.1-1.6)	1.4 (1.2-1.8)	-
No	1	-	1	1	-
Chronic illness or death in household in the last 12 months					
Yes	-	-	-	-	-
No	-	-	-	-	-
<i>Risk</i>					
Number of lifetime sexual partners					
Zero	-	-	0.7 (0.5-0.9)	-	-
One	-	-	1	-	-
Two	-	-	1.3 (0.97-1.7)	-	-
Three to nine	-	-	1.4 (1.0-1.8)	-	-
Ten and above	-	-	-	-	-
<i>Barrier</i>					

	All women (<i>n</i> = 7484)	Pregnant in the last 24 months (<i>n</i> = 1176)	Not pregnant in the last 24 months (6308)	All men (<i>n</i> = 5555)	Men in couple (<i>n</i> = 1983)
Experienced physical abuse in the last 12 months [‡]					
Yes (often + sometimes)	-	-	-	-	-
No	-	-	-	-	-

P = 0.05 (bold)

PLWHA, people living with HIV and AIDS; ART, antiretroviral therapy; NA, not applicable

^{*} *N* changes (female: 7324; male: 5522)

[‡] *N* changes (female: 7335; male: 5516)

[‡] *N* changes (female: 4231; male: NA)