ETHIOPIA FURTHER ANALYSIS

Evaluating HIV Seroprevalence Estimates from Ethiopia

Further Analysis of the 2005 Ethiopia Demographic and Health Survey

This report presents findings from a further analysis study undertaken as part of the follow up to the 2005 Ethiopia Demographic and Health Survey (EDHS). Macro International Inc. provided technical assistance for the project. Funding was provided by the U.S. Agency for International Development (USAID) under the terms of Contract No. GPO-C-00-03-00002-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

This report is part of the MEASURE DHS programme, which is designed to collect, analyse, and disseminate data on fertility, family planning, maternal and child health, nutrition, and HIV/AIDS.

Additional information about the 2005 EDHS may be obtained from the Central Statistical Agency (CSA), P.O. Box 1143, Addis Ababa, Ethiopia; Telephone: (251) 111 55 30 11/111 15 78 41, Fax: (251) 111 55 03 34, E-mail: csa@ethionet.et. Additional information about the DHS project may be obtained from Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705 USA; Telephone: 301-572-0200, Fax: 301-572-0999, E-mail: reports@macrointernational.com, Internet: www.measuredhs.com.

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Further Analysis of the 2005 Ethiopia Demographic and Health Survey

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Tables and Figures

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Summary

This study describes the methods used for obtaining HIV seroprevalence estimates in the 2005 Ethiopia Demographic and Health Survey (EDHS), a population-based survey that collected data on behavioral, social, and demographic indicators and also tested blood samples for HIV. The HIV prevalence estimates obtained from the EDHS are evaluated for potential bias due to non-response in the survey. They are also compared with the estimates of HIV prevalence obtained from samples collected from women who visited the antenatal care (ANC) facilities selected for HIV sentinel surveillance.

The 2005 EDHS collected demographic and health information from 13,928 households in 535 sample enumeration areas. Of these, a subsample of 6,787 households were selected for collection of blood samples for HIV testing. A total of 6,778 men age 15-59 and 7,142 women age 15-49 years were eligible for blood sample collection. Testing for HIV was conducted using standard testing and quality-control procedures. The test results for individuals were anonymously linked to information collected in the survey questionnaire through bar codes. We compared EDHS estimates of HIV prevalence among women with those from the 2005 ANC surveillance survey. Geographic information system (GIS) methods were used to map sentinel surveillance sites and EDHS clusters that were within a radius of 15 kilometers of the ANC surveillance sites. The HIV prevalence estimate for women from the ANC surveillance survey was compared with the EDHS estimate for women residing within 15 kilometers of the ANC surveillance sites. To evaluate the extent of potential bias due to non-response in the EDHS, the predicted prevalence of HIV among non-tested adults was calculated using multivariate statistical models based on those who were interviewed and tested, using a common set of predictor variables.

Of the eligible men and women, individual questionnaires were completed for 89 percent of men and 95 percent of women, and blood specimens were collected for 84 percent of men and 90 percent of women. The EDHS estimate of HIV prevalence for women age 15-49 (1.9 percent) was much lower than the ANC surveillance estimate. When the comparison was restricted to women residing within the catchment areas of the ANC surveillance sites, the EDHS estimate (4.3 percent) compared more closely with the ANC estimate. When the comparison was further restricted to women who attended ANC for their most recent birth, the DHS estimate (6.5 percent) was greater than the ANC surveillance estimate (5.3 percent). Comparisons by age and urban/rural residence pointed to possible sources of bias in the ANC estimates. Our analysis of non-response indicated significantly higher predicated HIV prevalence rates among the non-tested men (1.3 percent) and women (3.4 percent) than among the tested men and women (0.9 percent and 1.9 percent, respectively). However, this bias did not have any significant effects on the national estimates of HIV prevalence.

The EDHS HIV estimate for women compared well with the ANC surveillance estimate when the comparison was restricted to women living in the catchment areas of ANC surveillance sites. Men and women not tested had higher estimated prevalence, but it did not significantly bias the national estimates based on the EDHS. We conclude that the HIV prevalence estimates obtained from the EDHS are reliable and they are nationally representative. The EDHS also provides important information on associated characteristics and behaviors of adults. These data are useful for identifying higher-risk and vulnerable populations and for informing HIV prevention, care, and treatment programs.

1 Introduction

Reliable data on the prevalence of HIV in the general population are essential for planning an effective response to the epidemic and dealing with its consequences. National data for Ethiopia have not been available thus far. The HIV/AIDS epidemic in Ethiopia was recognized in the mid-1980s, with the first cases of AIDS reported in Addis Ababa in 1986 (Lester et al., 1988). Initial surveillance efforts relied on certain high-risk groups, such as commercial sex workers and truck drivers. By the late 1980s, high rates of HIV prevalence were reported in these groups, especially in urban centers and along major commercial routes and roadways (Mehret et al., 1990a, 1990b). Efforts to monitor HIV prevalence in the general population started in 1989 with the establishment of sentinel surveillance of pregnant women attending an antenatal care (ANC) clinic in Addis Ababa, but until 1997 no other sites were included in the program. In recent years, especially after 2000, the number of urban ANC surveillance sites has increased dramatically. Rural sites have also been added to improve the representation of the rural population. By 2005, there were 82 ANC surveillance sites nationwide, 38 in urban areas and 44 in rural areas (Ethiopia Federal Ministry of Health/National HIV/AIDS Prevention and Control Office, 2006).

In recent years, sentinel surveillance of pregnant women attending selected ANC facilities has become a major source of data on HIV prevalence in Ethiopia as in other countries with generalized epidemic in sub-Saharan Africa (UNAIDS, 2006). The primary purpose of the surveillance system was to track trends, but it has also been used extensively to estimate levels (Stover et al., 2004). The limitations of ANC surveillance data are well known, including the underrepresentation of remote rural populations in health facility-based systems, the lack of data on men and non-pregnant women, and the limited ability to assess risk factors (Boerma et al., 2004). ANC data, therefore, may not represent the true population prevalence. Recently, the HIV prevalence estimates for Ethiopia have come under increased scrutiny when data from a nationally representative household survey, the 2005 Ethiopia Demographic and Health Survey (EDHS), became available. The 2005 EDHS showed a much lower prevalence level than previously estimated based on surveillance data (Central Statistical Agency and ORC Macro, 2006).

The 2005 EDHS is the second nationally representative, population-based survey in Ethiopia. It was designed to obtain national and sub-national data on the prevalence of HIV and its social, behavioral, and demographic variations in the country. The inclusion of HIV testing in the survey offered the opportunity to obtain information on the magnitude and patterns of HIV infection in the general adult population in Ethiopia. The overall goal of the survey was to provide program managers and policymakers involved in HIV/AIDS programs with strategic information needed to monitor and evaluate existing programs and to effectively design new strategies for combating the epidemic in Ethiopia.

This study describes the methods used for obtaining HIV seroprevalence estimates in the 2005 EDHS. The HIV prevalence estimates obtained from the EDHS are compared with the estimates of HIV prevalence obtained from samples collected from pregnant women who visited the ANC facilities selected for HIV sentinel surveillance throughout Ethiopia. A major challenge for population-based surveys like the EDHS is bias due to nonresponse resulting from refusal and absence. The study also discusses the patterns of nonresponse in the EDHS and evaluates how nonresponse in the survey may have biased the estimates of HIV prevalence.

2 Data and methods

The overall survey protocol and the protocol for HIV blood sample collection and testing were approved by the National Ethics Review Committee of the Ethiopia Science and Technology Commission in Addis Ababa, Ethiopia and by the Institutional Review Board at Macro International Inc. in Calverton, Maryland, USA.

2.1 The 2005 Ethiopia Demographic and Health Survey (EDHS)

2.1.1 Sample design

The EDHS covered a nationally representative probability sample of households throughout Ethiopia. The survey utilized a stratified, two-stage clustered sample design. The first stage involved selecting sample points or clusters from a list of enumeration areas covered in the 1994 Population Census. A total of 540 clusters (145 urban and 395 rural) were selected. Fieldwork was successfully completed in 535 clusters, and DBS samples collected in 534 clusters. The clusters were selected in such a manner as to allow a sufficient number of cases in each region. Since the sample was not allocated in proportion to the population size of each region, the EDHS sample is not self-weighting at the national level. Consequently, weighting factors need to be applied to the data to produce nationally representative results[1].

The second stage of selection involved systematic sampling of households from the census list of households in each cluster. Between 24 and 32 households per cluster were selected for a total of 14,645 households. The sample was constructed to allow separate estimates for key indicators for urban and rural areas and for the 11 geographic areas (9 regions and 2 city administrations), namely: Tigray; Affar; Amhara; Oromiya; Somali; Benishangul-Gumuz; Southern Nations, Nationalities, and Peoples (SNNP); Gambela; Harari; Addis Ababa; and Dire Dawa[2].

All adult women age 15-49 years residing in the selected households (either usual residents or visitors present in the household on the night before the survey) were eligible for individual interview. All men age 15-59 residing in every second sampled household were eligible for the individual interview. All eligible women and men in the male subsample of households were also eligible for blood specimen collection and subsequent testing for HIV. A total of 7,142 women and 6,778 men residing in 6,787 households were eligible for both individual interview and HIV testing.

2.1.2 Survey questionnaires

Social, behavioral, and demographic data were collected using three questionnaires—a household questionnaire, an individual woman's questionnaire, and an individual man's questionnaire. The household questionnaire was used to list all household members and identify men and women eligible for individual interviews. The household questionnaire was also used to collect information about each household member, such as age, sex, education, and relationship to the

[1] Weights are adjustment factors applied to each case in tabulations to adjust for differences in probabilities of selection and interview. In the EDHS, there are several types of weights. Household weight for a particular household is calculated as the inverse of the household selection probability multiplied by the inverse of the household response rate. Individual weight for a respondent is its household weight multiplied by the inverse of the individual response rate. Blood testing weight for a respondent is its household weight multiplied by the inverse of individual response rate for blood draw. The weights are standardised (each weight separately) so that the sum of the standardised weights equals the sum of the cases over the entire sample. In the analysis and tabulations, the weights are used as follows: 1) the household weight is used for any household-level analysis; 2) the individual weight is used for any individual-level analysis, not including the HIV result; 3) the blood testing weight is used for any individual-level analysis, including any HIV result; 4) the individual weight for men is used for any couple-level analysis, not including the HIV result; and 5) the blood testing weight for men is used for any couple-level analysis, including HIV result.

[2] The numbers of cases for some regions appear to be small because they are weighted to make the regional distribution nationally representative.

household head. It was also used to collect information on household amenities and ownership of durable assets, such as source of water, type of toilet facility, and ownership of mosquito nets, which would allow an estimation of the wealth index.

The women's questionnaire and the men's questionnaire were used to collect information on background characteristics, reproduction, marriage and sexual activity, knowledge and attitudes towards HIV/AIDS, and knowledge and prevalence of other sexually transmitted infections (STIs). In addition, the women's questionnaire collected information on reproductive history, maternal and child health, nutrition, and maternal mortality.

The questionnaires, which had been prepared in English, were translated into the three main local languages (Amharic, Oromiffa, and Tigrigna). To ensure that the questions were clear and could be understood by the respondents, the questionnaires and all other aspects of the survey were field tested prior to the start of the survey fieldwork. The lessons learned from the pretest were used to finalize the questionnaires and all other logistical arrangements for the survey.

2.1.3 Blood specimen collection

The protocol for blood specimen collection and analysis was based on the anonymous linked protocol developed for the Demographic and Health Survey. This protocol allows for the linking of HIV results with socio-demographic data collected in the individual questionnaires. This is done only when the information that could potentially identify an individual is destroyed before the linking takes place. This process requires that identification codes be deleted from the data file and that the back page of the household questionnaire, which contains the barcode labels and names of respondents, be destroyed prior to merging the HIV results with the individual data file. Eligible women and men in the subsample of households selected for HIV testing who were interviewed were asked to voluntarily provide a few drops of blood. Informed consent was obtained by explaining the procedure for drawing blood, the confidentiality of the data, and the fact that the test results would not be made available to the subject. The respondents were given an opportunity to ask any questions about the survey to help them decide whether or not they wanted to participate. The interviewer recorded the respondent's decision on the questionnaire and signed the questionnaire affirming that the consent statement had been read. For youth age 15-17, consent to take blood samples was sought from their parents or guardians.

For those who consented, specially trained interviewers used a single-use, spring-loaded, sterile lancet to draw a few drops of blood from a finger prick onto a filter paper card. The dried blood spot (DBS) samples from each person were given a barcode label, with a duplicate label attached to the household questionnaire on the line number showing consent for that respondent. A third copy of the same barcode label was affixed to a Blood Sample Transmittal Form to track the blood samples from the field to the laboratory. Each respondent who consented to HIV testing was given an information brochure on AIDS, a list of fixed sites providing voluntary counseling and testing (VCT) services throughout the country, and a voucher to access free VCT services at any of the sites for the respondent and/or his or her partner.

Filter papers containing the DBS samples were air-dried overnight in plastic boxes and stored at ambient temperature in lots of 20 separated by glassine paper in zipper-locked bags containing desiccants. Specimens were periodically collected from the field and taken to the Ethiopia Health and Nutrition Research Institute (EHNRI) for laboratory testing.

2.1.4 Laboratory testing for HIV

In preparation for carrying out the HIV testing, an assessment of the equipment and staff training required for the testing of the DBS samples was conducted jointly by EHNRI and Macro staff. In addition, a validation study was conducted to set up the methodology for testing the DBS samples for HIV using two Enzyme-Linked Immunosorbent Assay (ELISA) tests from different manufacturers. The purpose of the validation study was twofold: 1) to validate the test kits on DBS;

and 2) to validate the testing algorithm chosen for the EDHS. Paired plasma and DBS specimens were tested in a serial algorithm. Plasma was compared to DBS samples to ensure validity of the DBS technique and the discordant samples were tested using a second ELISA (to test the algorithm). Any further discordance in the results was confirmed by a Western Blot. The EDHS testing algorithm adhered to international guidelines for HIV testing in population-based surveys (WHO/UNAIDS, 2005).

Blood specimens were tested with a screening test, Vironostika HIV Uniform Plus O manufactured by BioMerieux (ELISA I). All samples that were positive on the first screening test as well as 10 percent of the negatives were further tested with Enzygnost Anti HIV-1/2 Plus manufactured by Dade Behring (ELISA II). The positive samples on both tests were regarded as positive and negative samples on both tests were regarded as negative. Samples with equivocal or discordant results on the two assays were subject to repeat testing using both ELISAs. Discordant samples from repeat ELISAs were resolved using a confirmatory test, Genetic Systems HIV-1 Western Blot manufactured by Bio-Rad.

Laboratory testing procedures called for both internal and external quality controls. Internal quality control involved setting criteria of performance for all steps in the specimen logistics, from collecting specimens to reporting data. Laboratory personnel were supervised to stringently follow the procedures as outlined in the Laboratory Manual, including procedures for logging and tracking DBS samples from the field, storage of DBS samples, eluting DBS samples, performing the HIV testing algorithm, recording the test results and maintaining confidentiality of the records. In addition, kit controls were included on each run.

As part of the external quality control exercise, well characterized DBS challenge panels were obtained from the CDC/Atlanta, Newborn Screening Quality Assurance Program for use in validating an antibody assay using DBS to help detect analytical problems with the laboratory. The CDC DBS samples included a negative control, a weak positive control, and a strong positive control. These controls were run in duplicate on each run. In addition, 10 percent of the DBS samples (40 percent negative and 60 percent positive) were sent to an external laboratory at the National Institute for Communicable Diseases (NICD) in South Africa for retesting, to help evaluate precision and testing errors in the laboratory.

2.1.5 Data processing

The processing of the EDHS questionnaires began shortly after the fieldwork commenced on April 27, 2005. Data were entered using Macro International's CSPro computer program. All data were entered twice (100 percent verification) by two separate data entry operators. The concurrent processing of the data was a distinct advantage for data quality because EDHS senior staff was able to advise field teams of errors made in the field that were detected during data entry.

2.2 The 2005 ANC Surveillance Survey

The ANC surveillance data were obtained from the 2005 surveillance survey of pregnant women attending 82 ANC surveillance sites from all 11 regions of the country (Ethiopia Federal Ministry of Health/National HIV/AIDS Prevention and Control Office, 2006). Pregnant women attending sentinel sites for their first prenatal visit were eligible for participation in the survey. The target sample size for each ANC facility was recommended to be 250 for rural sites and 400 for urban sites. Women were selected consecutively until the target sample size was reached.

At the end of a three-month period, the sampling was to stop regardless of whether the target was reached. However, because of low ANC coverage in the country, the data collection period was extended to 20 weeks for the rural sites. Those that were unlikely to meet the target number collaborated with satellite sites. A total of 28,247 women were included in the ANC surveillance survey. In the ANC survey, the participants were not informed of their inclusion in the HIV surveillance sample. Participants had their blood samples taken routinely for other tests as part of their

ANC visit, and the same blood samples were used for HIV testing. Because the surveillance HIV test results were not linked to patient records, informed consent was not required according to the WHO guidelines (WHO/UNAIDS, 2005).

2.3 Comparison of HIV estimates from the EDHS and the ANC surveillance survey

A geographic information system or GIS-based methodology was used to identify the EDHS clusters which were located within a reasonable distance of the ANC sites. Sample households within these clusters were expected to represent the catchment population of the ANC site. A list of ANC surveillance facilities was obtained from the 2005 sentinel surveillance report. The locations of the ANC surveillance sites were provided by the Ministry of Health. The locations were geo-referenced to the town or village where the sites were located. All coordinates were projected to the corresponding Universal Transverse Mercator (UTM) zones for Ethiopia. The geo-referenced locations of the ANC surveillance sites were then plotted with the EDHS cluster locations. The distance from each EDHS cluster to the nearest ANC surveillance site was calculated as Euclidian or "as the crow flies" distance. The distances were calculated in kilometers using ArcView 9.1 (ESRI 2006). For each ANC site, the EDHS clusters within a 15 kilometer radius were identified. The 15 kilometer radius was used as an approximation of the geographic catchment area of the ANC site.

After identifying the EDHS clusters within 15 kilometers of each ANC site, HIV prevalence among EDHS women residing in the catchment areas of ANC sites was tabulated by current pregnancy status, experience of a child birth in the past three years, and whether received ANC for the most recent birth in the past three years. HIV prevalence among EDHS women residing in the catchment areas of ANC sites was also compared with ANC surveillance estimates on selected background characteristics, including age, urban/rural residence, end educational status. The EDHS sample size for currently pregnant women in clusters in the ANC catchment areas was relatively small, which may have lead to a less precise HIV estimate for these women. The inclusion of all women who gave birth and those who attended ANC clinics in the past three years generally yielded a larger sample size and was expected to provide more precise estimates. In the case of the ANC surveillance survey, information on previous ANC care was not available.

2.4 Analysis of nonresponse bias

To estimate the extent of nonresponse bias and its potential impact on the observed HIV prevalence, all eligible respondents were divided into four groups: (1) interviewed, tested; (2) not interviewed but tested; (3) interviewed, not-tested; and (4) not-interviewed, not-tested. Prevalence of HIV in the two non-tested groups (3 and 4) was predicted based on multivariate statistical models for those who were interviewed and tested using a common set of predictor variables. A logistic regression model was used to calculate predicted prevalence separately for the "not-interviewed, not-tested" and "interviewed, not-tested" groups. Predictions for the "not-interviewed, not-tested" group was based on a limited set of variables (only from the household questionnaire). Predictions for the "interviewed, not-tested" group additionally used several individual socio-demographic and behavioral characteristics of the respondents, which were collected in the survey. All models were run separately for women and men.

Variables for predicting HIV prevalence in the "not-interviewed, not-tested" group included age, education, wealth index, residence, and geographic region. Additional variables for predicting HIV in the "interviewed, not-tested" group included: marital status; childbirth in past five years (women only); work status; media exposure; ethnicity; religion; circumcision (men only); STI or STI symptoms in the past 12 months; alcohol use at last sex in the past 12 months; number of sex partners in the past 12 months; cigarette smoking/tobacco use; age at first sex; number of lifetime sexual partners; number of sexual partners in the past 12 months; condom use at last sex in the past 12 months; higher-risk sex (sex with a nonmarital, noncohabiting partner) in the past 12 months; knowledge of prevention methods (abstinence, being faithful, and condom use); attitudes towards people living with HIV (PLHIV); women's ability to negotiate safer sex with their spouse; women's

participation in household decisionmaking (women only); number of medical injections in the past 12 months; duration of stay in current place of residence; number of times slept away in the past 12 months (men only); away (from usual place of residence) for more than one month in the past 12 months (men only); and previously tested for HIV.

Multivariate analyses used STATA version 9.0. Adjusted prevalence was calculated as a weighted average of observed prevalence in the "interviewed, tested" group and predicted prevalence in the two non-tested groups. Sampling weights were applied in accordance with standard survey procedures. We used blood testing sampling weights for the tested, individual sampling weights for the "interviewed, not-tested", and household sampling weights for the "not-interviewed, not-tested" groups, respectively.

3 Results

Results from the 2005 EDHS indicated that 1.4 percent of adults age 15-49 were infected with HIV. The HIV prevalence was much higher among women (1.9 percent) than among men (0.9 percent), and much higher in urban areas (5.5 percent) than in rural areas (0.7 percent). Women who were pregnant at the time of the EDHS had lower HIV prevalence (1.1 percent) than those who were not pregnant (1.9 percent). HIV prevalence was also lower among women who gave birth in the three years preceding the EDHS than among those who did not. However, HIV prevalence was higher among women who gave birth in the past three years and received ANC for their last birth (3.7 percent) than among women who did not receive ANC or did not give birth in the past three years (1.6 percent).

3.1 Comparison of HIV estimates from the EDHS and the ANC surveillance survey

The HIV prevalence among women in the 2005 EDHS (1.9 percent) was much lower than that among pregnant women included in the 2005 ANC surveillance survey (3.5 percent).[3] Comparing ANC and EDHS estimates in urban and rural areas revealed similar patterns in that HIV prevalence was much higher in urban areas in both the data sources.

Table 3.1 compares ANC surveillance survey estimate of HIV prevalence among women with EDHS estimates for currently pregnant women, women who gave birth in the previous three years, and women who attended ANC for their last birth. Comparisons are made separately for all women in the EDHS sample and women living in sample clusters within 15 kilometers of the nearest ANC surveillance site.

In the EDHS, HIV prevalence was higher among women who lived in a community within 15 kilometers of the nearest ANC surveillance site (4.3 percent) than among all women included in the survey (1.9 percent). This may be because ANC sites tend to be disproportionately located near urban areas where HIV prevalence is higher. The EDHS estimate in the ANC catchment areas was much closer (4.3 percent) to the ANC surveillance survey estimate (5.3 percent) than the EDHS national estimate for all women (1.9 percent).

[3] This is the prevalence adjusted for differences in regional urban-rural population sizes from 79 ANC sites. Unadjusted rates from 82 ANC sites are used in comparing unweighted prevalence among women in EDHS clusters in the ANC catchment areas.

Table 3.1 Comparison of HIV prevalence among women age 15-49 from the ANC surveillance survey and the EDHS, Ethiopia 2005

Characteristic	ANC[1] (adjusted)	EDHS			
		All women (weighted)		Women who live in a community within 15 km of nearest ANC site (unweighted)	
	Percent	Percent	Number	Percent	Number
Total (women 15-49)	3.5	1.9	5,729	4.3	1,911
Currently pregnant					
No		1.9	5,250	4.5	1,810
Yes		1.1	479	2.0	101
Gave birth in past 3 years					
No		2.0	3,305	4.7	1,417
Yes		1.7	2,423	3.2	494
Attended ANC for last birth in past 3 years					
No ANC/no birth in past 3 years		1.6	5,099	4.1	1,681
Birth in past 3 years with ANC		3.7	630	6.5	230

[1] Ethiopia Federal Ministry of Health/National HIV/AIDS Prevention and Control Office, 2006

The ANC surveillance survey estimate of HIV prevalence (5.3 percent) was lower than the EDHS estimate for women who lived within the 15-kilometer catchment areas of the ANC surveillance sites who gave birth in the past three years and received ANC for their last birth (6.5 percent). Younger women (age 15-24) in the ANC catchment areas of the EDHS sample had lower HIV prevalence than younger women in the ANC surveillance survey (Table 3.2). This pattern reversed for older women, where women age 25 years and older in the ANC catchment areas had higher HIV prevalence than those in the ANC surveillance survey. This finding suggests that women covered by ANC surveillance sites are not representative of all women even within the 15-kilometer catchment areas of the surveillance sites. The total ANC prevalence estimate was much closer to the urban rather than the rural ANC estimate, suggesting some over-representation of urban women in the ANC surveillance survey.

Table 3.2 Comparison of HIV prevalence among women age 15-49 from the ANC surveillance survey and the EDHS, by age, residence, and education, Ethiopia 2005

Characteristic	EDHS 15 km catchment area (unweighted)	Attended ANC, EDHS 15 km catchment area (unweighted)	ANC (unadjusted)
Total (women 15-49)	4.3	6.5	5.3
Age			
15-24	2.5	7.7	5.6
25-34	6.0	6.0	5.4
35-49	6.0	5.7	3.3
Residence			
Urban	5.9	7.4	9.5
Rural	1.5	4.9	2.2
Education			
None	3.2	3.1	na
Primary	4.6	6.7	na
Secondary+	5.5	10.3	na

na = Not applicable

3.2 Analysis of nonresponse bias in the EDHS

3.2.1 Nonresponse rates

A total of 6,787 households were selected for HIV testing in the EDHS sample, of which 4,959 were in rural areas and 1,828 were in urban areas. Of the selected households, 99 percent were found to be occupied at the time of the fieldwork and were interviewed (Table 3.3).

Table 3.3 Response rates for household and individual interviews and percentage who were tested for HIV, by sex and urban-rural residence, Ethiopia 2005

Sex/residence	Number of households selected and occupied	Percentage households interviewed	Number eligible for individual interview and testing	Percentage interviewed	Percentage tested for HIV
Men (15-59)					
Urban	1,828	97.6	1,948	83.6	59.5
Rural	4,959	98.9	4,830	91.2	81.7
Total	6,787	98.6	6,778	89.0	75.4
Women (15-49)					
Urban	1,828	97.6	2,239	92.9	72.9
Rural	4,959	98.9	4,903	96.5	87.9
Total	6,787	98.6	7,142	95.4	83.2

In the households with completed interviews, a total of 6,778 men age 15-59 and 7,142 women age 15-49 were identified as eligible for the individual interview and blood specimen collection. Of the eligible men and women, individual questionnaires were completed for 89 percent of men and 95 percent of women, and blood specimens were collected for 75 percent of men and 83 percent of women. The response rates for HIV testing were much lower in urban areas than in rural areas, and especially for men. In urban areas, only 60 percent of men and 73 percent of women were tested for HIV compared with 82 percent of men and 88 percent of women in rural areas.

An individual was only considered absent after three callback visits. The lower response rate for men reflects more frequent and longer absence of men from the households. Eight percent of eligible men and 2 percent of eligible women were not tested for HIV because they were absent at the time of the survey (Table 3.4). Another 15 percent of men and 13 percent of women were not tested because they refused to participate in the survey or refused to give blood specimen. For both men and women, refusal was the reason for nonresponse much more often than absence, and especially so for women.

Table 3.4 Nonresponse rate for HIV testing, interview status, and reason for nonresponse, by sex and urban-rural residence, Ethiopia 2005

Sex/residence	Nonresponse rate	Interview status		Reason for nonresponse		
		Interviewed	Not interviewed	Refused	Absent	Other/ missing
Men (15-59)						
Urban	40.5	24.2	16.3	26.7	11.1	2.7
Rural	18.3	9.6	8.6	10.3	6.4	1.6
Total	24.7	13.8	10.8	15.0	7.8	1.9
Number	1,671	936	735	1,018	526	127
Women (15-49)						
Urban	27.2	20.1	7.0	22.1	3.9	1.2
Rural	12.1	8.8	3.3	9.2	1.5	1.4
Total	16.8	12.4	4.5	13.3	2.3	1.3
Number	1,203	884	319	946	161	96

Nonresponse due to refusal or absence was much higher in urban areas than in rural areas (Figure 3.1). Nonresponse was considerably higher among more educated and richer respondents. Men and women with secondary or higher education and those belonging to the richest 20 percent households had considerably higher nonresponse rates for blood draw than less-educated and poorer respondents.

Figure 3.1 Nonresponse rate for HIV testing by selected background characteristics, Ethiopia 2005

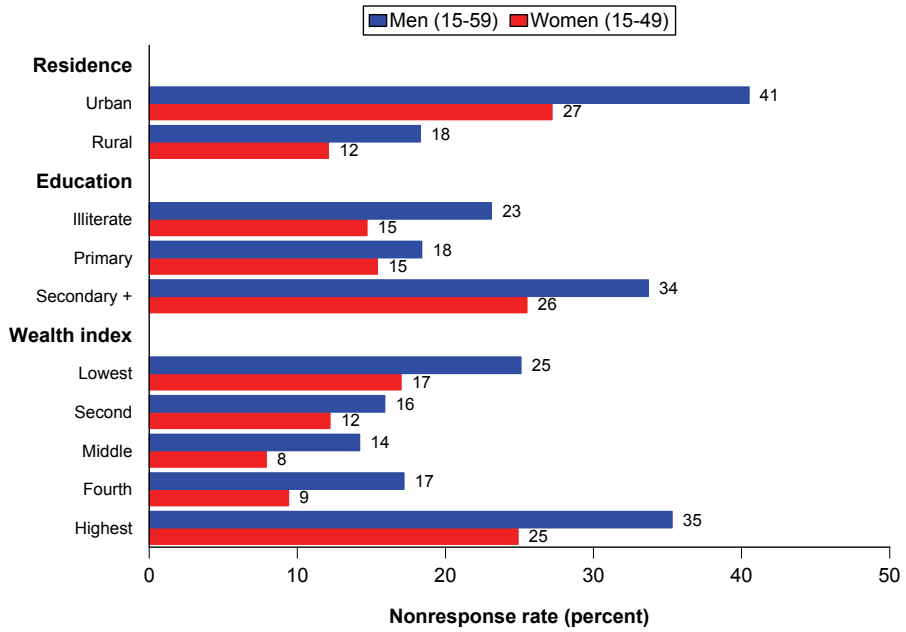
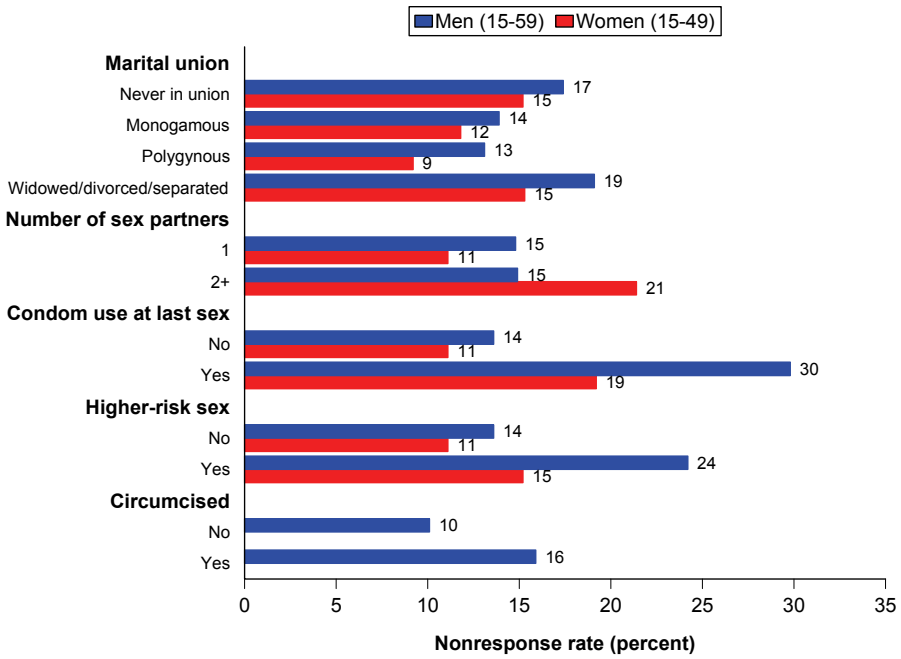


Figure 3.2 shows patterns of nonresponse for blood draw by selected risk factors for respondents who were interviewed (mostly refusal cases). Nonresponse rates were somewhat lower for men and women in polygynous unions and among those who did not use a condom at last sex in the past 12 months. On the other hand, nonresponse rates were somewhat higher among widowed, divorced, and separated men and women, higher among women who reported two or more sex partners in the past 12 months, and higher among men and women who reported sex with a non-spousal (non-marital, non-cohabiting) partner. These groups tend to have higher HIV prevalence. Additionally, circumcised men (who tend to have lower HIV prevalence) had a higher nonresponse rate than uncircumcised men. Nonresponse rates and reasons for nonresponse by other characteristics are provided in Appendix Tables A.1-A.3.

Figure 3.2 Nonresponse rate for HIV testing by selected risk behaviours (among those interviewed), Ethiopia 2005



3.2.2 Effects of nonresponse bias on observed estimates

Table 3.5 shows how the predicted prevalence of HIV among the non-tested respondents differs from the observed prevalence among those who were tested. It also shows the impact of the nonresponse bias on the adjusted prevalence estimates of these infections for all eligible respondents. Predicted prevalence among the non-tested men and women is presented by interview status and reason not tested. Observed prevalence of HIV among tested men age 15-59 is 0.9 percent while among tested women age 15-49 it is 1.9 percent. Predicted prevalence of HIV among the non-tested men and women (1.3 percent among men and 3.4 percent among women) is significantly higher than among those who were tested. Appendix Tables A.4 and A.5 provide background information on predicted prevalence among non-tested men and women and the overall adjusted prevalence for all eligible men and women by categories of age, education, wealth status, urban-rural residence, and geographic region.

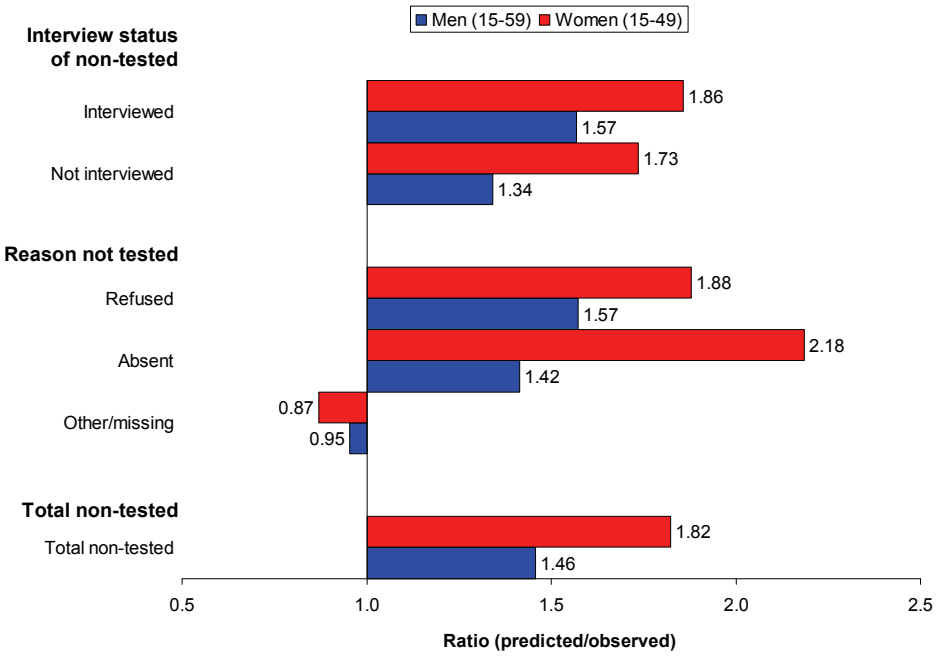
Table 3.5 Predicted HIV prevalence among respondents not tested and adjusted HIV prevalence for all eligible men age 15-59 and women age females 15-49, Ethiopia 2005

Characteristic	Observed HIV prevalence among respondents tested	Predicted HIV prevalence among respondents not tested						Adjusted prevalence among all eligible respondents
		Interview status		Reason not tested			Total not tested	
		Interviewed	Not interviewed	Refused	Absent	Other/ missing		
Men (15-59)								
Urban	2.6	3.2	3.1	3.2	3.5	1.9	3.2	2.8
Rural	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Total	0.9	1.4	1.2	1.4	1.3	0.9	1.3	1.0
Number	5,107	936	735	1,018	526	127	1,671	6,778
Women (15-49)								
Urban	7.7	8.0	8.0	8.0	8.5	6.3	8.0	7.8
Rural	0.7	1.0	0.7	0.9	0.7	0.8	0.9	0.7
Total	1.9	3.5	3.2	3.5	4.1	1.6	3.4	2.1
Number	5,939	884	319	946	161	96	1,203	7,142

Figure 3.3 shows the ratio of predicted HIV prevalence among the men and women not tested and the observed prevalence among those tested, by interview status and reason for not testing.

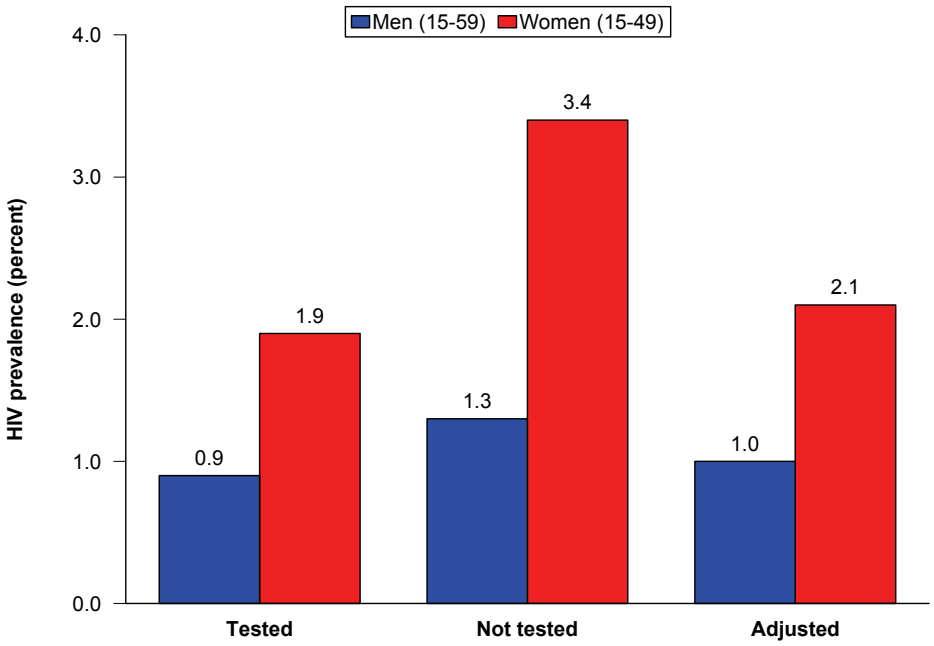
Overall, the predicated prevalence among the non-tested men is 46 percent higher and among non-tested women is 82 percent higher than among tested men and women, respectively. This pattern holds irrespective of interview status and reason for being tested, but the non-tested/tested ratios are higher among interviewed, non-tested men and women than among those who were not interviewed and not tested. Men who refused testing were 57 percent more likely than tested men to be HIV-positive. Women who refused testing were 88 percent more likely than tested women to be HIV-positive. Corresponding proportions for men and women who were absent were 42 percent and 118 percent, respectively. The predicted HIV prevalence among non-tested men and women was higher than the observed prevalence in most subgroups by age, education, wealth status, urban/rural residence, and geographic region, with the notable exception of rural men (see Tables A.4 and A.5).

Figure 3.3 Ratio of predicted HIV prevalence among men and women who were not tested to the observed prevalence among those who were tested, by interview status of those who were not tested and reason not tested, Ethiopia 2005



Adjusting the observed HIV national estimates for tested men and women, by accounting for the predicted rates among the non-tested men and women, makes little difference to the observed estimates. Overall, adjusted prevalence among all eligible men and women is only slightly higher (1.0 percent among men and 2.1 percent among women) than the observed prevalence among the tested men and women (0.9 percent among men and 1.9 percent among women), and these differences are not statistically significant (Figure 3.4).

Figure 3.4 Observed HIV prevalence rates for men and women who were tested and for those who were not tested, and overall adjusted HIV prevalence rates, Ethiopia 2005



4 Conclusions

The 2005 EDHS is a large, population-based survey that collected nationally representative data on the prevalence of HIV among men and women in Ethiopia. The survey protocol allowed for anonymously linking of laboratory test results with the socio-demographic and behavioral information collected in the survey. The confidentiality of respondents was maintained throughout. Laboratory testing for HIV was conducted using standard testing and quality-control procedures. The particular value of a population-based survey like the EDHS is the provision of data on the distribution of HIV infection among the general adult population, remote rural populations, men, young non-pregnant women, and regions or provinces.

The survey obtained reasonably high participation rates. Individual questionnaires were completed for 89 percent of men and 95 percent of women. Blood specimens were collected for 75 percent of men and 83 percent of women. The nonresponse rate was higher among men and among urban, more educated, and richer respondents, which is typical of most household surveys in developing countries (Mishra et al., 2008).

The EDHS estimate of HIV prevalence was found to be much lower than the ANC surveillance estimate. Ethiopia is not unique in this regard. Nationally representative surveys with HIV testing in a number of other countries in sub-Saharan Africa have similarly found much lower levels of HIV prevalence than previously estimated levels, which were based on surveillance information (Montana et al. 2008). This has led to a significant downward adjustment of HIV prevalence rates in a number of countries, as the data from population-based surveys have become available.

Our analysis shows that when the comparison was made with women residing in the 15 kilometer catchment areas of the ANC sites, the EDHS estimates were similar to the estimate for women included in the ANC surveillance survey.

When the ANC surveillance estimate was compared with the EDHS estimate for women residing in the 15 kilometer catchment areas of the ANC surveillance sites, the gap between the two estimates narrowed considerably. In fact, EDHS women residing in the 15 kilometer catchment areas of ANC surveillance sites who received ANC for their last birth in the past three years had a higher HIV prevalence (6.5 percent) than those in the ANC surveillance survey (5.3 percent). This suggests that the two data sources compare rather well when the comparison is restricted to the catchment areas of the ANC surveillance sites.

The ANC surveillance estimate was higher for younger women (15-24) than the EDHS estimate for women in the ANC catchment areas, but lower at older ages. The total ANC prevalence estimate was much closer to the urban ANC estimate. Urban prevalence was much higher than rural prevalence within each set of estimates.

Our analysis to evaluate survey estimates for potential bias due to nonresponse indicated that non-tested men and women had significantly higher predicted HIV prevalence rates than those tested. However, this bias had only a small, insignificant effect on the observed national prevalence estimates for both men and women.

A major limitation is that our selection of EDHS clusters within a 15 kilometer radius around the ANC surveillance sites was based on the assumption that 15 kilometers is a reasonable maximum distance which women would travel for ANC care, yet it may not reflect a true catchment area for an ANC site. A previous analysis of ANC attendees at sentinel surveillance sites in Uganda showed that these distances correspond reasonably well with the actual administrative areas where clients were living (Musinguzi et al. 2007). Moreover, the distance women travel for ANC in a country may vary from one region to another and may be different for urban and rural areas. For a more meaningful comparison, the catchment areas should be defined by examining the ANC client records for each surveillance site.

Another source of bias may be due to displacement of GPS coordinates of EDHS clusters (five kilometers in rural areas and two kilometers in urban areas) to protect confidentiality of survey participants. However, because the displacement was random and the results from individual ANC catchment areas were aggregated up to the national level, any effect of such bias is expected to be small. The comparison between the ANC surveillance survey and the EDHS may also be affected by differences in HIV testing protocol and differences in the definitions of urban and rural areas.

In the analysis of nonresponse bias in the EDHS, one limitation is that the estimates are only adjusted to the extent that the socio-demographic and behavioral characteristics included in the analysis are correlated with the risk of HIV infection. Another limitation is that the adjustments for respondents "not interviewed, not tested" are based on limited information available from the household questionnaire. Moreover, our adjustments for nonresponse do not account for any bias due to exclusion of population members not living in households, such as those living on the street or in institutions (e.g., prisons, boarding schools, military barracks, refugee camps, and brothels).

In summary, the HIV prevalence estimate derived from the ANC surveillance survey appears to have overestimated HIV prevalence among women in the general population. The EDHS estimate compared well with the ANC surveillance estimate when the comparison was restricted to women residing within the catchment areas of the ANC surveillance sites. Patterns by age and urban/rural residence point to possible sources of bias in the ANC estimates. On the other hand, our analysis of nonresponse suggested bias in EDHS estimates due to significantly higher predicted HIV rates among the non-responders. However, this bias did not have any significant effects on the national estimates of HIV prevalence.

Overall, the EDHS provided high-quality, reliable, representative national prevalence estimates of HIV, and its associated characteristics and risk factors. These data are useful for: identifying geographic regions with elevated rates of HIV and higher-risk and vulnerable populations; providing a better understanding of risky and protective sexual behaviors; assessing availability and access to health services; and planning for prevention, care, and treatment programs. Data from the EDHS are also useful for calibrating prevalence estimates from surveillance systems and improving the accuracy of national estimates. However, to provide nationally representative trend data on HIV prevalence and associated risk factors, there is a need to carry out similar surveys at regular intervals.

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Appendix

Table A.1 HIV response rates by selected background characteristics and sex, Ethiopia 2005

Characteristic	Men		Women	
	Number eligible for HIV testing	HIV response rate	Number eligible for HIV testing	HIV response rate
Age				
15-19	1,457	74.1	1,718	82.2
20-24	1,185	74.9	1,329	81.2
25-29	953	74.0	1,311	84.0
30-34	841	75.6	853	84.8
35-39	725	75.0	821	82.6
40-44	551	75.1	602	85.7
45-49	463	78.6	508	84.7
50-54	365	78.6	na	na
55-59	238	79.4	na	na
Education				
No education	2,745	76.9	4,251	85.3
Primary	2,111	81.6	1,563	84.6
Secondary +	1,919	66.3	1,328	74.5
Wealth status				
Lowest	1,377	75.0	1,473	83.0
Second	1,016	84.2	1,070	87.9
Middle	957	85.8	1,006	92.2
Fourth	994	82.8	968	90.6
Highest	2,434	64.8	2,625	75.1
Residence				
Urban	1,948	59.5	2,239	72.9
Rural	4,830	81.7	4,903	87.9
Region				
Tigray	563	84.0	625	89.9
Affar	387	60.5	405	73.3
Amhara	959	84.9	937	87.8
Oromiya	1,126	85.1	1,101	87.8
Somali	336	57.7	362	71.3
Benishangul-Gumuz	403	82.1	436	88.1
SNNP	956	86.2	1,070	93.2
Gambela	398	73.6	413	82.3
Harari	423	66.4	469	73.6
Addis Ababa	834	62.1	912	73.9
Dire Dawa	393	47.6	412	70.9
Total	6,778	75.4	7,142	83.2

na = Not applicable

Table A.2 Nonresponse rates by selected background characteristics and sex, Ethiopia 2005

Characteristic	Men				Women			
	Non-response rate	Reasons for nonresponse			Non-response rate	Reasons for nonresponse		
		Refused	Absent	Other/ missing		Refused	Absent	Other/ missing
Age								
15-19	25.9	15.7	8.0	2.1	17.8	12.9	3.6	1.3
20-24	25.1	14.2	9.5	1.4	18.8	15.1	2.6	1.2
25-29	26.0	15.3	8.9	1.8	16.0	12.7	2.0	1.3
30-34	24.4	15.8	7.5	1.1	15.2	12.4	1.6	1.2
35-39	25.0	15.6	7.5	1.9	17.4	13.5	2.1	1.8
40-44	24.9	15.3	6.9	2.7	14.3	11.8	1.0	1.5
45-49	21.4	13.0	5.2	3.2	15.4	13.6	0.4	1.4
50-54	21.4	14.5	5.8	1.1	na	na	na	na
55-59	20.6	13.5	5.0	2.1	na	na	na	na
Education								
No education	23.1	12.7	7.6	2.8	14.7	11.4	1.5	1.8
Primary	18.4	11.6	6.1	0.8	15.4	11.6	3.0	0.7
Secondary +	33.7	22.2	9.7	1.8	25.5	21.1	3.8	0.7
Wealth status								
Lowest	25.1	14.5	9.2	1.5	17.0	13.4	2.2	1.4
Second	15.9	8.4	5.6	1.9	12.2	9.2	0.9	2.1
Middle	14.2	6.7	5.2	2.3	7.9	5.6	1.2	1.1
Fourth	17.2	10.4	5.4	1.4	9.4	6.9	1.2	1.2
Highest	35.3	23.3	9.8	2.1	24.9	20.1	3.6	1.2
Residence								
Urban	40.5	26.7	11.1	2.7	27.2	22.1	3.9	1.2
Rural	18.3	10.3	6.4	1.6	12.1	9.2	1.5	1.4
Region								
Tigray	16.0	7.5	6.6	2.0	10.1	7.0	1.8	1.3
Affar	39.5	22.5	16.3	0.8	26.7	24.2	1.7	0.7
Amhara	15.1	8.9	4.8	1.5	12.2	10.1	1.3	0.8
Oromiya	14.9	7.6	5.4	1.9	12.2	8.5	2.3	1.5
Somali	42.3	29.5	10.4	2.4	28.7	24.0	2.8	1.9
Benishangul-Gumuz	17.9	13.2	2.7	2.0	11.9	8.0	0.5	3.4
SNNP	13.8	6.7	5.9	1.3	6.8	4.9	0.9	1.0
Gambela	26.4	13.6	9.8	3.0	17.7	12.4	3.6	1.7
Harari	33.6	20.8	10.9	1.9	26.4	22.0	3.2	1.3
Addis Ababa	37.9	25.3	9.7	2.9	26.1	20.4	4.4	1.3
Dire Dawa	52.4	37.9	13.0	1.5	29.1	24.8	3.4	1.0
Total	24.7	15.0	7.8	1.9	16.8	13.3	2.3	1.3
Number	1,671	1,018	526	127	1,203	946	161	96

na = Not applicable

Table A.3 Nonresponse rates by selected risk behaviors, background characteristics and sex, Ethiopia 2005

Characteristic	Men			Women		
	Non-response rate[1]	Reasons for nonresponse		Non-response rate[1]	Reasons for nonresponse	
		Refused	Other/ missing		Refused	Other/ missing
Marital Union						
Never in union	17.4	17.3	0.1	15.2	14.9	0.3
In monogamous union	13.9	13.2	0.7	11.8	11.5	0.3
In polygynous union	13.1	13.1	0.0	9.2	7.9	1.3
Widowed/divorced/separated	19.1	18.7	0.4	15.3	15.1	0.3
Child birth in the past 5 years						
No	na	na	na	16.0	15.8	0.2
Yes	na	na	na	9.7	9.1	0.6
Occupation						
Not working	21.3	21.1	0.1	13.0	12.6	0.4
Professional/services	27.0	27.0	0.0	18.3	18.3	0.0
Agriculture	10.1	9.5	0.6	5.7	4.7	1.0
Manual	26.5	26.3	0.2	15.4	15.1	0.3
Regular exposure to media sources per week						
None	12.9	12.3	0.6	11.4	11.0	0.5
One source	15.5	15.2	0.3	14.8	14.6	0.2
Two sources	21.9	21.9	0.0	21.2	21.0	0.2
All three sources	32.1	31.7	0.3	19.8	19.8	0.0
Ethnicity						
Amhara	17.5	17.0	0.5	16.6	16.2	0.3
Guragie	17.5	17.2	0.3	8.9	8.7	0.3
Oromo	14.7	14.5	0.3	13.6	13.5	0.1
Tigraway	11.9	11.6	0.3	10.1	9.5	0.6
Affar/Sidamo/Somali/Welaita	21.6	21.4	0.2	13.8	13.7	0.2
Other	10.2	9.4	0.8	8.4	7.5	0.9
Religion						
Orthodox	14.6	14.2	0.4	12.5	12.2	0.3
Moslem	19.8	19.4	0.4	15.8	15.4	0.4
Protestant/Catholic/Other	10.1	9.4	0.7	9.2	8.7	0.5
Circumcision						
No	10.1	9.0	1.1	na	na	na
Yes	15.9	15.6	0.4	na	na	na
STI or STI symptom in the past 12 months						
No	15.5	15.1	0.4	13.0	12.7	0.4
Yes	15.6	14.1	1.6	9.6	9.6	0.0
Smokes cigarettes or uses tobacco						
No	15.0	14.6	0.4	12.9	12.6	0.3
Yes	18.2	17.5	0.7	14.3	12.1	2.2
Age at first sex						
Never had sex	15.5	15.4	0.1	14.8	14.5	0.3
<15	13.5	13.5	0.0	11.1	10.7	0.3
15-17	16.6	15.9	0.7	11.9	11.3	0.6
18-19	18.0	17.5	0.5	13.5	13.2	0.3
20+	14.1	13.5	0.6	16.9	16.6	0.3
Number of sex partners in lifetime						
Never had sex	15.5	15.4	0.1	14.8	14.5	0.3
Had 1 partner	15.1	14.6	0.5	12.6	12.2	0.4
Had 2 sex partners	14.4	14.2	0.2	11.5	11.0	0.5
Had 3+ sex partners	16.3	15.4	0.9	9.9	9.3	0.6
Number of sex partners in past 12 months						
No sex in past 12 months	16.5	16.4	0.1	15.5	15.2	0.3
Had 1 partner	14.8	14.2	0.7	11.1	10.7	0.4
Had 2+ sex partners	14.9	14.9	0.0	21.4	21.4	0.0
Higher risk sex in the past 12 months						
No sex in past 12 months	16.5	16.4	0.1	15.5	15.2	0.3
Sex with spouse/cohabiting	13.6	12.9	0.7	11.1	10.6	0.5
Sex with other	24.2	24.0	0.2	15.2	15.2	0.0
Condom use at last sex in past 12 months						
No sex in past 12 months	16.5	16.4	0.1	15.5	15.2	0.3
Had sex and used condom	29.8	29.8	0.0	19.2	19.2	0.0
Did not use condom	13.6	12.9	0.7	11.1	10.7	0.4
Number of times slept away						
0	15.4	15.0	0.4	na	na	na
1-2	13.8	13.6	0.2	na	na	na
3-4	20.1	19.5	0.5	na	na	na
5+	16.6	15.6	1.0	na	na	na

Continued…

Table A.3—*Continued*

Characteristic	Men			Women		
	Non-response rate[1]	Reasons for nonresponse		Non-response rate[1]	Reasons for nonresponse	
		Refused	Other/ missing		Refused	Other/ missing
Away from home						
Never	15.4	15.0	0.4	na	na	na
Less than 1 month	14.5	14.0	0.5	na	na	na
1+ month	19.0	18.6	0.5	na	na	na
Participates in 2+ major household decisions (women's empowerment)						
No	na	na	na	14.2	13.8	0.4
Yes	na	na	na	11.8	11.5	0.4
Number of years in current residence						
<3	17.2	17.2	0.0	17.4	17.4	0.0
3-9	19.4	19.2	0.2	15.1	14.8	0.3
10+	14.9	14.4	0.5	12.1	11.7	0.4
Knowledge of ABC prevention methods						
0	21.4	20.6	0.8	13.8	13.2	0.5
1	16.5	15.6	1.0	12.6	12.2	0.5
2	13.9	13.4	0.5	10.8	10.3	0.5
3	14.9	14.7	0.2	14.1	14.0	0.1
Attitude to PLWHA (scale)						
Lowest	13.4	12.6	0.8	12.9	12.5	0.4
Lower	12.5	11.7	0.8	8.8	8.5	0.4
Middle	15.0	14.7	0.2	12.7	12.0	0.7
Higher	19.0	18.9	0.1	16.5	16.4	0.1
Highest	21.1	20.7	0.4	19.9	19.9	0.0
Ability to negotiate safer sex						
0	16.8	15.9	0.8	13.5	12.7	0.8
1	14.5	14.2	0.3	11.2	10.9	0.4
2	15.8	15.4	0.4	14.5	14.3	0.2
Number of injections in the past 12 months: professionals						
0	15.9	15.5	0.4	14.0	13.7	0.4
1-3	12.7	12.1	0.6	9.7	9.2	0.5
4+	15.4	15.2	0.2	10.4	10.0	0.4
Alcohol use during sex						
No sex in past 12 months	16.5	16.4	0.1	15.5	15.2	0.3
Not use before last sex	14.9	14.4	0.5	11.4	10.9	0.4
Used (either/both)	14.1	12.5	1.6	8.7	8.2	0.4
Previously tested						
Never tested	14.6	14.2	0.4	12.6	12.2	0.4
Tested, not in past 12 months	22.9	22.9	0.0	18.1	18.1	0.0
Tested, in past 12 months	19.2	19.2	0.0	20.8	20.8	0.0
Total	15.5	15.1	0.4	13.0	12.6	0.4
Number	936	910	26	884	858	26

[1] Calculated only for those who interviewed. Data for these variables are not available for non-interviewed persons.
na = Not applicable

Table A.4 Predicted HIV prevalence among the non-respondents and adjusted HIV prevalence estimates for all eligible men, Ethiopia 2005

Characteristic	Observed HIV prevalence among tested	Predicted HIV prevalence among non-tested respondents						Adjusted prevalence among all eligible respondents
		Interview status		Reason not tested			Total non-tested	
		Inter-viewed	Not inter-viewed	Refused	Absent	Other/ missing		
Age								
15-19	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20-24	0.4	0.5	0.4	0.5	0.4	0.2	0.5	0.4
25-29	0.7	1.1	1.0	1.2	0.9	1.2	1.1	0.8
30-34	1.9	2.2	5.5	2.8	5.6	1.5	3.6*	2.2
35-39	1.8	5.9	2.8	6.1	2.9	1.6	4.5*	2.2
40-44	2.8	3.6	3.2	3.7	2.9	4.1	3.5	2.9
45-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-54	0.9	1.1	1.4	1.1	1.4	1.2	1.2	0.9
55-59	0.3	0.4	0.7	0.4	0.8	0.1	0.5	0.4
Education								
No education	0.8	0.4	0.5	0.4	0.6	0.6	0.5	0.7
Primary	0.5	0.8	0.4	0.7	0.5	0.3	0.6	0.5
Secondary +	2.0	3.2	3.2	3.2	3.3	2.5	3.2*	2.3
Wealth status								
Lowest	0.6	0.2	0.4	0.2	0.4	0.3	0.3	0.6
Second	0.3	0.1	0.2	0.2	0.2	0.3	0.2	0.3
Middle	0.9	0.7	0.6	0.4	0.8	0.7	0.6	0.8
Fourth	0.4	0.5	0.2	0.4	0.3	0.1	0.4	0.4
Highest	2.2	3.0	2.8	3.0	3.1	2.0	2.9	2.4
Residence								
Urban	2.6	3.2	3.1	3.2	3.5	1.9	3.2	2.8
Rural	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Region								
Tigray	2.0	1.9	2.8	1.8	3.3	1.1	2.4	2.1
Affar	2.2	0.8	0.4	0.8	0.4	0.9	0.7	1.7
Amhara	1.4	1.9	1.4	1.9	1.6	0.9	1.7	1.5
Oromiya	0.4	0.3	0.4	0.3	0.4	0.2	0.4	0.4
Somali	-	0.1	0.7	0.2	0.9	0.7	0.4*	0.1*
Benishangul-Gumuz	-	1.2	1.2	1.2	1.4	0.7	1.2*	0.2*
SNNP	0.4	0.3	0.3	0.3	0.3	0.5	0.3	0.4
Gambela	6.3	3.9	2.1	4.3	1.9	1.2	3.0*	5.5
Harari	2.1	2.8	2.5	2.6	2.8	2.8	2.7	2.2
Addis Ababa	3.3	5.3	4.8	5.2	5.2	4.3	5.1*	3.9
Dire Dawa	1.7	2.0	2.0	2.0	2.0	1.8	2.0	1.8
Total	0.9	1.4	1.2	1.4	1.3	0.9	1.3*	1.0
Number	5,107	936	735	1,018	526	127	1,671	6,778

Note: An asterisk indicates significance at p value ≤ 0.05.

Table A.5 Predicted HIV prevalence among the non-respondents and adjusted HIV prevalence estimates for all eligible women, Ethiopia 2005

Characteristic	Observed HIV prevalence among tested	Predicted HIV prevalence among non-tested respondents						Adjusted prevalence among all eligible respondents
		Interview status		Reason not tested			Total non-tested	
		Inter-viewed	Not inter-viewed	Refused	Absent	Other/ missing		
Age								
15-19	0.7	0.9	1.1	0.9	1.3	0.7	1.0	0.7
20-24	1.7	3.1	2.2	3.0	3.2	0.5	2.9*	1.9
25-29	2.1	3.3	6.0	3.6	7.6	1.8	4.1*	2.3
30-34	1.5	2.8	3.9	3.0	6.7	0.2	3.1*	1.6
35-39	4.4	10.2	8.3	10.4	8.8	6.3	9.7*	5.2
40-44	3.1	3.1	1.8	3.4	1.7	0.9	2.8	3.0
45-49	0.8	3.3	2.3	3.3	4.2	2.1	3.1*	1.1
Education								
No education	1.0	1.9	1.7	1.8	2.2	1.4	1.8*	1.1
Primary	2.5	4.4	4.1	4.6	3.7	2.5	4.3*	2.6
Secondary +	5.5	7.0	7.0	7.0	7.5	5.3	7.0	5.8
Wealth status								
Lowest	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Second	1.0	1.4	0.7	1.3	0.4	1.1	1.2	1.0
Middle	0.4	0.4	0.5	0.3	0.6	0.7	0.4	0.4
Fourth	0.2	0.3	0.3	0.3	0.4	0.2	0.3	0.2
Highest	6.1	7.5	7.5	7.6	8.0	5.0	7.5*	6.4
Residence								
Urban	7.7	8.0	8.0	8.0	8.5	6.3	8.0	7.8
Rural	0.7	1.0	0.7	0.9	0.7	0.8	0.9	0.7
Region								
Tigray	2.6	5.5	1.8	5.8	2.1	1.4	4.6	2.8
Affar	3.3	7.1	0.7	6.5	0.1	6.1	6.1	3.9
Amhara	1.8	3.0	4.1	3.0	5.8	1.3	3.2	2.0
Oromiya	2.2	3.8	3.1	3.8	4.4	1.3	3.6	2.4
Somali	1.3	1.4	4.2	1.9	3.2	4.5	2.2	1.6
Benishangul-Gumuz	0.9	4.1	0.6	4.4	2.0	0.6	2.7	1.1
SNNP	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1
Gambela	5.6	8.3	3.3	7.5	3.7	0.6	6.1	5.6
Harari	4.6	4.2	6.1	4.5	5.6	6.0	4.7	4.6
Addis Ababa	6.1	6.5	5.9	6.4	5.8	6.4	6.3	6.1
Dire Dawa	4.4	4.3	7.1	4.6	5.4	10.2	4.9	4.5
Total	1.9	3.5	3.2	3.5	4.1	1.6	3.4*	2.1
Number	5,939	884	319	946	161	96	1,203	7,142

Note: An asterisk indicates significance at p value ≤ 0.05.