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ABSTRACT

This study explored the factors associated with changes in uptake of HIV testing in Tanzania, based on an analysis of data from the 2003–04 Tanzania HIV/AIDS Indicator Survey (THIS) and the 2007–08 and 2011–12 Tanzania HIV/AIDS and Malaria Indicator Surveys (THMIS). The study population consisted of young women age 15–24 at the time of the survey. Multivariate decomposition analysis was used to assess factors associated with the changes in HIV testing uptake between the 2003-04 and 2007-08 surveys and between the 2007-08 and 2011-12 surveys.

HIV testing uptake among the study population was 7%, in 2003-04, 31% in 2007-08 and 40% in 2011-12. The time period of the survey had an important effect on uptake of HIV testing independent of other covariates. Women's characteristics that were significantly associated with higher odds of HIV testing across the surveys were age (20–24), education level (primary and secondary), ever being married, having at least one lifetime sexual partner, having a sexually transmitted infection (STI) or STI symptoms and attending antenatal care (ANC).

According to the decomposition models used in the study, changes in women's characteristics (endowments) in the 2003–04 surveys compared with the 2007–08 survey would have resulted in a decrease in HIV testing uptake in the absence of the changes in effects of these characteristics, which contributed most of the changes in HIV testing uptake. Comparing 2007–08 with 2011–12, the changes in endowments contributed to 21% of the changes in HIV testing uptake, while 78% of the changes were attributed to coefficients.

Keywords: HIV testing, uptake

INTRODUCTION

Approximately 35.3 million people were estimated to be HIV infected in 2012 (UNAIDS 2013). In recent years increased coverage of anti-retroviral therapy (ART) has led to a decline in morbidity and mortality related to HIV and its associated opportunistic infections (Ivers et al. 2005; Ferradini et al. 2006; Barth et al. 2008). Studies have showed a global decline in HIV epidemics among general populations (Beyrer & Abdool Karim 2013). Despite these successes, variation in HIV testing uptake exists across regions (Staveteig et al. 2013). In 2010, for example, in Burundi, Tanzania and Rwanda uptake of HIV testing among men and women was 37%, 55% and 75% respectively (Staveteig et al. 2013), suggesting that where a person lives may influence their likelihood of being tested for HIV.

HIV counselling and testing (HTC) is an integral component of HIV preventive strategies. Studies using mathematical models have revealed that about 50% of new HIV infections are from HIV-infected persons who are unaware of their HIV status, making it more difficult to prevent the spread of the infection (Hall et al. 2012). While early diagnosis and treatment are associated with good treatment outcomes (Gianella et al. 2011), delayed diagnosis and treatment increase the disease burden and represent missed opportunities for prevention (Siegfried et al. 2010; Miro et al. 2011).

Knowing one's HIV status may influence change in personal behaviour, a critical part of efforts to prevent HIV (WHO 2005; Cock et al. 2010). Individuals tested positive for HIV are likely to be linked to HIV care and treatment. Among the benefits of linking patients in HTC are reducing mother-to-child transmission, preventing uninfected partners from becoming infected, improving the quality of life, reducing morbidity and mortality related to opportunistic infections and reducing the frequency of hospitalizations (Mabuto et al. 2014). High cost associated with the management of HIV-infected patients underscores the importance of preventive efforts in addressing HIV (Ng'ang'a et al. 2014).

The concept of test and treat has been studied, and results have shown that receiving HIV treatment was associated with a 96% reduction in new infections among sero-discordant couples. These findings highlight the need to increase HIV testing uptake and treatment (Cohen et al. 2011). Furthermore, one of the prevailing concepts of HIV prevention effort is increasing the number of

patients being tested and treated. Increasing those receiving ART in the population reduces community viral load (CVL). The idea behind reducing CVL is that as the number of individuals being tested and receive ART increases, greater numbers of HIV-infected persons will be virologically suppressed, leading to reduced CVL, and consequently reduced incidence of HIV infection in the general population (Das et al. 2010).

Tanzania is one of the sub-Saharan countries heavily affected by the HIV epidemic. According to the 2007–08 HIV/AIDS and Malaria Indicator survey (TACAIDS 2008), the prevalence of HIV declined from 7% in 2004 to 6% in 2008. Decreases were greatest among men in the urban areas but the overall change was not statistically significant (TACAIDS 2008). More recently, the 2011–12 survey (TACAIDS 2013) indicated an overall decline in national HIV prevalence from 6% in 2007–08 5%, though this decline was also not statistically significant (TACAIDS 2013). Despite these declines in HIV prevalence, in 2012 only 62% of women and 47% of men age 15–49 had ever tested for HIV and received their results, leaving a large proportion of people unaware of their HIV status (TACAIDS 2014). Higher levels of HIV testing uptake are needed in a test and treat model if reduction in HIV incidence is to be realized (Granich et al. 2009; Dodd et al. 2010; Alsallaq et al. 2013)

The principal focus of this paper is among young women at high risk of HIV acquisition in Tanzania. While previous surveys indicated a consistent decline in HIV prevalence among boys age 15–24, the decline is notable among girls age 15-19 but not among women aged 20-24 (TACAIDS 2014). Among other factors, difference in HIV prevalence in this subgroup of population could be attributed by early age at sexual debut and early marriages among young women compared with young men. Early age at sexual debut was also noted to be associated with increased risk of HIV infection among young women in Kenya (Gitonga et al. 2012). It is particularly critical for young women at the debut of their sexual and reproductive lives to have access to information about their HIV status through routine HIV testing.

The Tanzanian Government in collaboration with international donors have significantly expanded and decentralized centers for HIV testing care and treatment. Between 2004 and 2007 Tanzania made changes in national HIV/AIDS policy to increase availability and access to care and treatment services, meanwhile building capacity of health care workers (TACAIDS 2008). In 2004, the government started to provide care and treatment services such as free anti-retroviral

drugs. In 2007, the government rolled out the care and treatment services closer to the community (health centres and dispensaries). During the same year, a new approach, Provider Initiated Testing and Counseling (PITC), was adopted to complement the voluntary counselling and testing approach to allow more people who come into contact with health care providers to be offered HIV testing to determine their HIV serostatus. In addition, the national HIV counselling and testing campaign was launched in 2007 by the President of Tanzania as an effort to mobilize more people to undergo HIV testing to determine their HIV serostatus and to establish linkages between prevention, care, treatment and social support. Furthermore, in 2008 Tanzania established a law against stigma and discrimination for people living with HIV/AIDS (PLWHA) to intensify community actions (TACAIDS 2008).

Despite of these extensive efforts, uptake of HIV testing among young women is relatively low. Understanding factors associated with HIV testing uptake in this population is critical. In the present study, we first explored the trend in HIV testing uptake among young women age 15–24 between 2003–04 and 2011–12. Secondly, we evaluated individual and contextual factors associated with the changes in HIV testing uptake comparing the 2003–04 THIS, the 2007–08 THMIS and the 2011–12 THMIS.

METHODS

Study Design and Population

In Tanzania, the Demographic Health Surveys (DHS), HIV/AIDS Indicator Surveys (THIS) and HIV/AIDS and Malaria Indicator Surveys (THMIS) have collected nationally representative data at regular intervals through cross-sectional surveys. Three such surveys including HIV serostatus testing have been conducted: 2003–04, 2007–08 and 2011–12. We used data from the THIS and THMIS to evaluate trends in uptake of HIV testing and factors associated with the changes in HIV testing uptake among young women age 15-24 from Tanzanian Mainland. Secondary data analyses were performed using the 2003–04 THIS as well as the 2007–08 and 2011–12 THMIS.

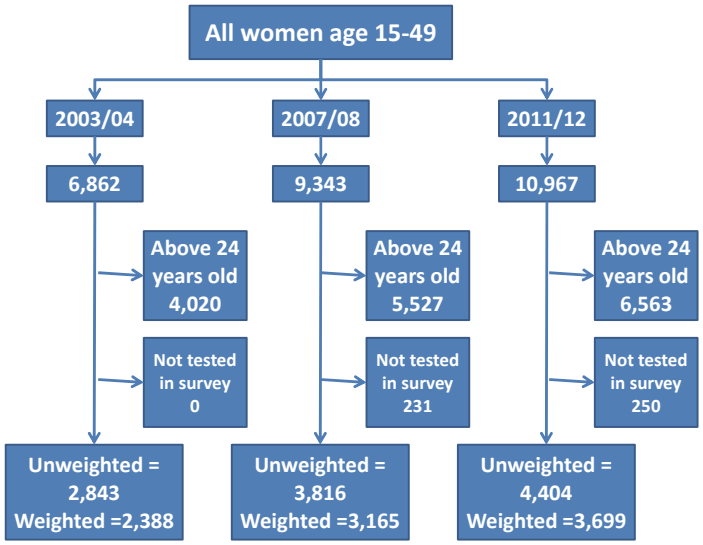
Selection of the Study Participants and Data Sources

The study population was restricted to young women (age 15–24), as this group is considered as one of the potentially high-risk populations for HIV infection. The final weighted total sample size was 9,252, from the three successive surveys (Figure 1).

Data collection

Prior to each survey, and in consultation with stakeholders and donors, a Technical Working Group in Tanzania adapted standardized questionnaires from DHS and AIS surveys for the health needs of Tanzania. These questionnaires were then translated into Kiswahili. During the surveys, after obtaining informed consent, standardized questionnaires were administered to participating individuals. Among other things, questionnaires captured information on socio-demographic characteristics (age, gender, marital status, education, residence, religion, employment, asset ownership); biological (ever had a sexually transmitted infection (STI) in the last 12 months, received HIV test results) and antenatal care (ANC) for recent births.

Figure 1. Selection of study subjects



>24: women older than age 24

Variables and Definitions

The outcome variable is the proportion of young women who reported that they were tested for HIV and received test results within two years preceding the surveys.

Independent variables

The independent variables explored in this study are summarized in Table 1. These include the following:

Socio-demographic variables: Respondent's age (15–19, 20–24), place of residence (rural, urban), administrative zone (Central, Lake, Northern, Eastern, Western, South West Highlands Southern Highlands, and Southern), employment status (employed, not employed), number of lifetime sexual partners (0, 1, 2, >2). Those with missing values on number of lifetime sexual partners were assumed to be >2).

Zones were used rather than administrative regions in order to have consistency across the surveys. Between 2003 and 2012, some of the regions were split to form new districts and regions, and thus the 2011–12 survey has more administrative regions than the 2003–-04 survey. All the regions, however, (new and old) belong to the same zones and the geographical coverage of the zones has remained consistent throughout the surveys. Composition of the administrative regions

in their respective zones is follows; Eastern (Morogoro, Coastal, Dar es Salaam), Northern (Kilimanjaro, Tanga, Arusha), Lake (Mwanza, Geita, Mara, Simiyu, Shinyanga), Central (Dodoma, Manyara, Singida), Western (Kigoma, Tabora), South-west highlands (Katavi, Rukwa, Mbeya), Southern highland (Iringa, Njombe, Ruvuma) and Southern (Lindi, Mtwara).

Biological variables

Reported having an STI or symptoms of STI in the last 12 months, or not. Birth and antenatal clinic visit in the past two years preceding the surveys. Women who had a birth in the two years prior to the survey were asked whether they received any ANC (any number of visits) from any provider for their most recent birth. Respondents were grouped accordingly; those who did not give birth in the past two years, those who gave birth and received any ANC, those who gave birth but did not attend any ANC.

Statistical Analysis

Statistical analyses were conducted using STATA version 12. To evaluate the trend in uptake of HIV testing across three consecutive surveys, we performed descriptive analyses of HIV testing stratified by selected variables. Analyses were done separately for the periods 2003–2007, 2007–2011 and 2003–2011. Pooled logistic regression models were run for each of the two sub-periods (2003-04 to 2007-08 and 2007-8 to 2010-11) to determine whether year of survey was associated with testing uptake independently from other factors. The change in HIV testing uptake between the three cross-sectional surveys can be attributed to the change in the distribution of selected characteristics (compositional changes or endowments) as well as the change in the effects of the selected characteristics (effects changes or differences in coefficients).

Multivariate decomposition models, which are used for portioning changes over time into components attributable to changing effects and changing composition or characteristics, were used to determine factors associated with changes in HIV testing uptake across the survey periods The difference observed in HIV testing uptake was decomposed into components attributable to differences in characteristics between surveys (i.e. compositional differences or endowments) and group differences in effects of characteristics (i.e. differences in coefficients or behavioural responses). For example, changes in HIV testing can be due to differences in distribution of employment status as well as due to the effects of employment between surveys.

All analyses performed in this study were weighted for probability sampling and non-response, as is standard in all surveys that are part of the DHS Program. Because we restricted our outcome to respondents who had HIV serostatus results, we used HIV weight. All associations were deemed statistically significant at cut off p-value of less than 0.05. Complex sampling (multi-stage sampling and stratification) and 95% confidence intervals were considered and SVY set (STATA survey prefix) command was for survey data.

Ethical Consideration

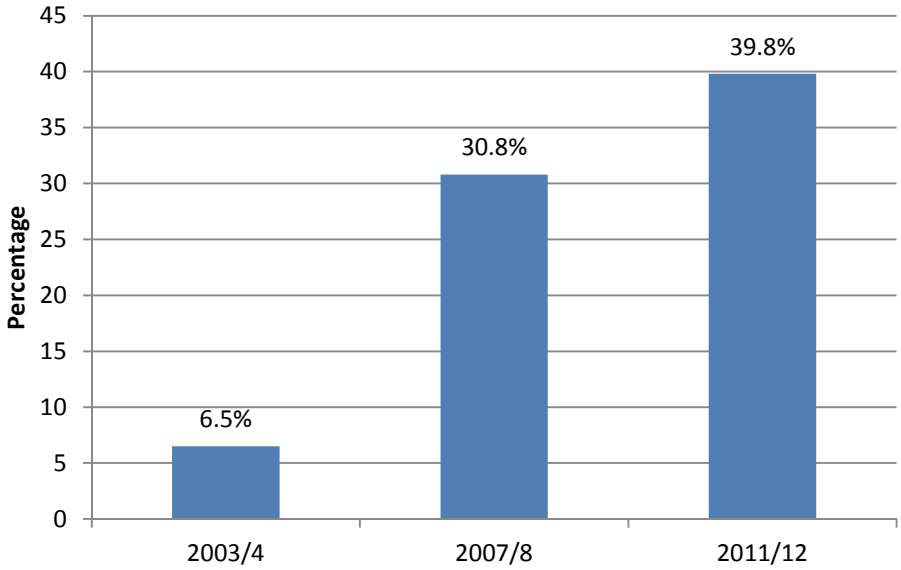
The THIS and THMIS surveys received approval by the Tanzania National Institute of Medical Research (NIMR), the Institutional Review Board (IRB) of ICF International, and the U.S. Centers for Disease Control and Prevention (CDC). All adult respondents gave informed consent. As part of the DHS fellowship, the authors submitted a proposal to the DHS Program/ICF International and received permission to download and use the data for this study. The DHS Program authorized data access; and the data was used solely for the purpose of the current study.

RESULTS

Trends in Uptake of HIV Testing

Figure 2 depicts trends in the uptake for HIV testing and receiving results in the two years preceding the survey, for three consecutive surveys among the study population. HIV testing uptake increased remarkably, from 7% in 2003-04 to 31% in 2007-08 and 40% in 2011–12.

Figure 2. Percentage of women age 15-24 who tested for HIV and received results over the 3 successive surveys



Characteristics of the Study Participants

Table 1 shows the socio-demographic characteristics of the study participants. In all three surveys, women age 15–19 outnumbered those age 20-24, and over 65% were living in rural areas. Most women had a primary level of education (71% in 2003-04, 70% in 2007–08 and 60% in 2011–12). Concerning their lifetime number of sexual partners, 31% of women reported no sexual partners, 34% reported one lifetime sexual partner, and 9% reported two lifetime sexual partners. The 2003–04 survey seemed to have a higher proportion of women reporting more than two lifetime sexual partners (18%) compared with the 2007–08 and 2011–12 surveys both at 14%.

Most women were employed (63% in 2003–04, 607% in 2007–08 and 64% in 2011–12). The percentage of women who were HIV-positive declined from 4% in 2003–04 to 3% in 2011–12. Across the three surveys, most of the women had not had a birth in the two years preceding the survey—at 66%, 68% and 68% for the 2003–04, 2007–08 and 2011–12 surveys respectively. About one-third of the women, 31%, reported giving birth and attending ANC in the two years preceding the survey, across the three surveys.

Table 1. Percentage distribution of socio-demographic characteristics of the respondents for Tanzania HIV/AIDS and Malaria Indicator Surveys (2003, 2007, and 2011)

Characteristics	2003 (n=2,388)	2007 (n=3,165)	2011 (n=3,699)
Age (year)			
15-19	51.7	53.1	55.9
20-24	48.3	46.9	44.1
Residence			
Urban	34.2	26.1	26.6
Rural	65.8	73.9	73.4
Region			
Central Zone	10.8	8.0	9.0
Lake zone	25.4	28.9	28.9
Northern Zone	13.0	13.0	11.8
Eastern Zone	24.4	15.5	16.0
Western Zone	8.1	11.6	9.6
South West Highlands Zone	9.3	9.6	10.2
Southern Highlands Zone	7.8	7.5	9.7
Southern Zone	5.2	5.8	4.8
Educational level			
No education	17.2	17.9	13.3
Primary	71.3	70.4	59.5
Secondary and above	11.6	11.6	27.1
Marital status			
Never married	51.2	51.2	55.2
Ever Married	48.8	48.9	44.8
Number of life sex partners			
0	29.8	31.0	31.7
1	33.9	34.0	36.0
2	18.1	20.0	18.1
3+	18.1	14.9	14.2
Blood test result			
HIV negative	96.0	96.2	97.2
HIV positive	4.0	3.8	2.8
Currently working			
Not working	37.0	40.3	36.2
Working	63.0	59.7	63.8
Had STI in last 12 months?			
No	98.6	98.4	98.2
Yes	1.4	1.6	1.8
Birth and attended ANC			
No birth <2 years preceding the survey	66.4	68.2	68.1
Had birth within 2 years and attended ANC	30.6	31.3	30.9
Had birth within 2 years but not attended ANC	3.0	0.6	0.9

Changes in HIV Testing in Relation to Women's Characteristics

Table 2 summarizes changes in uptake of HIV testing in relation to participant's characteristics. In order to assess the change, analysis of HIV testing was divided in two phases—between the 2003–04 and 2007–08 surveys, and between the 2007–08 and 2011–12 surveys. Overall, HIV testing uptake increased by 24 percentage points between 2003–04 and 2007–08, and 9 percentage points between 2007–08 and 2011–12, reflecting a more rapid rate of change in the former phase than in the latter. HIV testing uptake increased both among women age 15–19 and 20–24; however, the change was greater among women age 20–24. Among women residing in urban areas, uptake of HIV testing increased by 27 percentage points between the 2003–04 and 2007-08 surveys, nearly six times the change from 2007–08 to 2011-12, at 5 percentage points.

Within the surveys, the change in HIV testing uptake was greater among married women compared with unmarried women, and also greater among HIV-positive women compared with HIV–negative women. Compared with women with no birth in the two years preceding the survey, the change in HIV testing was greater among those who had a birth and attended ANC (46 percentage points versus 14 percentage points in phase 1, and 20 percentage points versus 4 percentage points in phase 2. The change in HIV testing uptake in phase 1 was much greater among women with more than two lifetime sexual partners, at 38 percentage points, than among women with no sexual partners, at 5 percentage points, while in phase 2 the difference was smaller (see Table 2).

Table 2. Trends in HIV testing among women age 15-24: The percentage who have been tested for HIV and received the results in the two years preceding the survey, by socio-demographic characteristics for TMHIS 2003, 2007 and 2011

				Percentage point difference in HIV testing		
Characteristics	**2003/04 (n=2,388)**	**2007/08 (n=3,165)**	**2011/12 (n=3,699)**	**Phase 1 2007-2003**	**Phase 2 2011-2007**	**2011-2003**
Age(year)						
15-19	5.8	21.3	27.1	15.5	5.8	21.3
20-24	7.3	41.5	55.9	34.2	14.4	48.6
Residence						
Urban	13.0	39.9	44.6	26.9	4.7	31.6
Rural	3.2	27.5	38.1	24.3	10.6	34.9
Zones						
Central Zone	5.2	25.8	37.9	23.7	6.1	29.8
Lake zone	5.3	23.9	36.5	26.8	7.3	34.1
Northern Zone	8.3	33.1	37.7	28.4	8.7	37.1
Eastern Zone	11.9	39.1	42.9	21.4	15.6	37.0
Western Zone	5.8	40.5	45.0	25.4	11.2	36.6
South West Highlands Zone	3.9	18.9	32.1	15.0	13.2	28.2
Southern Highlands Zone	3.1	41.7	48.4	38.6	6.7	45.3
Southern Zone	1.6	30.0	47.4	28.4	17.4	45.8
Educational level						
No education	2.5	25.2	33.5	22.7	8.3	31.0
Primary	5.9	30.5	40.1	24.6	9.6	34.2
Secondary and above	16.3	40.7	42.5	24.4	1.8	26.2
Marital status						
Never married	6.8	20.2	27.9	13.4	7.7	21.1
Ever Married	6.3	41.8	54.5	35.5	12.7	48.2
Number sex partners in lifetime						
0	4.5	9.6	13.7	5.1	4.1	9.2
1	7.9	38.5	48.3	30.6	9.8	40.4
2	7.5	40.7	57.4	33.2	16.7	49.9
3+	6.4	43.9	54.4	37.5	10.5	48.0
Blood test result						
HIV negative	6.6	30.5	39.3	23.9	8.8	32.7
HIV positive	6.5	36.3	57.0	29.8	20.7	50.5
Currently working						
Not working	8.7	25.1	34.0	16.4	8.9	25.3
Working	5.3	34.6	42.9	29.3	8.3	37.6
Had STI in last 12 months?						
No	6.4	30.5	39.4	24.1	8.9	33.0
Yes	17.2	49.2	62.2	32.0	13.0	45.0
Birth and attended ANC						
No birth <2 years preceding the survey	8.3	22.6	26.5	14.3	3.9	18.2
Had birth within 2 years and attended ANC	2.8	48.6	69.0	45.8	20.4	66.2
Had birth within 2 years but not attended ANC	6.9	25.3	44.9	18.4	19.6	38.0
Overall Total	**6.6**	**30.8**	**39.8**	**24.2**	**9.0**	**33.2**

Factors Associated with Uptake of HIV Testing across the Surveys

Table 3 shows the results from the pooled logistic regression models for the factors associated with HIV testing uptake across the two survey phases. Of the factors examined, factors that were found to be associated with women's likelihood to test for HIV and receive results included having an education (primary or secondary), ever being married, having had at least one lifetime sexual partner and ANC attendance within the two years preceding the survey. Having had an STI was also associated with HIV testing uptake, but the association was not statistically significant. The coefficient on survey year (using earlier survey as a reference) was positive and statistically significant in both surveys. This indicates that, above and beyond the standard demographic characteristics predicting HIV testing, women in more recent surveys were more likely to have been tested. This difference may relate to changes in the policy environment, for example programs encouraging testing, and to greater accessibility of testing sites.

Table 3. Pooled multivariate logistic regression for factors associated with HIV testing uptake among women age 15-24 across 2 surveys

	Phase 1	Phase 2
	2003/04-2007/08	2007/08-2011/12
	HIV testing uptake	
Surveys	**OR (95% CI)**	**OR (95% CI)**
Characteristics		
Survey year	8.71 (6.80 - 11.15)	1.34 (1.11 - 1.61)
Age (year)		
15-19	1.0	1.0
20-24	1.02 (0.80 - 1.30)	1.27 (1.07 - 1.50)**
Residence		
Urban	1.0	1.0
Rural	0.46(0.36 - 0.58)***	0.53(0.44 - 0.63)***
Region		
South West Highlands Zone	1.0	1.0
Central Zone	1.35 (0.83 - 2.19)	1.50 (1.06 - 2.14)**
Lake zone	1.34 (0.89 - 2.02)	1.15 (0.87 - 1.53)
Northern Zone	2.13 (1.42 - 3.19)***	1.94 (1.34 - 2.83)**
Eastern Zone	1.89 (1.25 - 2.85)**	1.74 (1.27 - 2.39)**
Western Zone	3.15 (2.06 - 4.83)***	2.65 (1.85 - 3.80)***
Southern Highlands Zone	2.08 (1.34 - 3.23)**	2.19 (1.59 - 3.02)***
Southern Zone	1.44 (0.84 - 2.46)	1.72 (1.07 - 2.77)**
Educational level		
No education	1.0	1.0
Primary	1.90(1.46 - 2.46)***	1.99(1.57 - 2.52)***
Secondary and above	5.46(3.76 - 7.94)***	4.81(3.48 - 6.63)***
Marital status		
Never married	1.0	1.0
Ever married	1.49(1.15 - 1.92)**	1.36(1.13 - 1.64)***
Number sex partners in lifetime		
0	1.0	1.0
One	4.44(3.21 - 6.15)***	3.88(3.09 - 4.88)***
Two	4.74(3.30 - 6.82)***	4.59(3.52 - 5.99)***
More than two	4.62(3.12 - 6.84)***	4.77(3.55 - 6.40)***
Blood test result		
HIV negative	1.0	1.0
HIV positive	0.86 (0.55 - 1.35)	1.14 (0.74 - 1.75)
Currently working		
Not working	1.0	1.0
Working	0.99 (0.79 - 1.26)	1.09 (0.91 - 1.32)
Had STI in last 12 months?		
No	1.0	1.0
Yes	1.62 (0.97 - 2.77)	1.54 (0.97 - 2.44)
Birth and attended ANC		
No birth <2 years preceding the survey	1.0	1.0
Had birth within 2 years and attended ANC	1.47(1.18 - 1.83)**	3.10(2.60 - 3.69)***
Had birth within 2 years but not attended ANC	1.22(0.48 - 3.10)	1.51(0.83 - 2.75)

* = significant at 0.05; ** = significant at 0.01; *** = Significant at <0.001

The results from multivariate decomposition regression models are shown in Tables 4a & 4b. According to the model, in 2003–04 compared with 2007–08, changes in population characteristics (endowments) would have resulted in a decline in overall HIV testing in the absence of any changes of the effects of these characteristics on the likelihood of being tested. Compositional changes such as increased proportion of women residing in rural areas would have contributed to decreased odds in HIV testing uptake among women in the absence of the effects of other characteristics. Our findings also revealed that a change in uptake of HIV testing in 2003–04 compared with 2007–08 was attributed to the changes in the effects of characteristics on testing factors (coefficients).

Comparing the 2007–08 and 2011–12 surveys, the changes in endowments contributed to 22% of the changes in HIV testing uptake, whereas 78% of the changes in HIV testing uptake was attributed to differences in the effects of those characteristics (coefficients). Both endowments and coefficients were statistically significant in both multivariate decomposition models. Increased education level of women (having any level of education versus having none) made it much more likely that women would be test for HIV. The increase in the proportion of women with any education should have made it more likely for women to be tested, regardless of any changes in effects.

In terms of coefficients, the factors that appear to have a statistically significant association with uptake of HIV testing are attending ANC (44%), being age 20–24 (35%), having primary education (14%) and residing in a rural area (36%).

Table 4a. Decomposition changes in HIV testing among women age 15-24 in TMHIS 2003 to 2007

		Due to Difference in Characteristics (E)		Due to Difference in Coefficients (C)	
HIV testing		**Coefficient**	**Percent**	**Coefficient**	**Percent**
Age group	15-19	1.0		1.0	
	20-24	-0.00007	-0.0288	0.0067	2.7657
Residence	Urban	1.0		1.0	
	Rural	-0.0089***	-3.666	0.0461**	19.052
Zone	South West Highlands Zone	1.0		1.0	
	Central Zone	-0.0024*	-0.9758	0.0002	0.842
	Lake zone	0.0013	0.5495	-0.0014	-0.5948
	Northern Zone	-0.0057***	-0.0035	0.0015	0.6041
	Eastern Zone	-0.0064**	-2.6346	0.0033	2.1948
	Western Zone	0.0079***	3.2746	0.0049	2.009
	Southern Highlands Zone	-0.0005***	-0.2239	0.0084	3.4742
	Southern Zone	-0.0005	0.2094	0.0092	3.8014
Educational level	No education	1.0		1.0	
	Primary	-0.001***	-0.4253	-0.0137	-5.6564
	Secondary & above	0.0003***	0.1225	0.0003	-0.1093
Marital status	Never married	1.0		1.0	
	Ever married	0.0001**	0.0197	-0.0042	-1.722
Number sex partners in lifetime	0	1.0		1.0	
	One	0.0001***	0.0481	0.0156	6.4606
	Two	0.0052 ***	2.1621	0.0121	5.0033
	More than two	-0.0091 ***	-3.7754	0.0170	7.0277
Blood test result	HIV negative	1.0		1.0	
	HIV positive	0.0004	0.0145	0.0012	0.4751
Currently working					
	Not working	1.0		1.0	
	Working	-0.0006	-0.2258	0.0092	3.8152
Had STI or symptoms of STI	No	1.0		1.0	
	Yes	0.0001	0.0205	-0.0022	-0.893
Birth & ANC	No birth	1.0		1.0	
	ANC & birth	0.0009***	0.3740	0.0793***	32.766
	Birth but no ANC	-0.0002	-0.0955	0.0001	0.0449
Constant				0.0597***	24.654
Total			-5.256**		105.26***

* Significant at 0.05; ** Significant at 0.01; *** Significant at <0.001

Table 4b. Decomposition changes in HIV testing among women age 15-24 in TMHIS 2007 to 2011

		Due to Difference in Characteristics (E)		Due to Difference in Coefficients (C)	
HIV testing		**Coefficient**	**Percent**	**Coefficient**	**Percent**
Age group	15-19	1.0		1.0	
	20-24	-0.0019***	-2.0725	0.0320**	35.29
Residence	Urban	1.0		1.0	
	Rural	0.0004**	0.4002	0.0330	36.382
Region	South West Highlands Zone	1.0		1.0	
	Central Zone	0.0005	0.5898	-0.0030	-3.3221
	Lake zone	-0.00001	-0.0116	-0.0072	-7.9518
	Northern Zone	-0.0011**	-1.2432	-0.0074	-8.1773
	Eastern Zone	0.0003	0.32511	-0.0119	-13.055
	Western Zone	-0.003**	-2.5389	-0.0144**	-15.903
	Southern Highlands Zone	0.0024**	2.6182	-0.005	-5.5294
	Southern Zone	-0.0012**	-1.3627	0.0029	3.2135
Educational level	No education	1.0		1.0	
	Primary	-0.0143***	-15.803	0.0124	13.628
	Secondary & above	0.0423***	46.653	-0.0022	-2.4257
Marital status	Never-married	1.0		1.0	
	Ever-married	-0.0022**	-2.4582	-0.0032	-3.5296
Number of sex partners in lifetime	0	1.0		1.0	
	One	0.0039***	4.3212	-0.0248	-27.32
	Two	-0.0043***	-4.752	-0.0123	-13.525
	More than two	-0.0015***	-1.6056	-0.0127	-14.034
Blood test result	HIV negative	1.0		1.0	
	HIV positive	-0.0009	-0.9805	0.00431	4.7497
Currently working	Not working	1.0		1.0	
	Working	0.00001	0.0118	-0.0109	-12.1
Had STI	No	1.0		1.0	
	Yes	0.0003	0.3193	0.0008	0.8537
Birth & ANC	No birth	1.0		1.0	
	ANC & birth	-0.0007***	-0.7741	0.0395***	43.52
	Birth but no ANC	0.0004**	0.4654	0.0007	0.7629
Constant				0.6022	66.371
Total			22.1***		77.9***

* Significant at 0.05; ** Significant at 0.01; *** Significant at <0.001

DISCUSSION

Trends in Uptake of HIV Testing

The present study demonstrated a rapid increase in uptake of HIV testing among women age 15–24 over the past eight years in Tanzania. Nearly 40% of the women age 15–24 included in the 2011–12 survey had been tested for HIV and received test result—six times the percentage as in the 2003–04 survey. A greater increase in uptake of HIV testing occurred between 2003–04 and 2007–08 than occurred between 2007–08 and 2011–12. The increase could be attributable to the wider availability of rapid HIV testing kits (lowering cost of testing), the rolling out of free antiretroviral therapy, which started in December 2004, as well as national campaigns to promote testing (TACAIDS. 2008; Isingo et al. 2012). The increase in uptake of HIV testing may also be due to the Presidential mass campaign for HIV testing in 2007, as well as enactment of the law in 2008 forbidding discrimination against people living with HIV (PLWH). Increased testing translates to an increased proportion of people who are aware of their status and thus possibly changing their behaviour in ways that reduce the risk of HIV infection.

Determinants of HIV Testing Uptake

The study found numerous factors associated with HIV testing uptake. The odds of HIV testing uptake were higher among women with primary and secondary education or higher as compared with women without any formal education. This finding is in agreement with a previous study among Ghanaian women which showed that higher education was strongly correlated with HIV testing uptake (Tenkorang and Owusu 2010). A possible explanation for this result could be that higher educational attainment provides more opportunities to clearly understand HIV infection and prevention. Moreover, women with more education are more likely to be employed and therefore have a better access to VCT services than women without formal education, as until about the year 2004 most VCT centers would charge clients a fee for service.

Marital status also showed to be related to uptake of HIV testing. Married women were more likely to undergo HIV testing than unmarried women. Similar findings have been documented by other studies (Tenkorang and Owusu 2010; Ziraba et al. 2011). In our study, higher odds of HIV testing uptake among married women could be due to advocacy of faith-based institutions on the importance of having HIV testing before marriage in Tanzania.

Compared with women without sexual partners, the odds of HIV testing uptake were higher in those with at least one lifetime sexual partner, a finding that is consistent with previous findings from Tanzania , as in Tanzania HIV infection is predominantly transmitted sexually.

The present study also found that attending ANC was also an important determinant for HIV testing. Women who had a birth within two years preceding the survey and attended ANC had increased odds of HIV testing compared with women who did not have a birth. No association of HIV testing uptake was noted among women who had a birth and did not attend ANC. As part of preventing mother-to-child transmission of HIV, women are required to test in order to receive ART for prevention and also to make decisions on breastfeeding and family planning practices. This requirement could explain higher HIV testing uptake among women who attended ANC. Analysis showed a difference in HIV testing uptake in relation to STI status. Having an STI or symptoms of an STI was associated with increased odds of HIV testing, although the association was not statistically significant, but may be clinically meaningful. Association between STI and HIV testing uptake also has been reported in other studies (Swenson et al. 2009). STIs are one of the risk factors for HIV infection and are often transmitted along with HIV. Individuals attending STI clinics are thus more likely to be counselled and eventually tested for HIV, which could explain higher odds of HIV testing uptake among this group.

This study also revealed that HIV testing uptake changes with age difference. Women age 20–24 had increased odds of HIV testing uptake compared with women age 15–19. Older age has been reported to be associated with an increased likelihood of being tested for HIV (Peltzer et al. 2013).This could be due to the fact that older women are more likely to be sexually active, more likely to be married and more likely to be economically empowered than younger women.

In addition, the study found that women who live in urban areas were more likely to test for HIV compared with rural women. Urban areas offer greater access to VCT services compared with rural areas, which may explain this finding. We also found zonal variations in uptake of HIV testing across the surveys. This could be explained by the regional variation in in availability of VCT services between zones.

Decomposition of the Changes in Uptake of HIV Testing

Decomposition analyses discerned the sources in the changes of HIV testing uptake. Changes in the composition of women with different levels of education, attending ANC visits and place of residence contributed to observable change in uptake of HIV testing. For example, during the first phase a decrease in the proportion of women with primary education or an increase in the proportion of women residing in rural areas would have resulted in decrease in HIV testing uptake in the absence of the effects of these characteristics. Although changes in the population composition contributed to the change in the increase in HIV testing uptake, most of the HIV testing uptake was due to the changes in the effects of women's characteristics. For example, attending ANC significantly contributed to the changes in HIV testing uptake in both first and second phases.

Strengths and Limitations of the Study

Unlike the standard logistic regression-based approaches that rely on individual-level data, multivariate regression decomposition in HIV testing provides opportunity for detailed explanations for the differences in the changes in HIV testing across the surveys. We were also not able to assess the true effect of HIV interventions performed across the survey periods, which also might have influenced the observed changes in HIV testing.

Conclusions

Uptake of HIV testing increased remarkably over the three surveys. The differences across surveys are to a large extent explained by ANC attendance. This is a reflection of a rapid expansion of HIV testing services into ANC in order to increase prevention of mother-to-child transmission of HIV (PMTCT) across all survey periods. Knowing one's HIV status is the gateway to HIV treatment and prevention. However, the expansion in HIV testing has been greater among women with high-risk characteristics, and thus has become more targeted. Until testing is universal, an effective expansion strategy would be to prioritize those groups most likely to be infected.

References

Alsallaq, R.A., Baeten, J.M., Celum, C.L., Hughes, J.P., Abu-Raddad, L.J., Barnabas, R.V., and Hallett, T.B. 2013. Understanding the Potential Impact of a Combination HIV Prevention Intervention in a Hyper-endemic Community. *PLoS ONE*, 8(1), pp.1–13.

Barth, R.E., Van Der Meer, J.T. M., Hoepelman, A.I.M., Schrooders, P.A., Van De Vijver, D.A., Geelen, S.P.M., and Tempelman, H.A. 2008. Effectiveness of Highly Active Antiretroviral Therapy Administered by General Practitioners in Rural South Africa. *European Journal of Clinical Microbiology and Infectious Diseases*, 27(10), pp.977–984.

Beyrer, C. and Abdool Karim, Q. 2013. The Changing Epidemiology of HIV in 2013. *Current Opinion in HIV/AIDS*, 8(4), p.306.

Charles, M.P., Kweka, E.J., Mahande, A.M., Barongo, L.R., Shekalage, S., Nkya, H.M., Lowassa, A., and Mahande, M.J. 2009. Evaluation of Uptake and Attitude to Voluntary Counselling and Testing among Health Care Professional Students in Kilimanjaro. *BMC Public Health*, 9(128), pp.1–9.

Cock, K.M.D., Marum, E., and Mbori-Ngacha, D. 2010. Viewpoint: A Serostatus-based Approach to HIV/AIDS Prevention and Care in Africa. *The Lancet*, 362, pp.1847–1849.

Cohen M.S., Chen Ying Q., McCauley M., Gamble T., Hosseinipour M.C., Kumarasamy N., Hakim J.G., Kumwenda J., Grinsztejn, B., Pilotto J.H.S., Godbole, S.V., Mehendale, S., Chariyalertsak, S., Santos B.R., Mayer, K.H., Hoffman, I.F., Eshleman, S.H., Piwowar-Manning, E., Wang, L., Makhema, J., Mills, L.A., de Bruyn, G., Sanne, I., Eron J., Gallant, J., Havlir D., Swindells, S., Ribaudo, H., Elharrar, V., Burns, D., Taha, T.E., Nielsen-Saines, K., Celentano, D., Essex, M., and Fleming, T. R. 2011. Prevention of HIV-1 Infection with Early Antriretroviral Therapy. *New England Journal of Medicine*, 365(6), pp.493–505.

Das, M., Chu, P.L., Santos, G.M., Scheer, S., Vittinghoff, E., McFarland, W., and Colfax, G.N. 2010. Decreases in Community Viral Load are Accompanied by Reductions in New HIV Infections in San Francisco. *PLoS ONE*, 5(6).

Dodd, P.J., Garnett, G.P., and Hallett, T.B. 2010. Examining the Promise of HIV Elimination by "Test and Treat" in Hyperendemic Settings. *AIDS (London, England)*, 24(5), pp.729–735.

Ferradini, L., Jeannin, A., Pinoges, L., Izopet, J., Odhiambo, D., Mankhambo, L., Karungi, G., Szumilin, E., Balandine, S., Fedida, G., Carrieri, M.P., Spire, B., Ford, N., Tassie, J.M., Guerin, P.J., and Brasher, C. 2006. Scaling Up of Highly Active Antiretroviral Therapy in a Rural District of Malawi: An Effectiveness Assessment. *The Lancet*, 367(9519), pp.1335–1342.

Gianella, S., Von Wyl, V., Fischer, M., Niederoest, B., Battegay, M., Bernasconi, E., Cavassini, M., Rauch, A., Hirschel, B., Vernazza, P., Weber, R., Joos, B., and Günthard, H.F. 2011. Effect of Early Antiretroviral Therapy during Primary HIV-1 Infection on Cell-associated HIV-1 DNA and Plasma HIV-1 RNA. *Antiviral Therapy*, 16(4), pp.535–545.

Gitonga, M., Sinyard, M., and Gachuiri, G. 2012. Alcohol and Substance Use vis a vis HIV Sexual Risk Behaviours among Freshman Students at a Kenyan University College; Focus for Interventions. *Journal of Biology, Agriculture and Healthcare*, 2(8), pp.8–12.

Granich, R.M., Gilks, C.F., Dye, C., De Cock, K.M., and Williams, B.G. 2009. Universal Voluntary HIV Testing with Immediate Antiretroviral Therapy as a Strategy for Elimination of HIV Transmission: A Mathematical Model. *The Lancet*, 373(9657), pp.48–57.

Hall, H.I., Holtgrave, D.R., and Maulsby, C. 2012. HIV Transmission Rates from Persons Living with HIV Who are Aware and Unaware of Their Infection. *AIDS*, 26(7), pp.893–896.

Isingo, R., Wringe, A., Todd, J., Urassa, M., Mbata, D., Maiseli, G., Manyalla, R., Changalucha, J., Mngara, J., Mwinuka, E., and Zaba, B. 2012. Trends in the Uptake of Voluntary Counselling and Testing for HIV in Rural Tanzania in the Context of the Scale Up of Antiretroviral Therapy. *Tropical Medicine and International Health*, 17(8), pp.15–25.

Ivers, L.C., Kendrick, D., and Doucette, K. 2005. Efficacy of Antiretroviral Therapy Programs in Resource-poor Settings: A Meta-analysis of the Published Literature. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, 41(2), pp.217–224.

Mabuto, T., Latka, M.H., Kuwane, B., Churchyard, G.J., Charalambous, S., and Hoffmann, C.J. 2014. Four Models of HIV Counseling and Testing: Utilization and Test Results in South Africa. *PLoS ONE*, 9(7).

Miro, J.M., Manzardo, C., Mussini, C., Johnson, M.A., Monforte A., Antinori, A., Gill, M.J., Sighinolfi, L., Uberti-Foppa, C., Borghi, V., and Sabin, C. 2011. Survival Outcomes and Effect of Early vs. Deferred cART among HIV-infected Patients Diagnosed at the Time of an AIDS-defining Event: A Cohort Analysis. *PLoS ONE*, 6(10), pp.4–11.

Ng'ang'a, A., Waruiru, W., Ngare, C., Ssempijja, V., Gachuki, T., Njoroge, I., Oluoch, P., Kimanga, D.O., Maina, W.K., Mpazanje, R., and Kim, A.A. 2014. The Status of HIV Testing and Counseling in Kenya: Results from a Nationally Representative Population-based Survey. *Journal of Acquired Immune Deficiency Syndromes (1999)*, 66 Suppl 1, pp.S27–36.

Peltzer, K., Matseke, G., and Peltzer, K. 2013. Determinants of HIV Testing among Young People Aged 18 – 24 Years in South Africa. *African Health Sciences*, 13(4), pp.1012–1020.

Powers, D.A. and Pullum, T.W. 2006. Multivariate Decomposition for Nonlinear Models. http://paa2006.princeton.edu/papers/60788.

Siegfried, N., Uthman, O.A., and Rutherford, G.W. 2010. Optimal Time for Initiation of Antiretroviral Therapy in Asymptomatic, HIV-infected, Treatment-naive Adults. *Cochrane Database of Systematic Reviews (Online)*, (3), p.CD008272.

Staveteig, S., Wang, S., Head, S., Bradley, S., and Nybro, E. 2013. Demographic Patterns of HIV Testing Uptake in Sub-Saharan Africa. DHS Comparative Reports 30 (April), pp.1–95.

Swenson, R.R., Rizzo, C.J., Brown, L.K., Payne, N., DiClemente, R.J., Salazar, L.F., Vanable, P.A., Carey, M.P., Valois, R.F., Romer, D., and Hennessy, M. 2009. Prevalance and Correlates of HIV Testing among Sexually Active African American Adolescents in Four U.S. Cities. *Sexually Transmitted Diseases*, 36(9), pp.584–591.

Tanzania Commission for AIDS (TACAIDS), National Bureau of Statistics (NBS), ORC Macro. Tanzania HIV/AIDS Indicator Survey 2003-04. Dar-es Salaam, Tanzania. TACAIDS, NBS, ORC Macro. 2008.

Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS commission (ZAC), National Bureau of Statistics (NBS), Office of Chief Government Statistician (OCGS), Macro International Inc. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar-es Salaam, Tanzania. TACAIDS, ZAC, NBS, OCGS, Macro International Inc. 2008.

Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS commission (ZAC), National Bureau of Statistics (NBS), Office of Chief Government Statistician (OCGS), ICF International. Tanzania HIV/AIDS and Malaria Indicator Survey 2011/12. Dar-es Salaam, Tanzania. TACAIDS, ZAC, NBS, OCGS, ICF International 2013.

TACAIDS. 2014. The United Republic of Tanzania Prime Minister 's Office National Policy on HIV/AIDS. Dar es Salaam.

Tenkorang, E.Y. and Owusu, G.A. 2010. AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV Correlates of HIV Testing among Women in Ghana: Some Evidence from the Demographic and Health Surveys. *AIDS Care*, 22(3), pp.296–307.

UNAIDS. 2013. Global Report: UNAIDS report on the global AIDS epidemic 2013.

WHO. 2005. Scaling-Up HIV Testing and Counselling Services.

Ziraba, A.K., Madise, N.J., Kimani, J.K., Oti, S., Mgomella, G., Matilu, M., and Ezeh, A. 2011. Determinants for HIV Testing and Counselling in Nairobi Urban Informal Settlements. *BMC Public Health*, 11(1), p.663.