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ABSTRACT

Zimbabwe has a high human immunodeficiency virus (HIV) burden. It is therefore important to scale up HIV testing and counselling (HTC) as a gateway to HIV prevention, treatment and care. The objective of this study is to determine factors associated with HIV testing uptake among adult men and women in Zimbabwe.

The study used data from 7,313 women and 6,584 men who completed interviewer-administered questionnaires and who provided blood specimens for HIV testing during the 2010-11 Zimbabwe Demographic and Health Survey (ZDHS). Associations between socio-demographic and sexual risk behaviours were examined using the Chi-square test for association and multivariate logistic regression.

The study found that more women than men were ever tested for HIV (61% versus 39%), which was similar to findings for testing in the 12 months before the survey (40% versus 26%). In the multivariate analysis, women who visited antenatal care (ANC) had significantly higher testing uptake, and men whose partners attended ANC in the past two years had a significantly higher testing uptake. For men, testing uptake increased with increasing age from age 20, and was particularly high for men age 45-49, while, for women testing was highest at age 20-29. Other significant factors for HIV testing among both women and men were educational attainment, high wealth status, currently/formerly being in union and being HIV-infected. Despite higher testing levels among those found to be HIV-infected, 26% of women and 45% of men were never tested for HIV.

ANC is an important gateway for HIV testing among pregnant women, and this model can be extended to their partners. Strategies aimed at generally increasing HIV testing uptake need to be adopted, particularly for men and for lower-income and less educated populations. The high proportion of undiagnosed individuals highlights the need for continued scale-up of HIV testing in Zimbabwe.

Key words: HIV testing, Zimbabwe, HIV/AIDS, Demographic and Health Survey

INTRODUCTION

Sub-Saharan Africa has the largest proportion of people living with the Human Immunodeficiency Virus (HIV). Data in mid-2010 indicated that 68% of HIV-infected people globally resided in this region, although the region contained only 12% of the global population (WHO et al. 2011). Zimbabwe is one of the sub-Saharan countries worst affected by the HIV epidemic, with a prevalence of 15% among adults age 15-49 (ZIMSTAT and ICFI 2012). At its peak in 1997, HIV prevalence was 27%. The decline between 1997 and 2010 has been attributed to changes in sexual behaviour and selective AIDS-induced mortality (Gregson et al. 2006).

Zimbabwe's commitment to the HIV/AIDS response has resulted in a drive towards the elimination of AIDS and new HIV infections through various strategies. HIV testing and counselling (HTC) is one of the cross-cutting priority prevention strategies in the Combination Prevention Strategy adopted in Zimbabwe, which includes Behaviour Change (BC), Voluntary Medical Male Circumcision (VMMC), Prevention of Mother-to-Child Transmission of HIV (PMTCT), condom programming and antiretroviral treatment (ART) services (NAC and MOHCW 2013). Moreover, HIV testing uptake is pivotal in the fight against HIV as it is an entry point into VMMC, PMTCT and HIV care and treatment.

In Zimbabwe HIV testing began in 1984 as part of routine screening of donated blood and blood products at the National Blood Transfusion Services of Zimbabwe (NBTSZ), and by 1990 diagnostic HIV testing had become available in clinical settings (MOHCC 2011). While there are various models of HIV testing recommended by the World Health Organization (WHO et al. 2011), the following models are more commonly available in Zimbabwe: i) stand-alone "opt-in" voluntary counselling and testing (VCT), ii) provider-initiated testing and counselling (PITC) in treatment settings i.e. tuberculosis (TB), sexually transmitted infections (STIs), inpatient or outpatient clinics, and iii) PITC in antenatal clinics. National HIV testing and counselling campaigns have also been adopted since 2010, which aim at improving demand for and access to testing services at the community level. In 2011 alone, close to one percent (118,032 people) of the national population (12,973,808) were tested for HIV in a ten-day campaign, of whom 49,911(42%) were males and 68,121(58%) were females (MOHCC 2011).

The overall goal of Zimbabwe's HTC strategy is to ensure that by 2015 85% of people know their HIV status (NAC 2011). According to the 2010-11 Zimbabwe Demographic and Health

Survey (ZDHS), only 36% of men and 57% of women have ever been tested for HIV and received their results. This finding shows that a large percentage of the population is not aware of their HIV status, despite the scale-up in provision of HIV testing from 48% to 95% of all health facilities between 2007 and 2009 (WHO 2011).

HIV testing, which makes people aware of their own HIV status, has been shown to result in risk-reduction behavioural change, reduced anxiety over possible infection, and facilitation of safe disclosure of infection status and future planning (Cremin et al. 2010). For people who are HIV-infected, the dangers of not knowing their HIV-positive status include continued transmission of HIV in the community, and this poses a higher risk of opportunistic infections such as TB (Corbett et al. 2003) and cryptococcal meningitis (Park et al. 2009), which can lead to early death.

Given the low uptake of HIV testing services in Zimbabwe, there is a need to identify and understand the factors associated with this low uptake. The objective of this study is to examine socio-demographic and sexual risk behaviours associated with ever being tested for HIV and testing uptake in the 12 months preceding the 2010 ZDHS.

DATA AND METHODS

This study is a secondary analysis using data from the 2010-11 ZDHS, which had a descriptive cross-sectional design. Ethics approval for conducting the 2010-11 ZDHS was obtained from the Medical Research Council of Zimbabwe, the Institutional Review Board of ICF International and the Centers for Disease Control (CDC), while the secondary data analysis protocol was also reviewed and approved by The Union Ethics Advisory Group.

Data and Sources of Data

The 2010-11 ZDHS is a representative survey, the latest in a series of Demographic and Health Surveys (DHS) conducted every five years in Zimbabwe with the aim of providing population and health indicator estimates at the national and provincial levels. The data are available on http://www.dhsprogram.com/data/available-datasets.cfm and the version of the dataset used is ZWIR62DT.ZIP. During the 2010-11 ZDHS, trained interviewers collected data using personal digital assistants (PDAs) through the Man's Questionnaire, for men age 15-54, and the Woman's Questionnaire, for women age 15-49. Blood specimens were also collected for those men and women who voluntarily provided written consent. In the 2010-11 ZDHS a nationally representative probability sample of 10,828 households was selected and 9,756 households were successfully interviewed, using a stratified, two-stage cluster design. The survey was conducted over six months from 29 September 2010 and late March 2011. Details of the sampling procedures and how the survey was conducted are available in the 2010-11 ZDHS report (ZIMSTAT and ICFI 2012).

Study Population

Of the 9,756 households that were successfully interviewed, 9,831 women age 15-49 and 8,723 men age 15-54 were eligible for interview and blood sample collection. Of these, interviews were completed for 9,143 women and 7,502 men. Our analysis was limited to the 7,313 women age 15-49 and 6,584 men age 15-54 who provided blood samples for HIV testing as part of the 2010-11 ZDHS.

Definition of Terms

The DHS wealth index (Rustein and Johnson 2004) used in this study to quantify differences in household economic status is based on information collected from respondents on several items that measure household ownership of consumer durables which tend to be correlated with household wealth status. Concerning union status, "currently in union" refers to women and men who were married or cohabiting at the time of the survey, while "formerly in union" refers to those who were divorced, widowed or separated. Women were asked if they were currently pregnant, while only men in a union were asked if their partner was currently pregnant; in both cases pregnancy status was self-reported.

A history of STIs was determined during the survey from respondents (both men and women) who had ever heard of STIs by asking first whether they had an STI in the past year. Subsequent questions, asked regardless of whether the respondent had heard of an STI, focused on symptoms of STIs: whether in the past year the respondent had a genital discharge, whether he/she had a sore or ulcer on or near his/her genitals, and whether he/she had pain or a burning sensation during urination.

For births in the past five years, women were asked about attendance at antenatal care (ANC), while men were asked if their partners had attended ANC for births in the past two years, in order to limit recall bias.

During the survey, technicians collected blood specimens for laboratory testing of HIV for all men and women who consented to the procedure. The collection procedure of the specimens, the consent process, transportation of the specimens and their laboratory analysis are discussed in the 2010-11 ZDHS report (ZIMSTAT and ICFI 2012). Respondents were not informed of their HIV status following testing and their results were also kept confidential and used only for survey purposes.

Comprehensive knowledge of HIV was assessed using the following criteria: i) knowing that correct and consistent use of condoms during sexual intercourse and having just one uninfected faithful partner can reduce the chances of getting HIV, ii) knowing that a healthy-looking person can have HIV, and iii) rejecting the two most common local misconceptions about HIV transmission—that HIV can be transmitted by mosquito bites and that HIV can be transmitted

by sharing food with a person who has AIDS. Finally, in this study having comprehensive accepting attitudes towards HIV was defined as: i) willingness to care for a family member with AIDS in the respondent's home, ii) willingness to buy fresh vegetables from a shopkeeper who has HIV, iii) accepting that a female teacher who has HIV but is not sick should be allowed to continue teaching and iv) not keeping secret that a family member was infected with HIV.

Statistical Analysis

Statistical analyses were performed using Stata/SE 13.0 (StataCorp, 2013: Stata Statistical Software, Release 13.0, College Station, TX: StataCorp LP). As mentioned, all analysis in this study was limited to women and men who were tested for HIV as part of the ZDHS. All further data presented were weighted to adjust for the sample design and differences in response rates to the ZDHS interview and the HIV testing component (ZIMSTAT and ICFI 2012). The chi-square test was used to establish associations between ever being tested for HIV and all socio-demographic characteristics and sexual risk behaviours. Logistic regression was then used to calculate multivariate-adjusted odds ratios and their 95% confidence intervals while adjusting for potential confounding. Logistic regression models were rerun with some variables being dropped or re-categorized to avoid collinearity until the model of best fit was achieved.

RESULTS

Table 1 shows associations between socio-demographic characteristics and ever being tested for HIV. Table 2 shows associations between sexual risk behaviours and ever being tested for HIV. Overall, uptake of HIV testing was much higher among women, at 61%, compared with 39% among men. A similar difference was noted for HIV testing uptake in the past 12 months, at 40% among women compared with 26% among men.

Table 1. Uptake of HIV testing among respondents by socio-demographic characteristics, ZDHS 2010-11

	Proportion ever tested for HIV					
	Women			Men		
Background characteristics	**N**	**%**	***p*-value**	**N**	**%**	***p*-value**
Age (in years)						
15-19	1,553	28.2	<.001	1,569	11.9	<.001
20-24	1,463	70.4		1,204	36.0	
25-29	1,354	78.9		1,082	50.7	
30-34	1,010	73.1		844	52.3	
35-39	843	67.7		712	50.1	
40-44	589	60.8		506	52.5	
45-49	501	50.6		333	57.7	
50-54	-			334	44.0	
Education level‡						
Primary or less	2,324	55.8	<.001	1,670	29.9	<.001
Secondary	4,688	62.8		4,495	39.9	
Higher	300	70.9		419	67.2	
Wealth index						
Poorest	1,375	57.5	<.001	1,092	33.4	<.001
Poorer	1,411	59.0		1,258	31.1	
Middle	1,457	63.2		1,351	36.6	
Richer	1,527	65.3		1,465	41.8	
Richest	1,544	59.3		1,419	50.1	
Residence						
Urban	2,297	62.1	.292	1,966	44.2	<.001
Rural	5,015	60.4		4,618	36.9	
Province						
Manicaland	1,005	62.6	.098	927	43.9	.001
Mashonaland Central	768	62.9		746	41.7	
Mashonaland East	740	60.1		690	36.0	
Mashonaland West	863	61.7		865	42.1	

(Continued...)

Table 1. – *Continued*

Background characteristics	Proportion ever tested for HIV					
	Women			Men		
	N	%	*p*-value	N	%	*p*-value
Matabeleland North	353	63.3		322	39.7	
Matabeleland South	407	64.2		346	28.2	
Midlands	939	53.6		860	30.6	
Masvingo	757	60.1		566	36.1	
Harare	1,122	62.0		967	42.1	
Bulawayo	360	63.3		295	47.7	
Religion						
Christians	3,917	60.2	.286	2,791	42.5	
Apostolic sect	2,843	62.2		1,800	35.9	<.001
Other religion/None*	553	59.5		1,813	36.5	
Union status						
Never in union	1,694	27.8	<.001	2,853	22.8	<.001
Currently in union	4,569	70.8		3,428	51.7	
Formerly in union	1,049	71.5		303	49.9	
Current pregnancy status†						
No or unsure	6,706	60.3	<.001	6,104	37.9	<.001
Yes	607	68.4		480	53.6	
ANC visit in past 5 years						
No ANC visit	290	46.7	<.001	-	-	
Had ANC visit	3,323	82.1		-	-	
No birth in past 5 years	3,700	43.0		-	-	
Partner visited ANC for birth in past 2 years						
No ANC visit	-	-		208	35.5	<.001
Had ANC visit	-	-		1,507	54.3	
No birth in past 2 years	-	-		4,869	34.5	
Has children						
No	1,859	26.4	<.001	-	-	
Yes	5,454	72.7		-	-	
No. of deaths of children <5yrs						
0	6,522	59.7	<.001	-	-	
1	634	72.3		-	-	
2+	157	68.1		-	-	
Total	7,313	60.9		6,584	39.1	

ANC = antenatal care; HIV = human immunodeficiency virus; ZDHS = Zimbabwe Demographic and Health Survey

‡ Only 1.3% and 2.4% of all men and women respectively have no education; hence "no education" and "primary education " have been combined

* "Other religion" refers to Muslims and followers of traditional and other minority religions

† Men who are not in union were not asked if they had a pregnant partner, and so are assumed not to have a pregnant partner

Table 2. Uptake of HIV testing among respondents by sexual risk behaviour characteristics, ZDHS 2010-11

	Proportion ever tested for HIV					
	Women			Men		
Background characteristics	**N**	**%**	***p*-value**	**N**	**%**	***p*-value**
Age at first sex						
Not had sex	1,269	16.1	<.001	1,573	14.8	<.001
<16 years	977	64.4		521	37.5	
16-17years	1,737	68.8		890	41.3	
18-19 years	1,615	73.3		1,245	45.6	
20+ years	1,652	73.3		2,238	51.7	
Don't know	63	52.5		117	43.9	
Ever had paid sex						
No	-	-		5,417	36.9	<.001
Yes	-	-		1,167	49.1	
Number of lifetime sexual partners						
0	1,269	16.1	<.001	1,573	14.8	<.001
1	3,867	69.1		882	39.8	
2	1,345	70.7		867	49.9	
3-4	608	75.1		1,337	43.6	
5+	223	77.4		1,925	50.5	
Consistent condom use in the past 12 months						
Had no sex	2,327	39.3	<.001	2,078	19.0	<.001
No	4,504	70.2		3,656	48.6	
Yes	482	79.0		850	47.0	
Time spent away in past 12 months						
None	3,027	54.7	<.001	3,124	33.3	<.001
<1 month	3,099	65.4		2,433	45.0	
≥1 month	1,187	65.2		1,026	42.7	
Had an STI in the past 12 months†						
No	6,671	59.8	<.001	6,227	38.4	<.001
Yes	641	72.3		357	50.7	
HIV status						
HIV-negative	6,018	58.2	<.001	5,750	36.7	<.001
HIV-positive	1,295	73.6		834	55.2	
Comprehensive knowledge of HIV						
No	3,204	53.6	<.001	3,075	33.4	<.001
Yes	4,109	66.6		3,509	44.0	
Accepting attitudes towards HIV						
No	4,501	57.8	<.001	4,057	35.7	<.001
Yes	2,812	65.9		2,528	44.5	
Total	7,313	60.9		6,584	39.1	

HIV = human immunodeficiency virus; STI = sexually transmitted infections; ZDHS = Zimbabwe Demographic and Health Survey

† 1.1% and <1% of those classified as "not having an STI in the past 12 months" reported being unsure of having an STI in the past 12 months

Factors Associated with Uptake of HIV Testing

Table 3 shows multivariate adjusted odds ratios and their 95% confidence intervals (CIs) for the socio-demographic and sexual risk behaviours associated with uptake of HIV testing during a person's lifetime and in the past 12 months among women and men interviewed. Women age 20-29 had the highest odds of ever being tested compared with women age 15-19, while declining testing uptake was associated with age ≥30, particularly for testing in the past 12 months. Among men, being age 20 and older was significantly associated with ever being tested and with testing uptake in the past 12 months, compared with men age 15-19. Men age 45-49 were much more likely to have been tested in their lifetime [aOR=4.49, 95% CI = (2.95-6.84)], while testing uptake in the past 12 months was highest in the 20-24 age group [aOR=2.48, 95% CI = (1.88-3.26)]. Testing uptake in a person's lifetime and in the past 12 months also increased significantly with higher education level and higher household wealth status, for both men and women.

While there were no differences in testing uptake by rural-urban residence for women, rural men were 42% more likely to have been tested in the past 12 months compared with urban men. Testing uptake in a person's lifetime was similar in all provinces excluding the Midlands province, where uptake was lower among women [aOR=0.63, 95% CI = (0.44-0.90)], while marginally lower differences in testing uptake in the past 12 months were noted only for women from Mashonaland East [aOR=0.72, 95% CI = (0.53-0.99)].

Lower testing uptake in a person's lifetime was found for both men [aOR=0.64, 95% CI = (0.54-0.76)] and women [aOR=0.74, 95% CI = (0.60-0.92)] of minority religions or those with no religion. Differences in testing uptake in the past 12 months were found only for men of minority religions or those with no religion [aOR=0.75, 95% CI = (0.63-0.90)] compared with men of Christian faith. Also, women and men currently in union and women formerly in union were more likely to have been tested compared with those not in union.

Table 3. Factors associated with uptake of HIV testing in a lifetime and in the past 12 months among male and female respondents, ZDHS 2010-11

Background characteristics	Women				Men			
	Ever HIV-tested		HIV-tested in past 12 months		Ever HIV-tested		HIV-tested in past 12 months	
	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%
Age								
15-19	ref.				ref.			
20-24	**1.67**	**(1.35, 2.07)**	1.11	(0.90, 1.37)	**2.46**	**(1.92, 3.16)**	**2.48**	**(1.88, 3.26)**
25-29	**1.73**	**(1.38, 2.16)**	0.99	(0.80, 1.24)	**3.27**	**(2.43, 4.41)**	**2.31**	**(1.66, 3.22)**
30-34	1.23	(0.97, 1.57)	**0.74**	**(0.59, 0.93)**	**3.23**	**(2.30, 4.54)**	**2.21**	**(1.54, 3.16)**
35-39	1.07	(0.82, 1.41)	**0.70**	**(0.55, 0.90)**	**2.93**	**(2.06, 4.16)**	**1.93**	**(1.32, 2.84)**
40-44	0.94	(0.70, 1.26)	**0.64**	**(0.49, 0.85)**	**2.94**	**(2.05, 4.24)**	**1.85**	**(1.20, 2.84)**
45-49	0.89	(0.64, 1.23)	**0.55**	**(0.40, 0.75)**	**4.49**	**(2.95, 6.84)**	**2.33**	**(1.50, 3.63)**
50-54	-	-	-	-	**2.82**	**(1.88, 4.24)**	**1.81**	**(1.16, 2.82)**
Education level‡								
Primary or less	ref.				ref.			
Secondary	**1.70**	**(1.45, 1.98)**	**1.22**	**(1.06, 1.40)**	**1.55**	**(1.32, 1.82)**	**1.52**	**(1.29, 1.80)**
Higher	**2.29**	**(1.60, 3.27)**	**1.47**	**(1.07, 2.03)**	**2.57**	**(1.88, 3.47)**	**1.74**	**(1.28, 2.37)**
Wealth index								
Poorest	ref.				ref.			
Poorer	1.14	(0.95, 1.37)	1.11	(0.92, 1.33)	0.97	(0.77, 1.22)	1.08	(0.86, 1.35)
Middle	**1.47**	**(1.17, 1.85)**	**1.23**	**(1.02, 1.49)**	**1.29**	**(1.03, 1.60)**	**1.46**	**(1.17, 1.82)**
Richer	**1.57**	**(1.20, 2.06)**	**1.33**	**(1.08, 1.65)**	**1.53**	**(1.17, 2.00)**	**1.72**	**(1.27, 2.31)**
Richest	**1.53**	**(1.15, 2.03)**	**1.31**	**(1.04, 1.66)**	**2.10**	**(1.59, 2.77)**	**2.09**	**(1.52, 2.88)**
Residence								
Urban	ref.				ref.			
Rural	1.08	(0.84, 1.39)	1.10	(0.93, 1.31)	1.21	(0.94, 1.56)	**1.42**	**(1.07, 1.88)**
Province								
Manicaland	ref.				ref.			
Mashonaland Central	0.99	(0.68, 1.46)	1.04	(0.77, 1.41)	1.09	(0.75, 1.59)	0.97	(0.60, 1.55)
Mashonaland East	0.81	(0.57, 1.14)	**0.72**	**(0.53, 0.99)**	0.80	(0.53, 1.20)	0.66	(0.43, 1.02)
Mashonaland West	0.91	(0.60, 1.38)	1.10	(0.80, 1.52)	1.08	(0.74, 1.56)	1.05	(0.69, 1.61)
Matabeleland North	1.42	(0.92, 2.18)	1.20	(0.87, 1.65)	1.37	(0.86, 2.17)	0.79	(0.48, 1.28)
Matabeleland South	1.35	(0.95, 1.92)	1.12	(0.82, 1.52)	0.68	(0.47, 1.00)	0.86	(0.52, 1.44)
Midlands	**0.63**	**(0.44, 0.90)**	0.79	(0.61, 1.03)	**0.53**	**(0.39, 0.74)**	**0.67**	**(0.45, 0.99)**
Masvingo	0.90	(0.63, 1.28)	0.99	(0.76, 1.30)	0.76	(0.53, 1.10)	0.76	(0.49, 1.16)
Harare	1.04	(0.72, 1.49)	0.89	(0.69, 1.16)	**0.70**	**(0.50, 0.98)**	0.76	(0.52, 1.11)
Bulawayo	1.22	(0.81, 1.83)	1.06	(0.81, 1.39)	0.91	(0.62, 1.34)	0.92	(0.61, 1.40)
Religion								
Roman Catholic	ref.				ref.			
Apostolic sect	0.97	(0.83, 1.12)	0.99	(0.87, 1.12)	0.84	(0.71, 1.00)	0.87	(0.71, 1.05)
Other religion/None*	**0.74**	**(0.60, 0.92)**	0.82	(0.66, 1.03)	**0.64**	**(0.54, 0.76)**	**0.75**	**(0.63, 0.90)**

(Continued...)

Table 3. – *Continued*

Background characteristics	Women				Men			
	Ever HIV-tested		HIV-tested in past 12 months		Ever HIV-tested		HIV-tested in past 12 months	
	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%
Union status								
Never in union	ref.				ref.			
Currently in union	**1.37**	**(1.04, 1.81)**	1.03	(0.79, 1.34)	**1.64**	**(1.22, 2.19)**	**1.75**	**(1.25, 2.44)**
Formerly in union	**1.71**	**(1.26, 2.31)**	1.04	(0.78, 1.38)	1.55	**(1.10, 2.17)**	1.47	**(1.05, 2.05)**
Current pregnancy status†								
No/Unsure	ref.				ref.			
Yes	1.17	(0.93, 1.48)	**1.47**	**(1.20, 1.79)**	**1.32**	**(1.04, 1.67)**	1.21	(0.92, 1.59)
ANC visit in past 5 years								
No ANC visit	ref.				ref.			
Had ANC visit	**5.50**	**(4.10, 7.38)**	**2.40**	**(1.78, 3.22)**	-	-	-	-
No birth in past 5 years	**1.76**	**(1.32, 2.34)**	**1.41**	**(1.06, 1.89)**	-	-	-	-
Partner visited ANC for birth in past 2 years								
No ANC visit	ref.				ref.			
Had ANC visit	-	-	-	-	**2.02**	**(1.49, 2.75)**	**1.94**	**(1.32, 2.87)**
No birth in past 2 years	-	-	-	-	1.57	**(1.13, 2.17)**	**1.50**	**(1.02, 2.22)**
Has children								
No	ref.				ref.			
Yes	**1.09**	**(1.02, 1.16)**	**1.09**	**(1.02, 1.16)**	-	-	-	-
No. of deaths of children <5yrs								
0	ref.				ref.			
1	1.15	(0.92, 1.44)	1.00	(0.83, 1.21)	-	-	-	-
2+	1.31	(0.90, 1.92)	1.25	(0.89, 1.76)	-	-	-	-
No. of lifetime sexual partners								
0	ref.				ref.			
1	**2.97**	**(2.18, 4.04)**	**3.75**	**(2.70, 5.20)**	1.24	(0.90, 1.71)	1.36	(0.97, 1.92)
2	**3.02**	**(2.17, 4.22)**	**3.65**	**(2.57, 5.19)**	**1.58**	**(1.12, 2.24)**	**1.70**	**(1.18, 2.46)**
3-4	**3.97**	**(2.61, 6.04)**	**4.14**	**(2.79, 6.15)**	1.09	(0.77, 1.55)	1.09	(0.76, 1.55)
5+	**4.46**	**(2.74, 7.26)**	**5.26**	**(3.15, 8.79)**	1.32	(0.93, 1.88)	1.39	(0.97, 1.99)
Time spent away in past 12 months								
None	ref.				ref.			
<1 month	1.12	(0.97, 1.29)	1.08	(0.96, 1.22)	1.16	(0.99, 1.36)	**1.19**	**(1.02, 1.38)**
≥1 month	**1.30**	**(1.09, 1.56)**	**1.20**	**(1.03, 1.40)**	**1.24**	**(1.02, 1.52)**	**1.23**	**(1.00, 1.51)**
Had STI in past 12 months								
No	ref.				ref.			
Yes	1.03	(0.83, 1.28)	1.02	(0.85, 1.21)	**1.41**	**(1.06, 1.87)**	1.08	(0.80, 1.44)

(Continued...)

Table 3. – *Continued*

Background characteristics	Women				Men			
	Ever HIV-tested		HIV-tested in past 12 months		Ever HIV-tested		HIV-tested in past 12 months	
	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%	aOR	95 CI%
Ever paid anyone for sex								
No	ref.				ref.			
Yes	-	-	-	-	0.94	(0.79, 1.11)	0.95	(0.79, 1.15)
Consistent condom use in past 12 months								
Had no sex	ref.				ref.			
Yes	**1.68**	**(1.24, 2.28)**	**1.29**	**(1.00, 1.65)**	1.22	(0.91, 1.65)	1.05	(0.76, 1.47)
No	0.98	(0.81, 1.18)	1.07	(0.89, 1.29)	**1.81**	**(1.34, 2.44)**	**1.76**	**(1.29, 2.40)**
HIV status								
HIV-negative	ref.				ref.			
HIV-positive	**1.40**	**(1.18, 1.66)**	1.03	(0.89, 1.20)	**1.56**	**(1.29, 1.87)**	**1.39**	**(1.16, 1.67)**
Comprehensive knowledge of HIV								
No	ref.				ref.			
Yes	**1.44**	**(1.27, 1.63)**	**1.23**	**(1.09, 1.39)**	1.08	(0.93, 1.26)	1.07	(0.92, 1.25)
Accepting attitudes towards HIV								
No	ref.				ref.			
Yes	**1.24**	**(1.08, 1.42)**	1.04	(0.93, 1.16)	1.12	(0.97, 1.30)	1.09	(0.94, 1.27)

aOR = adjusted Odds Ratio, ANC = ante-natal care, HIV = human immunodeficiency virus, STI = sexually transmitted infections, ZDHS = Zimbabwe Demographic and Health Survey

‡ Only 1.3% and 2.4% of all men and women respectively have no education, hence "no education" and "primary education" have been combined

* "Other religion" refers to Muslims, followers of traditional and other minority religions

† Men who are not in union were not asked if they had a pregnant partner, and so are assumed not to have a pregnant partner

NB: All odds ratios which are statistically significant at 5% significance level are highlighted in bold font

Self-reported pregnant women had a slightly higher odds of HIV testing in the past 12 months [aOR=1.47, 95% CI = (1.20-1.79)] compared with those not pregnant or unsure of their pregnancy status, while men who reported having a spouse who was currently pregnant also had higher odds of ever being tested [aOR=1.32, 95% CI = (1.04-1.67)]. Women who had attended ANC in the past five years had a higher likelihood of ever being tested for HIV [aOR=5.50, 95% CI = (4.10-7.38)] or being tested in the past 12 months [aOR=2.40, 95% CI = (1.78-3.22)]. Similarly, men who reported that their partners had attended ANC in the past two years also had higher odds of ever being tested [aOR=1.94, 95% CI = (1.32-2.87)] compared with men with spouses who had not given birth in the past two years.

HIV testing uptake in a person's lifetime and in the past 12 months increased with the number of lifetime sexual partners among women, while among men only those who reported two lifetime sexual partners had significantly higher testing uptake. Spending more than one month away from home was associated with higher testing uptake for both men and women, while reporting an STI history in the past 12 months was associated with higher testing uptake only among men [aOR=1.41, 95% CI = (1.06-1.87)].

HIV testing uptake was higher among women reporting consistent condom use in the past 12 months, while men reporting non-consistent use of condoms in the past 12 months were more likely to have ever been tested [aOR=1.81; 95% CI = (1.34-2.44)] or tested in the past 12 months [aOR=1.76; 95% CI = (1.29-2.40)]. Having ever been tested was more common among those diagnosed as HIV-infected during the survey, for both women [aOR=1.40; 95% CI = (1.18-1.66)] and men [aOR=1.56; 95% CI = (1.29-1.87)] compared with those who were HIV-negative. However, only 74% of the women and 55% of men who were diagnosed as HIV-infected had ever been tested, with even fewer of these women and men (65% and 35% respectively) having been tested in the past 12 months. Thus many HIV-positive individuals could not know their HIV status. Lastly, comprehensive knowledge of HIV and comprehensive accepting attitudes towards HIV were associated with testing uptake among women, although there was no such association among men.

DISCUSSION

This study provides information on HIV testing uptake from a nationally representative sample of adult men and women in Zimbabwe. Our findings show that fewer men than women have ever been tested for HIV, a result that is similar to findings of DHS surveys conducted in other sub-Saharan African countries (Peltzer et al. 2009; Staveteig et al. 2013). Given the high prevalence of HIV in Zimbabwe, such low uptake of HIV testing can be a barrier to early HIV treatment and care among those infected with HIV, and this could impact negatively on their survival and could result in poor antiretroviral treatment (ART) response upon initiation (Girardi et al. 2007; Waters and Sabin 2011).

Furthermore, studies from both resource-limited settings (Cornell et al. 2012; Mojumdar et al. 2010; Taylor-Smith et al. 2010) and well-resourced settings (Girardi et al. 2007; Krentz et al. 2004; Samet et al. 1994) have shown that men tend to have more advanced HIV disease upon initiation of ART, which is closely associated with late diagnosis of HIV infection. A recent review of ART programme data in Zimbabwe also revealed that men initiate ART later than women and that male gender is associated with patient attrition (Mutasa-Apollo et al. 2014). Though uptake of HIV testing is low among men, Zimbabwe ranks fifth in terms of uptake of HIV testing among women in Africa, according to a comparative study of data from DHS surveys conducted in 29 countries (Staveteig et al. 2013).

Our study found that antenatal care visits are the most important gateway to HIV testing and counselling among women. Also in our study, closely related to uptake of HIV testing in ANC is a significantly higher uptake of testing among women who reported being currently pregnant and women with children. DHS surveys conducted in other resource-limited countries have also shown equally high uptake of HIV testing in ANC (Staveteig et al. 2013). This is mostly attributed to integration of ‘opt-out’ provider-initiated testing and counselling in ANC as an entry point into PMTCT services and HIV treatment and care for HIV-infected pregnant mothers.

In Zimbabwe routine offer of HIV testing in antenatal sites was first piloted in 2005 and findings showed high rates of HIV testing uptake and acceptability in both rural (Perez et al. 2006) and urban settings (Chandisarewa et al. 2007). In sub-Saharan Africa the scale-up of integrated HIV screening within routine health care settings in resource-limited settings has also been credited for the remarkable scale-up of the proportion of women who have been tested in ANC

between the last two successive DHS surveys, particularly in Malawi, Rwanda, Senegal, Tanzania, Uganda and Zimbabwe (Staveteig et al. 2013).

HIV testing uptake is also higher among men whose spouses are currently pregnant and those whose partners attended ANC. Increased uptake in this group may be linked to increasing advocacy in Zimbabwe directed at the male partner to attend ANC visits with his spouse. Male partner attendance of ANC has been shown elsewhere to be an acceptable strategy for increasing male involvement in PMTCT, hence boosting male HIV testing (Katz et al. 2009) and promoting HIV prevention interventions (Farquhar et al. 2004). In a Ugandan study among men, spousal communication about HIV prevention was associated with self-reported HIV testing, while a greater level of interest in learning how to help one's partner have a safe pregnancy increased the likelihood of willingness to test for HIV (Gage and Ali 2005).

Despite the potential of increased HIV testing among men who accompany their pregnant spouses to ANC, much more remains to be achieved our results show that only 50% of men with currently pregnant partners have ever been tested and, similarly, only 55% of men whose partners visited ANC in the past two years reported being tested for HIV. In one Zimbabwean study (Chandisarewa et al. 2007), encouragement of women receiving HIV testing in ANC to bring their male partners showed that only 7% of men attended ANC. Likewise, in a Malawi study (Manzi et al. 2005) only 8% of HIV-infected partners undertook HIV testing.

We noted in our results that HIV testing uptake is highest among women age 20-29 while testing uptake in the 12 months preceding the survey declines with increasing age from age 30. This pattern closely correlates with age-specific fertility rates reported in the 2010-11 ZDHS (ZIMSTAT and ICFI 2012), where childbearing peaks at 212 and 194 live births per 1,000 women for ages 20-24 and 25-29, respectively, before dropping sharply with older age. This may further strengthen our intuition that women age 20-29 may have accessed HIV testing during ANC visits. Testing uptake among men is higher for those age ≥20, and this coincides with the median age of sexual debut, age 21, among Zimbabwean men (ZIMSTAT and ICFI 2012). This may be linked with self-perceived risk of HIV infection associated with engaging in sexual activity.

Similar to other resource-limited settings, (Fabiani et al. 2007; Peltzer et al. 2009; Weiser et al. 2006) HIV testing in Zimbabwe increases with education level and wealth status for both men and women. Further reference to data on women in the 2010-11 ZDHS report (ZIMSTAT

and ICFI 2012) shows that, while the total fertility rate declines with increasing education level and increasing wealth status, there is an inverse trend in the proportion of women who received ANC care from a skilled provider for the last live birth in the five years preceding the survey. Furthermore, a sub-analysis in the 2010-11 ZDHS on the content of ANC services among women who reported attending ANC also shows an inverse trend with increasing education and increasing wealth status in the proportion of women who had a blood sample taken. Similar trends are noted for proportions a) delivered in a health facility b) delivered by a skilled health worker and c) receiving a postnatal check in first two days after birth (ZIMSTAT and ICFI 2012), which are all opportunities for receiving an HIV test. This may indicate missed opportunities for HIV testing among those with lower education levels and poorer wealth status.

While lower levels of lifetime HIV testing uptake were noted for both women and men in the Midlands province, this was not true of testing uptake in the past 12 months. Reasons for this when compared with all other provinces are unclear and may need further exploration. Why HIV testing is lower among men and women of minority religions or non-religious is also unclear. In general, by religion, the study noted barriers to accessing healthcare services among people of the Apostolic Sect, whose religious beliefs shun seeking medical care and education of women (Maguranyanga 2011). It is therefore interesting that their access to HIV testing services does not differ from that of people of other religious beliefs, for both women and men.

Our study found that uptake of HIV testing is higher among women with more lifetime sexual partners, but no differences were noted among men with more lifetime sexual partners, nor are there differences in testing among men who reported ever paying for sexual intercourse. Though testing uptake is higher among women who reported consistently using condoms in the past 12 months, men reporting non-consistent condom use in past 12 months have higher testing uptake. Cross-sectional studies do not allow for determination of cause and effect (Mann 2003) and thus it is difficult to establish whether respondents' sexual risk behaviours preceded HIV testing uptake or vice-versa. Furthermore, testing uptake is higher among women with comprehensive knowledge of HIV and comprehensive accepting attitudes towards HIV, which could have been acquired in pretest or post-test counselling sessions or through mass media HIV education.

In one local prospective study, women who tested HIV-positive reported increased condom use in their regular relationships while women who tested HIV-negative were more likely to adopt risky behaviours in terms of numbers of previous or concurrent partnerships (Sherr et al. 2007). In another meta-analysis of 11 independent United States studies (Marks et al. 2005), the prevalence of high-risk sexual behaviours was reduced substantially after people became aware that they were HIV-infected. In view of this, it is evident that men with sexual risk behaviours that put them at risk of being infected with HIV are not accessing HIV testing services, and this needs improvement.

Testing uptake in a person's lifetime is higher among both men and women who were found to be HIV-infected, while testing uptake in the past 12 months was higher only among HIV-infected men. Despite this, just over a quarter of women and half of men who were found to be HIV-infected have never been tested, and these proportions are higher among those not tested in the past year. This highlights missed opportunities for diagnosis and entry into HIV treatment and care services among HIV-infected individuals.

While a significant proportion of HIV-infected individuals were previously tested, it is unclear whether HIV infection preceded testing, or vice-versa. For instance, one South African survey (Kranzer et al. 2011) revealed an increasing burden of undiagnosed HIV with increasing time period since the last HIV test, among individuals who had been previously tested. This underscores the need for frequent retesting so that individuals know their true HIV status. It may therefore be beneficial if future DHS surveys also ask respondents who were previously tested what their current HIV status is, with the aim of identifying the proportion that are unaware of their true HIV status.

Limitations of our study that may have affected the validity of our findings include recall bias among respondents of reported past events. Also, pregnancy status for women, history of STIs and HIV testing status were all self-reported and could not be validated. The interpretation of our results is also limited due to the cross-sectional design of the study, which does not permit determination of cause and effect. However, the large sample of the study enables us to draw conclusions that are nationally representative and can be inferred to the general Zimbabwean population.

CONCLUSIONS

Antenatal care visits and other maternal health services are an important means of accessing HIV testing services for women, and also through male involvement for men with pregnant partners. Given the increased HIV testing uptake among those with higher education levels and increased wealth status, policymakers should look into strategies for scaling up HIV testing in the lower level-income and lower-educated populace. In general, HIV testing uptake is lower among men than women, and this calls for policymakers to devise or strengthen strategies aimed at improving testing uptake among men.

Feasible options include continued integration of HIV testing with HIV prevention measures such as male circumcision provided in public health facilities. Since Zimbabwe introduced voluntary medical male circumcision in 2009, there have been 204,000 circumcisions done by December 2013, although this falls short of the targeted 80% coverage (1,912,595) among men age 15-49 (WHO et al. 2011). We therefore anticipate that testing uptake will increase significantly among men as Zimbabwe strives to reach the 80% coverage targets.

Conducting HIV testing campaigns or mobile VCT teams (Morin et al. 2006) can also be a feasible and acceptable strategy for increasing testing among men and the lower-educated and lower income-level populations. Also, given that HIV-related behaviour-change communication through mass media interventions has been shown to have a positive impact on knowledge of HIV transmission and reduction of high-risk sexual behavior (Bertrand et al. 2006), these strategies can help improve HIV testing uptake when disseminated with HTC communication. Lastly, the fairly high proportion of individuals with undiagnosed HIV highlights the need for HIV testing among first-timers and also for retesting among people who may have previously tested HIV-negative, so that these individuals can access HIV treatment and care services. Further studies on linkages between HIV testing and access to HIV treatment and care services among the HIV-infected may also provide additional useful information to policymakers on the extent to which testing leads to treatment and care.

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