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Research

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A Multilevel Analysis of the Determinants of HIV Testing in Zimbabwe: Evidence from the Demographic and Health Surveys

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ABSTRACT

Introduction: Zimbabwe is still burdened with HIV epidemic and the government has an ambitious aim in the post-2015 era to end the AIDS epidemic by 2030. To achieve this, the government has set up the 90-90-90 strategic milestones to be achieved by 2020. It is a daunting task to increase HIV testing uptake from the current estimate of 56% to 90% to meet these targets. The current government's initiative requires an understanding of determinants of HIV testing.
Objectives: The specific objectives of this study are to: (i) identify the individual and community-level determinants of HIV testing, focussing on predisposing, enabling and perceived need factors (PREP); and (ii) establish gender differences.
Materials and Methods: We applied multilevel logistic regression models to nationally-representative samples of 17,797 women and 14,587 men from the 2005/2006 and 2010/2011 Zimbabwe Demographic and Health Surveys (ZDHS) to examine the determinants of HIV testing.
Results: HIV testing uptake increased significantly between 2005/2006 and 2010/2011, especially for women (females OR=5.60; males OR=2.57). Most PREP factors associated with HIV testing are largely consistent with patterns in Southern Africa (e.g., higher uptake by women and those who are wealthier), but unique patterns have also emerged. In particular, results reveal important gender differences: rural residence is associated with lower uptake of HIV testing for women (OR=0.74) but higher for men (OR=1.16); community wealth is a more important factor in enabling HIV testing than household wealth for women, but the converse is true for men; and individual-level, rather than community-level stigma is important for women, while for men, it is community-level stigma that is important.
Conclusion: Observed gender disparities in determinants of HIV testing calls for gender specific response. Couple-oriented HIV counselling and testing services where men accompany their spouse to HIV screening during pregnancy may help increase HIV testing uptake for males and reduce gender disparities.

KEY WORDS: HIV testing; Community-level determinants; Gender disparity; Multilevel analysis; Zimbabwe demographic and health surveys (ZDHS).

ABBREVIATIONS: MQL: Marginalized Quasi Likelihood; PQL: Penalized Quasi Likelihood; VPC Variance Partition Coefficient; ZDHS: Zimbabwe Demographic and Health Surveys; STD Sexually Transmitted Diseases.

INTRODUCTION

A national HIV testing program was implemented a decade ago in Zimbabwe, providing HIV treatment to millions of HIV-positive individuals, many of whom previously struggled with the illness due to unknown HIV status. By 2015, Zimbabwe sought to half new HIV infection prescribed by the World Health Organisation's (WHO's) strategic plan.[1] Although, it has been a daunting task, adult HIV prevalence in Zimbabwe has almost halved from its peak of nearly 30% around 1997 to around 13.7% in 2011.[2] HIV related deaths have also been reduced by over 60% as a result of a successful HIV testing, treatment and support programme.[2] However,

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despite government's efforts to stem HIV scourge, Zimbabwe remains one of the countries in Sub-Saharan African countries still burdened with HIV epidemic.[3] The current aim in the post-2015 era is to end the AIDS epidemic by 2030. To achieve this, the government, in collaboration with its partners have set up the 90-90-90 strategic milestones to be achieved by 2020. The milestones means that by 2020, 90% of all people living with HIV will know their HIV status, 90% of all people with diagnosed HIV infection will receive sustained antiretroviral therapy and 90% of all people receiving antiretroviral therapy will have viral load suppression.[4] HIV testing has been used as an entry point for both HIV prevention and treatment; and an early detection of HIV can add 15 years to a person's life span.[5] People have to get tested and know their HIV status to enable them to seek treatment and to choose preventative strategies. For this reason, HIV testing services need to be available and accessible to all people to enable easy utilisation.[6]

To ensure targets are met, Zimbabwe needs to improve HIV testing coverage, but scaling up HIV testing coverage; currently estimated at 56% can be daunting, given that HIV testing is voluntary. The success of the HIV self-testing programme will require a better understanding of the factors that influence people's HIV testing behaviour, which this study seeks to achieve. Existing studies have identified a range of factors to be associated with HIV testing, including: place of residence, gender, marital status, and socio-economic status.[7,8] Extant literature from Sub-Saharan African countries indicates that gender has been an important determinant of HIV testing behaviour. Specifically, the studies found that females were more likely to get tested for HIV than males,[9,10] due to reasons such as frequent access to health care services through maternal care.[11]

Besides gender, marital status has been found to be strongly associated with HIV testing and findings have been consistent across gender. Individuals who are divorced, widowed and married tend to have higher odds of HIV testing than never married individuals.[12-14] For example, married individuals were found to be 2.54 times more likely to be tested for HIV than never married individuals in South Africa.[15] Similarly, a study in Ivory Coast[16] found that never married individuals were 66% less likely to be tested than married people.

HIV testing is also influenced by enabling factors such as wealth status, education, HIV awareness and media exposure. Several studies have found that poorer individuals were less likely to test for HIV than those from wealthy households.[10,14,16] It has been noted that poverty is likely to be associated with lack of education, and lack of education implies that messages regarding HIV testing are often inaccessible.[7,17] Education is a key indicator of socio-economic status and more educated individuals are more likely to have better health[5] due their ability to have better access to health information and to understand and respond to such information. Socio-economic challenges may also decrease the likelihood of HIV testing, due to lack of financial resources that would enable individuals to have access to health care services.[18-21]

The effect of HIV/AIDS factors (e.g., stigma and discrimination, risk perception of HIV infection, risky behaviour, HIV awareness, or knowing someone who died of HIV/AIDS) on HIV testing may depend on an individual's predisposing factors such as age, education, marital status, social and economic status.[5,22] These interactions may lead to an increased risk perception of HIV infection which may in turn decrease the willingness to utilise health care services that are linked to HIV.[23] The risk perception of contracting HIV may either increases or decreases the likelihood of using health care services.[24] An example of this phenomenon could be that, since HIV prevalence is reported to be positively associated with higher socio-economic status and education,[25] individuals with higher educational attainment and those who are wealthier may perceive themselves to be at risk of HIV infection, and therefore have recourse for HIV testing, compared to those who are less well-off.[16]

There is also evidence of a positive association between HIV awareness and HIV testing,[14] and awareness and education are highly correlated.[26] However, Lepine et al[12] have argued that HIV awareness may be negatively associated with HIV testing if the awareness affects risk perception and associated behaviours. Firstly, because individuals who have a good understanding of HIV prevention and transmission methods could be less likely to adopt risky behaviour and thus may perceive themselves to have less need for HIV testing as they think they are less at risk.[27] Secondly, people who overestimate their likelihood of getting infected through their poor health knowledge could have higher odds of HIV testing thinking they are more at risk. This notion resonates with Musheke et al[28] who assert that the effect of HIV knowledge on HIV testing may be heterogeneous in the population. For instance education may determine access and exposure to HIV information and will affect the way this information is used to modify attitudes towards HIV testing.

Also, many studies have linked HIV infection with risky sexual behaviours, including multiple sexual partners, limited ability to negotiate safer sex, which may lead to lower rates of condom use and disclosure of HIV status.[12,19,29] All of these may lead to an increased risk perception of HIV infection, leading to lower or higher uptake of HIV testing. In line with the effects of risk perception on healthcare utilisation, studies have shown that perceived susceptibility as a result of risky sexual behaviour exacerbates risk perception of HIV infection, in turn leading to underutilisation of health care services.[22] On the other hand, existing literature also suggests that perception of being at risk of a disease is a prerequisite for behaviour change,[30] and that perceived high risk of infection causes people to take precautionary measure including HIV testing and knowing the results in order to reduce the risk of getting the virus.[12,16] According to health behavioural models[31] perceived susceptibility to a particular health problem (e.g., am I at risk of HIV?), perceived seriousness of the condition (e.g., how serious is HIV/AIDS?, how hard would my life be if I get it?), and cues to action (e.g., witnessing the death or illness of a close friend

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or a family member due to HIV) may move an individual to take necessary action or change their behaviour.[31] Therefore, knowing someone who died because of HIV is also a significant cue to action to an individual to test for HIV.[32]

At community level, the likelihood of HIV testing may increase for individuals who reside in communities with higher HIV prevalence, high poverty, high risk perception of HIV infection, or within easy access of HIV intervention programmes, compared to individuals living in other communities.[7,18,22,30] While HIV/AIDS stigma may exist within self as a result of imagined fear due to perceived risk of HIV infection based on self-assessment, [33] stigma can also be observed and exerted from the outside world (health care providers, family, community, and friends). Either form of stigma may lead to more people underutilising health care services.[26]

Since risky sexual behaviour may be linked to poverty in the community, people living in poor communities may perceive themselves to be at a high risk of HIV infection, and this may reduce the likelihood of uptake of HIV testing services in such communities.[34] Furthermore, availability and quality of health care services, for example availability of family planning and HIV testing services in the community, may motivate individuals to seek help.[8]

Research on the determinants of HIV testing has received considerable research attention. However, different studies have come up with different positions and it is challenging to reconcile existing findings and use them to inform our knowledge about HIV testing in Zimbabwe. Most available literature has focused on the association between HIV testing and individual-level factors.[8,16,26,35] However, implications of community influence on HIV testing has received limited attention. Also, most studies have tended to analyse the association of predisposing factors such as age, gender, marital status, etc., without taking into account the enabling factors such as resources and enabling environment that facilitates individual's behaviour. Working from the premises that community inequalities in access to health care services is as significant as individual level factors, it is essential and worthwhile to investigate and understand the effects of both individual and community-level determinants of HIV testing in the context of Zimbabwe.

CONCEPTUAL FRAMEWORK

The trajectory to HIV testing first needs to be explained before undertaking the analysis. In this regard, Andersen[36] provided a useful analytical framework for examining determinants of HIV testing. This theoretical framework is grounded in the notion that utilisation of health care services is dependent upon contextual situations, which in turn influences individual circumstances. The framework is conceptualised based on the predisposition, enablement and need for health care use.[36] What is vital in this approach is its emphasis on the joint effects of community and individual level factors that influence health care service utilisation. First, the level of HIV testing uptake is affected by predisposing factors which usually includes personal attributes of an individual such as demographic characteristics (i.e., age, gender, marital status, religion, ethnicity and others). Secondly, predisposing factors are assumed to operate through enabling and perceived need factors and these comprise of contextual and sometimes personal circumstance, representing the ability to use health care services. In this study, enabling factors are composed of an individual's income, access to media, and awareness of HIV, observed HIV stigma, HIV disclosure and confidential concern.[12] Thirdly, enabling factors are assumed to facilitate or inhibit individuals from accessing HIV testing services. However, whether an individual has a means to access health care services, there must be a need for them taking that action.[31] The need factors pertain to the perceived and evaluated assessment of one's health status which may compel the need for seeking health care services.[18] For that reason, perceived/need factors such as whether an individual had engaged in risky behaviour

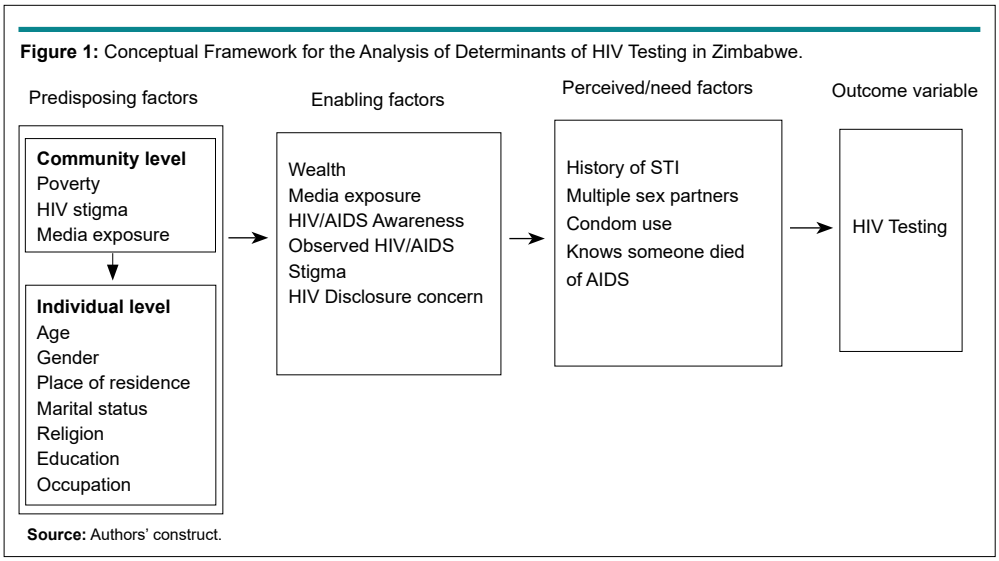

Figure 1: Conceptual Framework for the Analysis of Determinants of HIV Testing in Zimbabwe.

Source: Authors' construct.

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such as having multiple sex partners, or had history of sexually transmitted diseases (STD) and whether one knew someone who had died of HIV were also considered in the framework. The conceptual framework in Figure 1 provides a schematic display of the perceived determinants of HIV testing in Zimbabwe.

The accumulated effects of predisposing, enabling and need factors govern one's trajectory to HIV testing behaviour. Given the background of growing inequality in access to health care services in Zimbabwe, issues of community influence on HIV testing becomes at fore. A growing need exists for implication of both individual and community level effects on HIV testing. Such information will help the HIV prevention programs identify communities with high concentration of individuals who are likely to have been ever tested for HIV, as well as sub-populations that are not likely to be tested.[10] Guided by this conceptual framework, this study aims to understand individual and community-level factors associated with HIV testing. Specifically, the study aims to identify the predisposing, enabling and perceived need factors associated with HIV testing with particular focus on gender differences.

MATERIALS AND METHODS

The Data

This is a secondary data analysis study based on the 2005-2006 and 2010-2011 Zimbabwe demographic and health surveys (ZDHS), the first 2 nationally representative surveys to include HIV testing. The surveys were designed to provide national estimates of HIV in the population, including HIV testing coverage. The analyses is based on respondents aged between 15-59 years residing in 402 clusters, and the sample size was 32,384 of which 27.8% of males (n=14,587) and 43.7% of females (n=17,797) were ever tested for HIV. Overall, about 93% of those who tested for HIV received their test results. The individuals responded to a questionnaire survey asking questions related to their HIV testing history, socio-economic and demography background and health indicators such as individual's sexual behaviour, HIV related knowledge, attitude and behaviour and media exposure. The sample excluded the institutional population, which includes individuals living in hospitals, prisons and other institutions.

Outcome Variables

The key outcome variables of interest were whether the respondent was ever tested for HIV and received results. For each outcome variable, possible responses were 'yes' or 'no' if an individual had ever been tested for HIV or have received results or not.

Explanatory Variables

We identified a range of independent variables based on the conceptual framework described above, their presence in existing empirical literature and the sample distribution in the ZDHS datasets. The explanatory variables were clustered into specific categories; individual and community-level predisposing, enabling and perceived/need factors. These categories were considered to give the best representation of community and individual characteristics that are associated with HIV testing behaviour. Community-level HIV awareness, stigma and media exposure variables were imputed from relevant individual-level factors.

Individual-Level Socio-Economic and Demographic Predisposing Variables

While inclusion of wealth, occupation, education and media exposure may indicate the manifestation of economic position of an individual,[30] demographic factors such as gender, parity, religion, marital status and age are considered important because they may capture behavioural factors such as the perception of risk, acceptance of testing and sexual practice.[6] The following are factors which were included at individual level.

Gender: Gender plays a key role in health seeking behaviour and there is evidence from existing literature suggesting that women, due to reasons such as frequent access to health care services through antenatal care (ANC), are more likely to test and receive HIV test results than men.[11,12] The variable was used to compare utilisation of HIV testing services between males and females. This is a binary measure coded 1 if female and 0 if males.

Age: The ZDHS sample included females (aged 15-49) and males (aged 15-59) of reproductive age. Age was recorded into 5 categories: 15-24; 25-29; 30-34; 35-39; 40+. The variable was used to compare HIV testing behaviour between different age groups.

Marital status: This variable captures differentials in HIV testing behaviour between marital status categorises. It was recoded into 4 categories: never-married, married, widowed and divorced.

Type of place of residence: This variable captures HIV testing behaviour of individuals by urban/rural residence.

Level of education: This was one of the key variables, which captured socio-economic characteristics of individuals. The variable was recoded into 3 categories: primary, secondary and higher educational attainment.

Religion: Catholic and protestant followers tend to have higher odds of health care service utilisation.This behaviour has been interpreted as a consequence of greater social diversity within mainstream religious groups that facilitates change of behaviour towards health care services utilisation.[37] A categorical variable based on religious affiliation classified into: traditional/Catholic, Protestant, Pentecostal and Apostolic categories is included in the analysis.

Occupation: Economic dependency has been one of the major barriers to women's control over their health behaviour in developing countries. However, studies have shown that a woman's occupation is an important factor that influences her access to

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health care services. This is due to the fact that women who are working and earning money will have greater autonomy and control over financial resources, and thus they are more able to pay for health care services.[16] A categorical variable based on occupation is also included in the analysis.

Enabling Factors

Another explanatory domain in the conceptual framework relates to enabling factors. These are factors which promote or inhibit use of HIV testing services and they include enabling resources and environmental factors.

Household wealth: This variable was used as a measure of economic well-being. The index was constructed by DHS using principal component analysis to assign indicator weights based on household ownership of assets. This was a key variable of interest, and five wealth quintiles (poorest, poorer, middle, richer, and richest) were used in analysing the relationship between wealth and HIV testing behaviours.

Media exposure: This variable captures how individuals' exposure to media was associated with their HIV testing behaviour. Exposure to HIV/AIDS information through mass media may lead to high levels of awareness, which may in turn influence self-assessed risk of HIV infection and the need to test for HIV.[14] This variable was measured by 3 items relating to frequency of watching television, reading newspapers and listening to radio. An additive scale was imputed and classified into 3 level categorical variables: low, medium and high.

AIDS awareness: (1) AIDS awareness was derived from eight HIV related questions which consists of prevention and misconceptions about transmission. AIDS awareness index, was classified into 3 categories: low: if participants answered 3 or less questions correctly; medium: if answered up to 5 questions correctly; and high: if answered 6-8 questions correctly.

HIV related stigma: This referred to the respondent's attitude towards HIV developed from 4 questions of HIV related stigma, namely; 'If the respondent would buy vegetables from a vendor with HIV', 'can care for relative with HIV', 'would want an HIV-positive teacher to continue teaching', and 'would want others to know if a family member became infected with HIV'. The variable was classified into 3 categories: low: if not experienced any of the stigma indicators, medium: if experienced 1-2 of the stigma indicators and high stigma: if experienced 3-4 stigma indicators.

Observed stigma: Like in Sambisa,[26] this study uses this variable to assess individual's attitude towards people living with HIV. People act upon what they see happening around them.[23] People may have been discouraged from being tested for HIV if they observed people living with HIV being discriminated against in their communities or families. In a study by the Government of Zimbabwe,[38] a significantly number of people living with HIV reported that they had been forced to change residency or denied accommodation. We therefore, constructed observed 'stigma variable' from the following set of prompt items; whether participant knows someone suspected to have HIV/AIDS who has been denied health services, knows someone suspected to have HIV/AIDS who has been denied involvement in social events and knows someone suspected to have HIV who has been verbally abused. For the observed stigma variable, the additive scale was split into two categories: yes (1 or more) or no (0)

Disclosure and confidentiality: Not much attention has been given to HIV status disclosure and confidentiality dynamics within private and public places. People do not worry about how to disclose their HIV sero-status only, but they also worry about how their health information is shared.[39] Mashuba and Hemalata[37] pointed out that people living with HIV may have to disclose their HIV status to their family members, health care workers, employers, religious leaders, counsellors and community members. The disclosure and issues with how health information is going to be shared if results come out positive can act as a barrier to access to HIV testing services. Disclosure and confidentiality concern was a variable measured by a single item; 'would want others to know if a family member became infected with HIV and coded 'yes' if someone reported that they would want others to know if a family member became infected, and 'no' if they didn't want others to know.

HIV and risky sexual behaviour variables

Finally the perceived need factors were considered. The conceptual framework suggests that for someone to take an action on his/her health there must be a perceived risk and a need to do so.[31] Here the perceived need factors are operationalized by whether someone feels he/she is at risk HIV infection because of their history of STI, multiple sex practice or knowing someone who died of HIV. Literature suggests that people get tested for HIV following the Illness or death of people they know.[39] Each perceived need variable was coded 'yes or no'.

Condom used in the last sex encounter: This is a binary variable. Those who had not used condom takes the value of 0, and those who have used take the value of 1.

Multiple sex partners: This also is a binary variable, which takes the value of zero if an individual did not have sex or had sex with only one partner and takes the value of one if an individual had sex with more than one sex partner in the last 12 months preceding the survey.

History of Sexually Transmitted Infection (STI): This is a binary variable. Those who have never had STI take the value of 0, and those who have ever had STI takes the value of 1.

Methods of Analysis

A two-level logistic regression model for binary response was

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employed. Individuals who responded to the questionnaire were considered as level-1. Other studies which investigated multilevel determinants of HIV testing behaviour considered household[7] and couples,[12] as levels of analysis. This study did not consider household as a level of analysis because the average number of individuals in a household who have been ever tested for HIV as contained in the dataset was too small to be considered as a level of analysis. The study did not also consider couples; this was premised on the fact that never married people are less likely to be tested for HIV than married, divorced or widowed people.[14,25] Therefore, in this study of the determinants of HIV testing, level-2 of analysis was represented by a cluster, which is defined as a community.

Multilevel Logistic Models

We recognize that communities may share similar socio-economic and demographic characteristics, resources and experiences[7] and it is therefore, reasonable to assume that residents of one community maybe more similar to each other with respect of their HIV testing behaviour. With such background knowledge, it can be argued that variations in HIV testing in Zimbabwe may not have been as a result of individual characteristics alone, but of the effects of community effects in which they live as whole.[10,30] For that reason, this study used 2 level logistic regression models to investigate the community and individual level factors that influence HIV testing behaviour. The basic form of 2 level random intercepts logistic regression model used can be expressed as:

$$Logit(\pi_{ij}) = Log\,[\pi_{ij}/(1-\pi_{ij})] = \beta_0 + \beta X'_{ij} + u_{0j}$$

$$\text{Var } u_{(0j)} = \sigma^2_{u0}$$

Where(π_{ij}) is the probability of having ever been tested for HIV for an individual i, in the j^{th} community. β_0 is the regression intercept, X'_{ij} is the vector of covariates defined at individual or community level; β is the associated vector of usual regression parameter estimates, and is shared by all communities, while the random effect u_{0j} is specific to community$_j$.

Before including any explanatory variables in the models, it was crucial to know how much between communities variations were there in the propensity to test for HIV. To assess this, we look at the estimated value of σ^2_{u0}, which is the variance of the u_{0j} terms. We use a threshold model approach which measures proportions at group level:

$$\rho = \sigma_U^2/(\sigma_U^2 + \sigma_\varepsilon^2)$$

Where σ_U^2 is the total variance at community level, and σ_ε^2 is the total variance at individual level. For the multilevel logistic regression model, the level-1 residuals are assumed to have a standard logistic distribution with mean zero and variance $\sigma_\varepsilon^2 = \pi^2/3$ where π is the constant 3.14159. Thus, $\rho = \sigma_U^2/\sigma_U^2 + 3.29$.[40]

Modelling Approaches

Since our analysis is based on hierarchical data given the ZDHS multi-stage sampling design, it is necessary to use techniques that consider the possible dependence of individuals clustered in the community.[40] Conventional regression analysis techniques assume that individual observations are independent from one another. If this assumption is violated, estimates of the regression coefficients can be biased and standard errors may be underestimated. Multilevel regression techniques make it possible to take into account the possible dependence of the outcome variable between people in the same community.[40] Four models were fitted in the analysis. Model 0 was an empty model with year of survey as the only co-variate. This was fitted to decompose the total variance between individual and community level. Background demographic and socio-economic factors were then added in Model 1. The next model (Model 2) was composed of background demographic/socio-economic factors and HIV and risky sexual behaviour; enabling and need factors. The final model (Model 3) took account of community factors.

Measures of fixed effects, that is the effects of individual-level and community-level determinants of HIV testing were reported in terms of odds ratios, whilst the measures of variation (random effects) were expressed in terms of intra-class correlation coefficient (ICC). The estimation procedure was based on quasi-likelihood methods, starting with the default procedure 1st order marginalized quasi-likelihood methods (MQL) and extending to 2nd order penalized quasi likelihood (PQL). The 2nd order estimation was preferred because it is an improved approximation procedure.[41]

RESULTS

Descriptive and Bivariate Analysis

Cross-tabulation analysis, including chi-square tests were undertaken to assess the distribution of individuals who were ever tested for HIV by predisposing, enabling and need factors.Relevant means or proportions were imputed for community-level variables. The proportions of individuals who were ever tested for HIV and received their results are presented in Table 1, based on 2005-2006 and 2010-2011 ZDHS.

Percentage Distribution of Individuals Ever Tested for HIV and those Who Received the Results

Table 1 presents the proportion of individuals who ever tested for HIV; and the proportion that received results among those who were ever tested for HIV in the 2005-2006 and 2010-2011 surveys. The coverage of HIV testing was significantly higher for females (26%) *versus* males: (18 %), (p<0.005) in the 2005-2006 survey. By 2010-2011 the coverage of HIV testing increased for both males and females to 62 % for females: *versus* males: 38% (p<0.005). Among those who ever tested for HIV, 89% of males and 85% of females received results in the 2005/2006 survey; these percentages increased to 93% for males

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Table 1: Trends in HIV Testing Coverage and Receipt of Results.

Survey year	Proportion who have ever been tested for HIV			
	Males		Females	
	Weighted %	Unweighted cases	Weighted %	Unweighted cases
2005-6	17.7	7107	25.7	8849
2010-11	37.6	7480	61.5	8948
All	27.9	14587	43.7	17797
Survey year	Proportion who received results among those who have ever been tested for HIV			
	Males		Females	
	Weighted %	Unweighted cases	Weighted %	Unweighted cases
2005-6	88.6	1258	85.1	2274
2010-11	92.8	2812	96.4	5503
All	91.5	4070	93.1	7777

and 96% for females in the 2010-2011 survey.

Distribution of HIV Testing by Background Characteristics

A bivariate analysis was used to assess the association between each independent variable set out in the framework and the study outcomes. The Chi-square tests showed association between key variables and HIV testing, but not with receipts of HIV test results. The sample size of those who did not receive results after HIV test was too low to allow for a meaningful multivariate multilevel logistic regression analysis. Therefore, the determinants of receipts of HIV test results were excluded from further analysis. Given that over 90% of those who tested for HIV collected their results,[2] policies needs to focus mainly at increasing uptake of HIV testing in Zimbabwe.

The results in Table 2 indicated that there was an association between HIV testing and the following factors: age, place of residence, marital status, educational attainment, occupation, household wealth, exposure to media, and HIV awareness. The highest proportion (58%) was observed among females in the age group (25-29); compared to males (38%) in same age group. For both males and females, HIV testing coverage was lowest among individuals below the age of 20 years, followed by those aged 40 years and above. Because of disparities in socio-economic development between urban and rural areas, place of residence was also a key factor in determining access to HIV testing services. A higher proportion of people who ever tested for HIV were from urban than rural areas for both males and females. With respect to marital status, for females, the highest coverage of HIV testing was observed among those who were married (52%), whilst for men it was among those who were widowed (41%). As we expected, HIV testing coverage increased by educational attainment. For example only 19% of males and 36% of females with primary education ever tested for HIV, compared to 53% and 65% males and females with higher educational attainment, respectively.

Distribution of HIV Testing by Enabling and Need Factors

Table 3 shows differentials in HIV testing based on enabling and need factors, including household wealth, media exposure, HIV/AIDS awareness, observed stigma, and HIV test results disclosure concern. The proportion of individuals who were ever tested for HIV was higher among those from wealthier households. For example, 21% of males from poorest households *versus* 39% from richest household reported ever being tested for HIV. Whilst, HIV testing was higher among individuals who reported having higher media exposure or HIV awareness, it was lower among those who reported having observed HIV stigma and those with HIV disclosure concerns.

Individuals who engage in multiple sexual partnerships, have history of (STI), and do use condoms or those who knew someone who had died of HIV may consider themselves to be at a high risk of HIV infection. Therefore, they may perceive themselves as having a need to test for HIV.[12] In our sample, a higher proportion of individuals (35% of males and 57% of females) who mentioned that they have a history of STI had been tested for HIV than those who did not have a history of STI (28% of males and 43% of females). Furthermore, a higher proportion who reported having used condoms in the last sexual intercourse had been tested for HIV compared with individuals who did not use condoms (e.g. 62% *versus* 42% for females). For both males and females, those who reported having multiple sexual partners and those who knew someone who died of HIV were less likely to report having been tested for HIV than their counterparts without multiple partners or who did not know anyone who had died of HIV/AIDS, contrary to expectation.

The results from bivariate analysis suggested a significant association between variables considered in the framework. However, given that bivariate associations can be influenced by confounding factors, a multivariate analysis that simultaneously takes into account these effects was used to accurately establish the independent predictors of HIV testing behaviour.[42]

Multivariate Multilevel Analyses

Multivariate analyses here start with combining the data for males and females across the 2 surveys to assess gender differ-

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Table 2: Distribution of HIV Testing by Background Socio-Economic and Demographic Characteristics.

Background characteristics	Proportion ever been tested for HIV by background characteristics						All Cases (unweighted)
	Males			Females			
	Weighted %	N	*p*-value	Weighted %	N	*p*-value	
Age groups*			<0.05			<0.05	
15-24	16.7	6533		35.4	7717		14250
25-29	37.7	2218		57.9	3089		5307
30-34	36.3	1838		51.6	2470		4308
35-39	37.1	1462		48.0	1859		5321
40+	34.6	2536		36.5	2660		5196
Residence*			<.005			<.005	
Urban	34.6	4992		47.9	6571		11563
Rural	24.4	9595		41.3	11224		20819
Marital status*			<0.05			<0.05	
Never married	17.7	6724		22.9	4695		11419
Married	36.7	7154		51.9	10529		17683
Widowed	41.1	180		46.5	1231		1411
Divorced	34.2	529		49.1	1340		1869
Education level *			<0.05			<0.05	
Primary	18.8	4176		35.5	6065		10241
Secondary	29.6	9523		46.9	11083		20606
Higher	52.8	888		64.5	647		1535
Religion*			<0.05			<0.05	
Roman catholic	26.9	6837		42.2	4754		11591
Protestant	29.4	2202		41.3	3734		5936
Pentecostal	33.6	1944		47.2	3343		5287
Apostolic sect	25.8	3604		44.4	5964		9568
Occupation*			<0.05			<0.05	
Unemployed	18.5	4634		40.7	10278		14912
Professional	52.1	1056		72.6	1796		2852
Manual work	46.0	2121		70.8	729		2850
Agriculture	36.4	1842		58.6	1218		3060

*All variables statistically sig at 5% level <0.05

ences. Although, the association patterns observed in bivariate analysis were relatively consistent with gender, it is reasonable to recognise that the determinants of HIV testing among males and females are likely to be different.[9] For this reason, multivariate analysis is presented separately for males and females to explore the differences in predictors of HIV testing by gender. Results for the combined sample are given in Annexure, while tables 4 and 5 present estimates for females and males respectively. There is evidence of a significant gender disparity in HIV testing, with females being about twice as likely to be tested (average OR=1.8) as compared to males of similar characteristics (See Annexure).

The Determinants of HIV testing among females

Table 4 presents the odds ratios (ORs) associated with HIV testing for females. With all variables excluded, the results show females were 5.4 times more likely to have been HIV tested in 2010/2011 than in 2005/2006 survey. When all predisposing variables were included in Model 1, the odds of HIV testing substantially increased to 6.9. Females from rural areas were 36% less likely to test for HIV than those from urban areas. As females grow older, they have a tendency to avoid HIV testing. For example, females aged between 30-34 years and those who were 40 years and above were 31% and 65 % less likely than young individuals aged 15-24 years to test for HIV, respectively. Married females were 2.1 times while those who were widowed and divorced were 2.4 and 1.8 times more likely to test for HIV compared with those who never married. Also females who were professionals and those with manual jobs had 1.4 times higher odds of HIV testing than those who were unemployed. Again, the likelihood of HIV uptake increased significantly with birth order. For instance, birth order 2 was associated with 5.4 times higher odds of HIV testing than birth order 0. Furthermore, in-

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Table 3: Distribution of HIV Testing by Enabling and Need Factors.

Variable	Proportion ever been tested for HIV by enabling and need factors						
	Males			Females			
	Weighted %	N	*p*-value	Weighted %	N	*p*-value	All cases
Wealth *			<0.05			<0.05	
Poorest	20.7	2513		38.1	3227		5740
Poorer	21.3	2638		39.6	3143		5781
Middle	24.3	2712		42.9	3165		5877
Richer	30.1	3475		48.6	3925		7400
Richest	39.1	3249		46.9	4335		7584
Media exposure*			<0.05			<0.05	
Low	24.3	9446		44.1	12396		22742
Medium	37.8	3245		48.2	2662		5907
High	28.7	1877		34.4	1804		3681
HIV awareness*			<0.05			<0.05	
Low	19.2	661		23.8	1117		1778
Medium	33.8	7694		51.6	10174		17868
High	21.6	6232		34.7	6504		12736
Observed stigma*			<0.05			<0.05	
No	16.5	5148		47.3	14782		19930
Yes	22.4	9439		30.6	3013		12452
Disclosure concern*			<0.05			<0.05	
No	28.7	8226		44.3	9982		18208
Yes	26.9	6361		42.9	7813		14174
Need/risk perception factors							
History of STI*			<0.05			<0.05	
No	27.7	14204		43.3	17248		31452
Yes	35.2	383		57.2	547		930
Condom use*			<0.05			<0.05	
No	36.0	12057		42.1	16374		28431
Yes	37.1	2530		62.4	1421		3951
Multiple sexual partners*			<0.05			<0.05	
No	31.2	7501		47.4	11698		19199
Yes	24.5	6576		36.7	5931		12507
Know someone died of HIV*			<0.05			<0.05	
No	29.9	11089		47.3	14313		25402
Yes	21.7	3490		30.7	3261		6751

*Statistical significance at 5% level $p<0.05$.

dividuals with secondary or higher educational attainment were found to be 1.8 and 3.6 times more likely to have been tested for HIV compared with those with primary or no educational attainment. Compared with empty model 0, the inclusion of individual level variables in Model 1 increased the intra-community correlation to 6.8%, with approximately 21.4% of proportional change in variance unexplained.

Model 2 controlled for the enabling, perceived and need factors. The results showed that, although slightly reduced, the background characteristic factors remained significantly associated with HIV testing when enabling, perceived and need factors were controlled for. However, controlling for model 2 factors substantially explained the effect of place of residence such that place of residence was no longer significantly associated with HIV testing for females. Enabling factors such as wealth, media exposure and HIV awareness were found to be associated with HIV testing for females. Being wealthier was associated with increased odds of HIV testing. For instance, females in the richest quintile households were 1.3 times more likely to test for HIV

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Table 4: Average Odds of HIV Testing from Multilevel Logistic Regression Models (95% Confidence Intervals are given in Square Brackets)-Females.

Parameters	Model 1	Model 2	Model 3
Survey (2005-6)			
2010-11	5.39 [4.83-6.02]*	6.89 [6.08-7.79]*	6.91 [6.11-7.82]*
Residence (urban)			
Rural	0.74 [0.67-0.83]*	0.96 [0.82-1.11]	1.08 [0.91-1.29]
Age groups (15-24)			
25-29	1.02 [0.91-1.14]	0.93 [0.83-1.05]	0.93 [0.3-1.05]
30-34	0.69 [0.61-0.79]*	0.62 [0.54-0.71]*	0.62 [0.54-0.71]*
35-39	0.51 [0.44-0.59]*	0.46 [0.39-0.53]*	0.46 [0.39-0.53]*
40+	0.35 [0.30-0.40]*	0.31 [0.27-0.36]*	0.31 [0.26-0.36]*
Marital status (never married)			
Married	2.12 [1.85-2.43]*	2.23 [1.94-2.57]*	2.23 [1.94-2.57]*
Widowed	2.43 [2.00-2.95]*	2.40 [1.97-2.92]*	2.39 [1.97-2.91]*
Divorced	1.76 [1.47-2.11]*	1.71 [1.45-2.10]*	1.74 [1.45-2.09]*
Occupation(unemployed)			
Professional	1.41 [1.24-1.63]*	1.34 [1.17-1.54]*	1.34 [1.17-1.54]*
Manual work	1.41 [1.17-1.70]*	1.36 [1.12-1.64]*	1.34 [1.11-1.63]*
Agriculture	1.03 [0.88-1.19]	0.98 [0.84-1.15]	0.98 [0.84-1.14]
Religion (Catholic)			
Protestant	1.10 [0.99-1.22]	1.05 [0.94-1.17]	1.04 [0.94-1.17]
Pentecostal	1.08 [0.97-1.21]	1.05 [0.94-1.17]	1.04 [0.93-1.17]
Apostolic	0.93 [0.85-1.02]	0.96 [0.87-1.06]	0.96 [0.87-1.05]
Education (primary)			
Secondary	1.78 [1.63-1.94]*	1.56 [1.43-1.71]*	1.55 [1.42-1.70]*
Higher	3.60 [2.91-4.44]*	2.79 [2.24-3.47]*	2.78 [2.24-3.46]*
Enabling and perceived/need factors			
Wealth (poorest)			
Poorer		1.05 [0.93-1.19]	1.03 [0.91-1.17]
Middle		1.20 [1.06-1.37]*	1.14 [0.99-1.31]
Richer		1.24 [1.07-1.45]*	1.15 [0.97-1.36]
Richest		1.27 [1.05-1.53]*	1.16 [0.95-1.42]
Media exposure (low)			
Medium		1.21 [1.09-1.35]*	1.21 [1.09-1.34]*
High		1.67 [1.42-1.97]*	1.67 [1.42-1.97]*
HIV/AIDS Awareness(low)			
Medium		1.59 [1.31-1.93]*	1.59 1.31-1.93]*
High		2.04 [1.72-2.43]*	2.04 [1.71-2.43]*
Observed AIDS stigma(no)			
Yes		1.07 [0.90-1.27]	1.06 [0.90-1.26]
HIV disclosure concern(no)			
Yes		0.82 [0.74-0.90]*	0.81 [0.74-0.89]*
Knows someone died with Aids(no)			
Yes		1.23 [1.08-1.41]*	1.23 [1.08-1.41]*
History of STI (no)			
Yes		1.55 [1.27-1.89]*	1.55 [1.27-1.90]*
Community factors			
Poverty – gm			0.73 [0.56-0.94]*
Random Variance (SE)	0.239 (0.025)*	0.22 (0.024)*	0.218 (0.024)*
(VPC)=ICC(%)	6.8	6.3	6.2

VPC=Variance Partition Coefficient, ICC=intra-cluster correlation, *Statistical significance at 5% level $p<0.05$.

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than those from the poorest households. Similarly, those with higher levels of media exposure and HIV awareness had higher odds of HIV testing compared with their counterparts with lower levels of media exposure or HIV AIDS awareness. The results relating to perceived and need factors suggest that having disclosure concerns was associated with reduced odds of being tested for HIV by 18% compared with females with no disclosure concerns. On the other hand, having a history of STIs and knowing someone who died of HIV was associated with increased odds of HIV testing. The results provide no evidence of a relationship between HIV testing and observed stigma among females.

In the final model (Model 3), poverty in the community was the only community-level variable found to be significantly associated with HIV testing for females. Living in a community with a high proportion of individuals living in poverty was associated with reduced odds of HIV testing.The estimates for household wealth diminished after we controlled for community poverty such that household wealth was no longer significantly associated with HIV testing.

The results of the variance components model (i.e the empty model) and other models in Table 4 suggest that most of the variation in HIV testing for females was at the individual level. However, there were also some variation at the community level as indicated by the significant random variance in reporting of ever being tested for HIV across communities. As shown by the variance partition coefficient (VPC), the ICC was estimated at about 6-7%, even after controlling for individual and community level factors in Table 4. Thus, about 6% of the total unexplained variation in HIV testing could be attributed to unobserved community-level effects with the remaining 94% of unexplained variation attributable to individual–level factors.

The Determinants of HIV testing among males

The results for males (Table 5) slightly differed from those for females. As with females, the odds of HIV testing for males were higher in 2010/2011 than in 2005/2006, but the odds of HIV testing for males were lower by 3.03 points compared with the odds for females between the same periods (OR=5.60 females *versus* OR=2.57 males). This suggests that the increase in uptake of HIV testing was greater for women than men. In comparison with female's estimates, some results for males also differ when we controlled for background characteristics. It is noticeable that males residing in rural areas were about 1.2 times more likely than those from urban areas to have ever been tested for HIV. This finding differs with that of female which suggested that rural residence was associated with lower odds of HIV testing than urban residence. Results also revealed that being older is associated with lower odds of HIV testing for females, but not for males. Being married was associated with reduced odds of HIV testing by 32% for males, while being widowed was associated with increased odds by 47% compared to being never married. Unlike females, being a manual worker or working in agricultural sector was associated with increased odds of HIV testing for males.

Also differing from females, the odds of being tested for HIV was 21% higher for individuals belonging to Pentecostal church and 16% lower for those belonging to Apostolic faith, compared with those from Roman catholic church for males, but not for females. Education was found to be positively associated with HIV testing, with those with higher educational attainment exhibiting increased odds of HIV testing for both males and females.

Model 2 controlled for enabling, perceived and need factors. Comparing female and male, both wealth and media exposure were found to be associated with HIV testing. Like for females, being wealthier and having exposure to media were associated with increased odds of HIV testing for males. Similarly, males exposed to media messages were more likely than their counterparts with less media exposure to have tested for HIV. Among perceived and need factors that were associated with HIV testing were condom use, knowing someone who died of HIV and history of STI. The results suggest that those who did use condoms in their last sex encounter were 1.6 times more likely to have been tested for HIV than those who did not use condoms. Meanwhile, those who reported knowing someone who died of AIDS and those with a history of STI were 1.3 and 1.7 times more likely to test for HIV than their counterparts who did not know of anyone who had died of AIDS or had no history of STI. Circumcised males were about 1.3 times more likely to have been tested than those not circumcised. In the final model 3, the results showed that living in a community with a high proportion of individuals with stigma was associated with reduced odds of HIV testing. Other community level factors such as poverty and media exposure were not associated with HIV testing for males. Controlling for community-level stigma in Model 3 considerably reduced the estimates for place of residence such that rural residence was no longer significant for males.

The results for different models in Table 5 showed that most of the variation in HIV testing for males was at the individual level, but there were also some variation at community level as indicated by significant community-level random variance. The VPC (i.e., the ICC was estimated at about 2.5%, which was the proportion of total unexplained variability in HIV testing that could be attributed to unobserved community level effects. This implies that most (i.e., about 97.5%) of the unexplained variation in HIV testing was attributable to unobserved individual-level factors.

DISCUSSION, CONCLUSION AND RECOMMENDATION

Key Findings

The main objectives of this study were to identity individual and community-level factors associated with HIV testing in Zimbabwe, and establish gender disparities. Overall the results show

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Table 5: Average Odds of HIV Testing from Multilevel Logistic Regression Models (95% Confidence Intervals are given in Square Brackets)-Males.

Parameters	Model 1	Model 2	Model 3
Survey (2005-6)			
2010-11	2.57 [2.28-2.91]*	2.92 [2.53-3.37]*	3.04 [2.63-3.53]*
Residence (urban)			
Rural	1.16 [1.01-1.33]*	1.17 [1.02-1.34]*	1.13 [0.99-1.30]
Age groups (15-24)			
25-29	0.30 [0.24-0.38]*	0.37 [0.29-0.48]*	0.37 [0.29-0.48]*
30-34	1.04 [0.85-1.27]	1.04 [0.85-1.27]	1.04 [0.85-1.27]
35-39	0.93 [0.76-1.14]	0.93 [0.76-1.14]	0.93 [0.76-1.14]
40+	0.94 [0.76-1.15]	0.94 [0.76-1.16]	0.94 [0.76-1.15]
Marital status (never married)			
Married	0.68 [0.59-0.77]*	0.68 [0.59-0.77]*	0.57 [0.49-0.68]*
Widowed	1.47 [1.06-2.03]*	1.47 [1.06-2.03]*	1.23 [0.87-1.74]
Divorced	1.00 [0.82-1.22]	1.00 [0.82-1.22]	0.77 [0.62-0.96]*
Occupation(unemployed)			
Professional	1.18 [1.00-1.39]	1.17 [0.98-1.38]	1.16 [0.98-1.38]
Manual work	1.37 [1.20-1.58]*	1.35 [1.17-1.55]*	1.35 [1.18-1.55]*
Agriculture	1.20 [1.03-1.39]*	1.18 [1.02-1.37]*	1.20 [1.03-1.40]*
Religion (Catholic)			
Protestant	1.21 [1.05-1.40]*	1.25 [1.09-1.45]*	1.26 [1.09-1.45]*
Pentecostal	0.96 [0.84-1.09]	0.99 [0.87-1.12]	0.99 [0.87-1.13]
Apostolic	0.84 [0.74-0.95]*	0.85 [0.75-0.96]*	0.85 [0.75-0.96]*
Education (primary)			
Secondary	1.89 [1.29-2.76]*	1.82 [1.24-2.66]*	1.88 [1.28-2.75]*
Higher	3.03 [2.01-4.57]*	2.90 [1.92-4.37]*	3.00 [1.98-4.54]*
Enabling and perceived/need factors			
Wealth (poorest)			
Poorer		1.01 [0.88-1.18]	1.02 [0.88-1.19]
Middle		1.16 [1.01-1.35]*	1.18 [1.02-1.36]*
Richer		1.25 [1.06-1.47]*	1.26 [1.07-1.49]*
Richest		1.62 [1.34-1.96]*	1.65 [1.36-2.00]*
Media exposure (low)			
Medium		1.12 [1.01-1.25]*	1.12 [1.01-1.25]*
High		1.53 [1.35-1.73]*	1.54 [1.36-1.74]*
Condom used (no)			
Yes		1.63 [1.43-1.86]*	1.63 [1043-1.86]*
Knows someone died of Aids(no)			
Yes		1.26 [1.11-1.43]*	1.26 [1.11-1.44]*
History of STI (no)			
Yes		1.46 [1.15-1.85]*	1.45 [1.14-1.84]*
Community factors			
Stigma –gm			0.55 [0.34-0.87]*
Random effects			
Variance (SE)	0.082 (0.019)*	0.084 (0.019)*	0.083 (0.019)*
(VPC)=ICC(%)	2.4	2.5	2.5

VPC=Variance Partition Coefficient; ICC=intra-cluster correlation; *Statistical significance at 5% level $p<0.05$.

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that, HIV testing is improving as indicated by higher odds in 2010/2011 than in 2005/2006 surveys. This finding applies to both males and females, but the main difference lies in the degree females were more influenced to test for HIV in the 2010/2011 survey. This may be that most of females have been responding to calls for HIV testing during maternal health care services than males. Although, males have not been a focal target for HIV testing during antenatal care, recent initiatives have encouraged men to accompany their partners to health facility for HIV testing during pregnancy.

The two objectives were addressed by applying multilevel logistic regression models to separate samples by gender to identify and compare individual and community-level determinants of HIV testing among women and men. Measures of individual-level predisposing factors (i.e gender, age, educational attainment, marital status, household wealth, media exposure) showed significant associations with HIV testing. As expected, higher odds of having been tested for HIV were observed among females than males. Several studies conducted outside Zimbabwe, reported similar results to those found here with reference to differences in HIV testing between sexes. For example, a study conducted by Weiser et al[14] in Botswana and Mitchel et al[7] in ten Southern African countries are comparable to the results found here, showing a significantly higher uptake of HIV testing for females than males. This may be explained as follows: First, it is possible that women with little control over their sexual activities of their partners and more vulnerable to infection by their partners, may have perceived themselves to be at a high risk of HIV infection and consequently this may have acted as a cue for HIV testing.[31] The second explanation could be the fact that females are more likely to be exposed than man to health care services through maternal health care.[16,30,43] As such, the disparity may have been as a result of success of the increased testing uptake during antenatal care.

The person's age was found to be a significant predictor of health care service utilisation.The effect of age on HIV testing behaviour observed was consistent with other studies; although the study by Weiser[14] suggested that coverage of HIV testing begins to increase after 40 years. This study found lower odds of HIV testing among individuals over 30 years for females and those between the ages of 25-29 for males. This could be that older adults may have already experienced feeling of isolation due to illness or loss of someone they know who died of HIV.[35] Having an HIV diagnosis may increase that sense of isolation. Older people may also face unique issues such as being widowed or divorced and are dating again, but they may have less knowledge of HIV and are less likely to protect themselves than younger people. Although studies have shown that older people visit health care services more frequently than younger people, they are less likely than younger people to discuss their sexual health with the doctors, who in turn may be less likely to ask older people about these issues. Older women who are less worried about getting pregnant may have less of a perceived need for HIV testing since they will not pass HIV to unborn babies.[44] We did not find evidence of lower uptake of HIV testing among males over 30 years of age. Further, studies are needed to examine why being older for males was not associated with HIV testing.

We found that being married, divorced and widowed were associated with higher odds of HIV testing than being never married for females, but not for males. The finding that these females are more likely to test for HIV than those who never married has also been noted in previous studies.[10,14,16] This pattern is likely to relate to the fact that never married females perceive themselves to be at lower risk of HIV; thus see no need to test for HIV.[23,45] It may also be that those married or divorced may have had an opportunity for HIV testing during marriage and as partner involvement during ANC visit.[46] This study did not come to the same conclusion with other studies in regards to HIV testing for males based on marital status.[8,16] The study found that married and divorced males were less likely to have been tested compared to those who were never married. This could indicate that married and divorced males may be relying on proxy testing if their partners were ever tested for HIV during antenatal care.[47]

Several studies have found significantly higher odds of HIV testing among individuals with higher educational attainment than those with primary education.[8,14,16] The results presented here further confirm that the odds of having been tested for HIV were significantly higher among individuals with secondary or higher educational attainment. This finding applies to both males and females, but the main difference lies in the degree to which males were influenced by education. Disparities in HIV testing by education may be caused by differences in awareness of the importance of testing, access to testing centres and riskier sexual behaviour.[21] People with higher education may have better access to health care services generally, and particularly more uptake of antenatal care among females with higher education.[48]

Wealth may make it easy to afford payment of transport to go to testing centres consultation fees since health care services are paid for in Zimbabwe.[49] The results observed here show increased odds of having been tested for HIV among the wealthier than the poorer for males, and no association between wealth and HIV testing for females after controlling for community wealth/poverty. This finding is consistent with previous studies from similar settings in Sub-Saharan African countries[12,16] which found level of HIV testing increasing with wealth for males. Several hypotheses may explain this outcome. Firstly, HIV prevalence has been found to be positively correlated with socio-economic status in many sub-Saharan African countries.[50] Thus, individuals (particularly males) who are wealthy may perceive themselves more at risk, and therefore have a higher recourse to HIV testing compared to the poor.[16] Another explanation could be that HIV testing promotion and programmes are failing to reach the most deprived populations.[23] Thirdly, the adverse living conditions associated with low socio-economic status may itself constitute a barrier to access to HIV testing,[5]

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and that the wealthier may have the opportunity to access health service easily and to choose a health service which they are comfortable with. The fact that household wealth is more important for males, while community wealth is more important for females may suggest that most of males are economically empowered and have more resources enabling them to access healthcare services than females, while females rely on public health care which is cheaper or free in Zimbabwe.

Exposure to messages about HIV testing and counselling or campaigns about condom use or abstinence can be an important factor in motivating individuals to adopt HIV testing.[14] Several studies have found positive associations between HIV testing and higher media exposure.[7,10,11] This study found similar results and suggests that being exposed to media (i.e listening to radio daily, watching and reading newspapers frequently) increased the odds of having been tested for HIV for both males and females. This might reflect the fact that individuals who are exposed to mass media may have the opportunity to learn the benefits of HIV testing, where and how HIV counselling and testing is given, and this subsequently improve their awareness towards HIV related knowledge and stigma.

Females who were exposed to HIV stigma and HIV awareness were also more likely to have been tested than those who were not. The possible reason could be those who had better knowledge or comprehensive knowledge about HIV/AIDS are more likely to know how HIV/AIDS is transmitted, the prevention mechanism and the benefit of HIV testing.[51] The positive association between exposures to stigma could be as a result of success of HIV awareness programs aimed at reducing stigma in the communities. There is no evidence suggesting an association between HIV testing and HIV stigma and awareness for males.

The association between most of the sexual behaviour factors and HIV testing conform to what might be expected. For both males and females, the odds of having been tested for HIV were higher among individuals, who used condom during their last sexual contact, and those who had multiple sex partners. Several studies have found that people are more likely to be tested if they have risky sexual behaviours, such as having multiple sex partners and inconsistent condom use.[20,48,50] In regards to HIV knowledge and awareness, the highest estimates for HIV testing coverage are observed among individuals with medium to higher HIV/AIDS awareness, echoing the results found in the previous studies.[7,13]

At community level, community poverty, HIV-related stigma and media exposure were found to be associated with HIV testing. Community level risky sexual behaviour and HIV awareness were not associated with HIV testing, consistent with findings from previous studies.[12,18,25] In the general population, it was living in the communities with higher proportions of individuals with HIV-related stigma and media exposure that were associated with HIV testing. Living in a community with higher levels of media exposure was positively associated with HIV testing. Meanwhile, the results suggest that living in communities with proportion of individuals with higher HIV-related stigma was negatively associated with HIV testing in the general population. Similarly, the results showed that males living in communities with higher levels of stigmatisation were less likely to have reported ever testing for HIV. An explanation of this behaviour could be that men may be reluctant to know their HIV status if they feel that doing so they become defined in the community as ill or weak, or feel that they can be denied opportunities such as employment.[34] Living in a community with high levels of poverty was associated with reduced HIV testing for females, but not for males. Overall, there is no evidence of an association between HIV testing and other community level factors (i.e community education and risky sexual behaviour).

Finally, the analysis focused on ascertaining the intra-community correlation to obtain a clear picture of between-community variation in HIV testing. The study found significant community variations in HIV testing, partly attributed to the individual level factors. As shown in tables 4 and 5, the random part showed that about 6-7% of the total variation in HIV testing among females (and 2-3% for males) in Zimbabwe was attributed to differences across the communities. The results were fairly consistent with the literature where the proportion of total variation in HIV testing attributed to community level factors ranged from 4% to 15%.[8,12] As in other countries, the community level variation obtained supports the theory that some differences in health outcomes are attributed to the community characteristics in which the individuals live.[8,30] The study sheds light beyond the contribution of individual characteristics to the determinants of HIV testing in Zimbabwe.

STUDY LIMITATIONS

The data used in this study came from two nationally representative surveys with household and individual response rates of 98% and 97% respectively.[2] The missing data was lower than 5%, thus not likely to have affected the estimates in the study. However, the data had some weakness which might have affected the results. Firstly, the study did not control for the availability of HIV health care services at community level. The ZDHS does not provide data to distinguish whether the number of people having an HIV test is limited by the availability of testing services or whether the testing services were underutilised and why. There is a possibility that inclusion of factors regarding health care services would have helped to explain some of the variance in the model. While knowing one's own HIV status is a proxy for person's having received counselling, the indicator does not provide the quality of the counselling services. In countries like Zimbabwe, where scaling up of HIV testing services is happening; population-based surveys conducted every few years will not capture annual progress. The information in the survey was self-reported, so to some extent under-reporting of socially unacceptable behaviours and attitudes (such as stigma) and over reporting of socially desirable behaviours were likely. In Zimbabwe, HIV testing has been heavily promoted as a responsible thing to do, so it is

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possible that some people may say they have been tested when in fact they were not. Another limitation was that the HIV testing and risk measures did not include assessments of time since the behaviours occurred, not allowing this study to examine whether people who were recently tested or who recently engaged in risk sexual behaviour differed from practising these behaviours less or more recently. Although, variables for females domain such as 'problems of getting money, permission and transport to go to a health care centre are related to HIV testing behaviour, it would be a mistake to use them to make a general claim about their relative importance using variables available in ZDHS because most of these questions were not completed by the respondents. Otherwise the representation of the whole county is a major strength of this study as it allows generalization of findings for the country as a whole, for both genders.

CONCLUSION AND WAY FORWARD

Overall the multilevel results showed little variations in HIV testing across communities in Zimbabwe. The variations were mainly explained by individual level variables such as background characteristics rather than enabling, perceived need factors that were included in the models for both sexes. At community level, variables found to be contributing to the variations in HIV testing differed by gender. It was found that community poverty was negatively associated with HIV testing for females, while community stigma was important for males. Controlling for community level factors did not have much effect on community variation in HIV testing. Therefore, policies should focus on predisposing and enabling factors in order to improve HIV testing in Zimbabwe. For males' household wealth and HIV factors such as risky sexual behaviour are critical for improvements in HIV testing. Given that household wealth was a significant predictor of HIV testing for males, the introduction of financial incentives may stimulate males to access HIV testing services by providing compensation for transport cost and opportunity cost of time associated with accessing HIV testing services. Monetary incentives could reduce barriers and stigma as it may provide a broader reason for going to testing centres. More importantly perhaps for both sexes, awareness creation on HIV counselling and testing service utilization should focus on avoiding stigmatizing and discriminatory behaviours, so that clients can develop positive attitudes towards people living with HIV/AIDS. Introducing couple-oriented HIV counselling and testing services where men accompany their spouse to HIV screening during pregnancy may help increase the HIV testing uptake for males.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Annexure

Annexure: Average Odds of HIV Testing from Multilevel Logistic Regression Models (95% Confidence Intervals are given in Square Brackets) Males and Females.

Parameters	Model 1	Model 2	Model 3
Survey (2005-6)			
2010-11	4.16 [3.80-4.55]*	5.30 [4.67-6.02]*	5.60 [4.90-6.37]*
Gender (males)			
Females	1.98 [1.85-2.13]*	1.84 [1.63-2.07]*	1.83 [1.63-2.07]*
Residence (urban)			
Rural	0.79 [0.72-0.86]*	1.12 [1.00-1.26]*	1.18 [1.04-1.34]*
Age groups (15-24)			
25-29	1.30 [1.17-1.43]*	1.20 [1.08-1.33]*	1.20 [1.08-1.33]*
30-34	0.90 [0.80-1.01]	0.83 [0.74-0.94]*	0.83 [0.74-0.94]*
35-39	0.75 [0.66-0.86]*	0.69 [0.61-0.79]*	0.69 [0.61-0.79]*
40+	0.60 [0.53-0.69]*	0.55 [0.49-0.63]*	0.55 [0.49-0.63]*
Marital status (never married)			
Married	2.01 [1.78-2.26]*	2.30 [2.03-2.60]*	2.30 [2.03-2.59]*
Widowed	2.39 [1.98-2.88]*	2.50 [2.07-3.03]*	2.51 [2.07-3.04]*
Divorced	1.83 [1.56-2.16]*	1.80 [1.52-2.13]*	1.80 [1.52-2.13]*
Occupation(unemployed)			
Professional	1.31 [1.18-1.46]*	1.21 [1.08-1.35]*	1.21 [1.09-1.35]*
Manual work	1.28 [1.15-1.42]*	1.20 [1.08-1.34]*	1.21 [1.08-1.34]*
Agriculture	1.03 [0.93-1.14]	1.00 [0.91-1.11]	1.01 [0.91-1.11]
Religion (Catholic)			
Protestant	1.08 [0.98-1.18]	1.04 [0.95-1.15]	1.05 [0.96-1.15]
Pentecostal	1.18 [1.08-1.29]*	1.17 [1.06-1.28]*	1.17 [1.06-1.29]*
Apostolic	0.98 [0.90-1.05]	1.01 [0.93-1.09]	1.01 [0.93-1.09]
Secondary	1.67 [1.55-1.80]*	1.49 [1.38-1.61]*	1.50 [1.39-1.62]*
Higher	3.62 [3.04-4.31]*	2.82 [2.36-3.38]*	2.84 [2.37-3.40]*
Enabling and perceived/need factors			
Wealth (poorest)			
Poorer		1.00 [0.90-1.11]	1.01 [0.90-1.12]
Middle		1.12 [1.01-1.25]*	1.13 [1.01-1.26]*
Richer		1.25 [1.10-1.42]*	1.24 [1.09-1.41]*
Richest		1.40 [1.20-1.62]*	1.38 [1.18-1.60]*
Media exposure (low)			
Medium		1.22 [1.12-1.34]*	1.21 [1.10-1.32]*
High		1.62 [1.36-1.92]*	1.52 [1.28-1.82]*
HIV/AIDS Awareness(low)			
Medium		1.75 [1.51-20.2]*	1.76 [1.52-2.03]*
High		1.85 [1.58-2.16]*	1.86 [1.59-2.17]*
Observed AIDS stigma(no)			
Yes		0.81 [0.73-0.91]*	0.81 [0.73-0.91]*
HIV disclosure concern(no)			
Yes		0.83 [0.76-0.91]*	0.83 [0.76-0.91]*
Knows someone died with Aids(no)			
Yes		1.30 [1.14-1.48]*	1.29 [1.13-1.48]*
History of STI (no)			
Yes		1.66 [1.38-2.00]*	1.66 [1.38-1.99]*
Community factors			
HIV/AIDS stigma-gm			0.62 [0.42-0.92]*
Media exposure-gm			1.47 [1.14-1.89]*
Random Variance (SE)	0.129 (0.016)*	0.112 (0.015)*	0.11 (0.015)*
(VPC)=ICC(%)	3.8	3.3	3.3

VPC=Variance Partition Coefficient, ICC=intra-cluster correlation, *Statistical significance at 5% level $p<0.05$.