Does HIV Knowledge, HIV Stigma and Risky Sexual Behaviour Context Matter in Influencing HIV testing among adults who have ever had sex in Botswana? A Multilevel Approach.

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ABSTRACT

Despite significant strides in voluntary HIV testing in Botswana, there still remain significant regional (district) variations in HIV testing. The aim of this paper was to investigate the contextual effects of HIV testing in Botswana. A sample of 6244 respondents who have ever had sex was sourced from the 2013 Botswana AIDS Impact Survey. Analysis included descriptive statistics and multilevel logistic regression. Individual level factors associated with HIV testing included age, sex, marital status, level of education, Level of HIV knowledge, Level of HIV stigma, and consistent use of condom on first sexual contact. Demographic factors were more important predictors of HIV testing than socioeconomic and behavioral factors. The contextual factor associated with HIV testing was residing in a district with higher levels of HIV knowledge. Residing in districts with lower levels of stigma and lower levels of risky sexual behaviors did not have an effect on HIV testing. HIV knowledge context at district level had an independent effect on HIV testing and should be considered in HIV/AIDS programs. In particular, HIV/AIDS interventions aimed at improving knowledge levels should target districts with lower proportions of people with HIV knowledge to improve levels in HIV testing in Botswana.

INTRODUCTION

HIV and AIDS still remains the biggest threat to health globally. An estimated 75 million people have been infected with HIV since the beginning of the epidemic and 36 million have died of HIV (UNAIDS, n.d.). By 2013, it was estimated that 35.3 million were living with HIV worldwide (UNAIDS, 2013). Sub-Saharan Africa still remains the most affected with about 71% of people living with HIV worldwide. The HIV situation is even higher in Southern Africa with Botswana remaining one of the nations with the leading HIV prevalence in the world with 17% of the total population infected (Statistics Botswana, 2013). HIV counselling and testing remains one of the most crucial steps to prevention of the spread of the epidemic. Due to its numerous benefits, HIV counselling and testing has been acknowledged as the best opportunity to access comprehensive HIV care and support including antiretroviral therapy (ART) (Bunnell et al., 2006; Pronyk et al., 2002; Sweat et al., 2000; Liechty, 2004; WHO, 2002). Access to ART has also been recognized as one of the most crucial interventions aimed at reducing mortality levels in developing countries.

Botswana has made tremendous steps in increasing the proportion of people who have ever tested for HIV and as a result, AIDS related deaths have been substantially reduced mainly due to the comprehensive ART and PMTCT programme in Botswana (Statistics Botswana, 2013). However, Botswana is still remaining behind with achieving the Millenium Developmenmt Goal 6 targets of reversing the spread of HIV and unviversal acces to treatment and care for all in need (Government of Botswana & United Nations Botswana, 2010). However, there has been some progress in increasing the proportion of people who have ever tested for HIV in Botswana from 56.4% to 72.2% (CSO, 2009; Statistics Botswana, 2013).Despite this achievements, a significant number of people are still not testing for HIV. In addition, there are huge disparities in the proportion of people who have ever tested for HIV across districts in Botswana with the HIV prevalence between districts ranging from 11.1% to 27.5% (Statistics Botswana, 2013).

There has been a substantial attempt to study factors influencing HIV testing in Sub-Saharan Africa (SSA). Demographic variables such as age, marital status and residence have been found to be associated with HIV testing (Takarinda et al., 2014; Wimonsate, 2011, Hensen et al., 2015; Godif et al., 2015; Agha, 2012). Socioeconomic factors such as level of education, wealth, mass

media exposure and employment status have been seen to influence HIV testing (Takarinada et al., 2014; Hensen et al., 2015; Agha, 2012; Burns et al., 2005; Godif et al., 2015; Wimonsate, 2011). HIV knowledge have been seen to increase odds of HIV testing (Godif et al., 2015; Bwambale et al., 2014) and psychosocial factors such as HIV related stigma and discrimination have been found to influence HIV tesing (Godif et al., 2015; Matovu & Makumbi, 2007; Fylkesnes & Siziya, 2004; Bwambale et al., 2008). Sexual behaviour variables such as having more than one sexual partner during the past year, current and consistent use of condom were found to be associated with HIV testing (Samet et al, 1997; Agha, 2012; Morris et al., 2014). Such studies however neglect the important of context in influencing HIV testing. The influence of context on health seeking behaviour in other studies (Stephenson & Tsui, 2002). Studies that have explored the role of context on HIV testing in are scanty and none has been carried out i Botswana.

This study examines the influence of individual and district level variables in influencing HIV testing in Botswana. This study builds on findings of reviewed studies by advancing existing knowledge beyond understanding of individual and household level determinants of HIV testing. The aim of this paper was to investigate the contextual effects of HIV testing among people that have ever had sex in Botswana since HIV transmission is mainly through heterosexual contact. The objective of the study was to determine of levels of HIV knowledge, level of HIV stigma and level of risky sexual behaviour have an influence on HIV testing in Botswana. The study hyothesizes that the context of levels of HIV knowledge, HIV stigma and risky sexual behaviour at district level will have an independent effect on HIV testing in Botswana.

METHODS

Data Source

This study used data from the 2012 Botswana AIDS Impact Survey (BAIS). A total of 8332 individuals were successfully interviewed in a total of 26 districts in Botswana. Of the 8332 respondents, 6244 (79.4%) reported to have ever had sex.

Level of Measurement

Dependent Variable: During the survey, respondents were asked if they have ever tested for HIV, the virus that causes AIDS. Responses from respondents that were in the affirmative were coded "1" and regarded as having ever tested for HIV, otherwise they were coded as "0".

Independent Variables:

- Contextual factors:
    - **Proportion of people with comprehensive knowledge of HIV**

The following questions were used to determine the HIV Knowledge for each respondent (Target: COMPREHENSIVE)

- Is it possible for a healthy looking person to have HIV?
- Can people reduce their chances of getting HIV/AIDS by using a condom correctly every time they have sex?
- Do you think that a person can get infected with HIV through mosquito bites?
- Can people reduce their chances of getting HIV/AIDS by having only one uninfected sex partner who has no other partners?
- Can a person get infected with HIV by sharing a meal with a person who has HIV/AIDS?
- Can people get HIV because of witchcraft?

A correct answer for each of the questions was awarded a score of 1 and wrong answers 0. Scores for these questions were summed up for each case and resulting scores ranged from 0 to 6. Cases with score of 6 were regarded as having comprehensive HIV knowledge and those with 4 to 5 were regarded as medium HIV knowledge and those with scores 0 to 3 were regarded as having low HIV knowledge.

- Proportion of people with no HIV stigma.

The following questions were used to determine whether respondents had stigma towards people living with HIV. (Target: NO STIGMA).

- Would you ever share a meal with a person you knew or suspected had HIV/AIDS?
- If a member of your family became sick with HIV/AIDS, would you be willing to care for him or her in your household?
- If your housekeeper, nanny or anybody looking after your child has HIV but is not sick, would you allow him/her to continue working/assisting with babysitting in your house?
- If a teacher has HIV but is not sick, should s/he be allowed to continue teaching in school?
- If you knew that a shopkeeper or food seller had HIV or AIDS, would you buy vegetables from them?
- If a member of your family got infected with HIV, would you want it to remain a secret?

For each of the questions, answers that indicated some stigma were awarded a score of 1 or else they were awarded 0. Summing scores gave values ranging from 0 to 6. Respondents with high stigma were those with score ranging from 2 up to 6 and those with 1 score were referred to as having medium stigma and those with 0 score were referred to as having no stigma towards people living with HIV.

- Proportion of people with no risky sexual behavior

There were four (4) risky sexual behavior indicators that were used to determine the proportion of people with no risky sexual behavior at district level and these were:

- *Number of sexual partners last 12 months*
- *Condom use consistency last 3 sexual partners (12 months)*
- *Use of condom first time with last 3 sexual partners*
- *Sexual intercourse under the influence of alcohol or drugs last 12 months.*

Any respondent with risky sexual behavior was awarded a score of 1 otherwise a score of 0 was awarded. Score for the four risky sexual behavior indicators were summed and categorized as no risk (score 0), medium (score 1) and high risk (score 2-4).

- Individual level variables
  - Demographic factors
    - *Age, Sex, Marital Status, Residence*
  - Socioeconomic factors
    - *Highest level of education, Religious Affiliation, Employment Status, Level of HIV Knowledge Index, Level of Stigma Index*
  - Behavioral factors
    - *Number of sexual partners in the last 12 months of the survey, Consistent Condom Use last 12 months, Consistent Condom Use first time with last 3 sexual partners, Sex whilst under the influence of alcohol or drugs.*

Statistical (Analytical) Approach

HIV testing variable has two categories hence it is dichotomous. Descriptive statistics will be used to analyze the data. The appropriate model to be used for dichotomous outcome is the hierarchical generalized linear model. Identification of the random effect is allowed by the multilevel models. It represents the extent to which the outcome of interest varies between each level. Respondents are nested within districts and so this requires the following two level combined multilevel logistic regression equations:

- ***Level 1 regression equation:***

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{ij}) + e_{ij} \qquad (1)$$

Where: Y_{ij} refers to the score on HIV testing outcome for the ith respondent in the jth district; X_{ij} refers to the Level 1 predictor; β_{0j} refers to the intercept of HIV testing outcome in the jth district (Level 2); β_{1j} refers to the slope for the relationship in the jth district (Level 2)

between the Level 1 predictor and HIV testing outcome; $\mathbf{e_{ij}}$ refers to the random errors of prediction for the Level 1 regression equation.

- ***Level 2 Regression Equation***

Within the groups of Level 2, the coefficients at level 1, β_{0j} and β_{1j} become the dependent variables of the Level 2 regression equation. Thus;

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \qquad (2)$$

Where: γ_{00} refers to the overall intercept. This is the grand mean of the scores on the dependent variable across all the districts when all the predictors are equal to 0; $\mathbf{W_j}$ refers to the Level 2 predictor; γ_{01} refers to the overall regression coefficient, or the slope, between the outcome variable and the Level 2 predictor; $\mathbf{u_{0j}}$ refers to the random error component for the deviation of the intercept of a district from the overall intercept; γ_{10} refers to the overall regression coefficient, or the slope, between the dependent variable and the Level 1 predictor; $\mathbf{u_{1j}}$ refers to the error component for the slope (meaning the deviation of the district slopes from the overall slope)

A total of 7 models were used to determine the contextual effects on HIV testing in Botswana. Model 1 is an empty model, model 2 introduced district context variables only, model 3 introduced demographic variables as whereas model 4 included district context variables and introduced socioeconomic variables as controls. Model 5 included district context variables and introduced behavioral variables as controls. Model 6 included all the demographic, socioeconomic and behavioral variables only and model 7 (final) added the contextual variables as the main explanatory variables and demographic, socioeconomic and behavioral variables were treated as controls.

The regression models used the odds ratios as measures of association for the fixed effects. The odds ratios were modeled using the following equation:

- Logit $[p_{ij}] = \beta_0 + \beta_1 x_{ij} + u_j$

- $p_{ij}$is the probability of the outcome for the i^{th} woman in the j^{th} district;
- β is the vector of unknown parameters;
- x_{ij} is the explanatory variable corresponding to the i^{th} woman in the j^{th} district &
- u_j is the random effect at the district.

- Odds Ratio = $\exp(\beta_i)$

For random effects, the random intercept variance (RIV) coefficient was used to tests for either heterogeneity or homogeneity across districts. The RIV enables us to estimate the Intra-class correlation coefficient (ICC) which measures the degree of resemblance within the district. The formula for the ICC = **$RIV/(RIV+(\pi^2/3))$.** There is no official goodness of fit test available for non-linear outcomes except using the proportional change in variance (PVC) for alternative models. A high percentage reduction indicates a better fit **(Yang, 2001). In some** instances, Alkaike Information Criterion **(AIC)** & Bayes Information Criterion **(BIC)** may also be used but not reliable for non-linear outcomes.

RESULTS

Table 1 provides the percentage distribution of the respondents by their demographic, socioeconomic and sexual behavioural characteristics. It also provides percentage distribution of respondents by their district context. According to the table, about one fifth of respondents reside in districts with lower levels of people with comprehensive knowledge of HIV whereas 41.2% and 39.6% of respondents reside in districts with medium and high levels of people with comprehensive knowledge of HIV respectively. Two fifths of respondents (40.6%) reside in districts that have high levels of people with no stigma whereas 45.3% and 14.1% reside in districts with medium and low levels of people with no stigma correspondingly. About half of respondents (48.4%) reside in districts with medium levels of people with no risky sexual behaviour whereas 39.9% and 11.7% reside in districts with high levels and low levels of people with no risky sexual behaviour.

Table 1: Percentage Distribution of Respondents by their Background Characteristics

VARIABLES		Number	Percent N=6244
INDIVIDUAL LEVEL			
Demographic			
Age	10 to 19 years	287	4.6
	20 to 34 years	3067	49.1
	35 to 49 years	1947	31.2
	50 to 64 years	943	15.2
Sex	Male	2743	43.9
	Female	3501	56.1
Marital Status	Never Married	3102	49.7
	Married/Cohabiting	2889	46.3
	Formerly Married	253	4.1
Residence	Cities/Towns	2400	38.4
	Urban Villages	1551	24.8
	Rural	2293	36.7
Socioeconomic			
Education	None/Primary	1822	29.2
	Secondary	3009	48.2
	Tertiary	1413	22.6
Religion	Christian	5353	85.7
	Other Religions	292	4.7
	No Religion	599	9.6
Employment Status	Employed	4609	73.8
	Unemployed	1635	26.2
HIV Knowledge	Low	707	11.5
	Medium	2962	48.3
	Comprehensive	2467	40.2
HIV Stigma	Low	2300	37.5
	Medium	2566	41.8
	High	1270	20.7
Behavioral			
Number of Sexual Partners last 12 months	0 to1	5494	88.0
	2 or more	750	12.0
Always Use Condom	Inconsistent	2212	35.4
	Consistent/No Sex	4030	64.6
Always Condom First Sexual Contact	Inconsistent	891	14.4
	Consistent/No Sex	5313	85.6
Sex under the Influence of Alcohol or Drugs	Had Sex under influence	414	6.6
	Never had sex under influence	5813	93.4
DISTRICT LEVEL			
Proportion of People with Comprehensive Knowledge of HIV	Low	1197	19.2
	Medium	2572	41.2
	High	2475	39.6
Proportion of People with No Stigma towards People Living with HIV	Low	878	14.1
	Medium	2830	45.3
	High	2536	40.6
Proportion of People with No Risky Sexual Behaviour	Low	733	11.7
	Medium	3020	48.4
	High	2491	39.9
TOTAL		**6244**	**88.0**

Table 2: Percentage Distribution of respondents who have ever tested for HIV by background characteristics.

VARIABLES		Percent N=6244
INDIVIDUAL LEVEL		
Demographic		
Age***	10 to 19 years	**54.7**
	20 to 34 years	**90.6**
	35 to 49 years	**92.1**
	50 to 64 years	**80.9**
Sex***	Male	**82.7**
	Female	**92.1**
Marital Status***	Never Married	**91.0**
	Married/Cohabiting	**84.7**
	Formerly Married	**89.1**
Residence***	Cities/Towns	**90.4**
	Urban Villages	**87.6**
	Rural	**85.7**
Socioeconomic		
Education***	None/Primary	**84.3**
	Secondary	**88.3**
	Tertiary	**91.8**
Religion***	Christian	**88.7**
	Other Religions	**78.7**
	No Religion	**86.1**
Employment Status***	Employed	**88.9**
	Unemployed	**85.2**
HIV Knowledge***	Low	**80.3**
	Medium	**88.2**
	Comprehensive	**89.9**
HIV Stigma***	Low	**90.2**
	Medium	**89.5**
	High	**80.9**
Behavioral		
Number of Sexual Partners last 12 months	0 to1	**88.2**
	2 or more	**86.4**
Always Use Condom past 12 months**	Inconsistent	**89.4**
	Consistent/No Sex	**87.2**
Always Condom First Sexual Contact**	Inconsistent	**85.4**
	Consistent/No Sex	**88.4**
Sex under the Influence of Alcohol or Drugs	Had Sex under influence	**86.2**
	Never had sex under influence	**88.2**
DISTRICT LEVEL		
Proportion of People with Comprehensive Knowledge of HIV***	Low	**87.2**
	Medium	**86.3**
	High	**90.1**
Proportion of People with No Stigma towards People Living with HIV*	Low	**86.0**
	Medium	**87.5**
	High	**89.2**
Proportion of People with No Risky Sexual Behaviour	Low	**87.3**
	Medium	**87.2**
	High	**89.1**
TOTAL		

***=P<0.05; **=P<0.01; ***=P<0.001**

Levels of HIV testing

Out of the 6244 respondents that reported to have ever had sex, 88% reported to have ever tested for HIV. At bivariate level, HIV testing differed significantly by age group, sex, marital status, residence, level of education, religion, employment status, level of HIV knowledge, Level of HIV stigma, consistency of condom use during past 12 months and consistency of use of condom during first sexual contact with last 3 sexual partners (See table 2).

Multivariate Multilevel Modeling

Table 3, 4, and 5 shows the multilevel odds ratios assessing effects of individual and district level characteristics on HIV testing among respondents that have ever had sex. Factors associated with HIV testing at bivariate level included age, sex, marital status, residence, education, religion, employment status, level of HIV knowledge, level of stigma towards people living with HIV/AIDS, consistent condom use, consistent condom use first sex with last 3 sexual partners, district level proportion of people with comprehensive knowledge of HIV and district level proportion of people with no stigma towards people with HIV/AIDS.

Model 1 which is an empty mode had an intercept variance of 0.062. This intercept variance is used as a reference for the goodness of fit for other models. Model 2 introduced district context variables only and had a variance of 0.044. The model gave a proportional reduction change in variance of 29.03%. For this model, HIV testing was associated with proportion of people with comprehensive knowledge of HIV and proportion of people with no stigma towards people living with HIV. Residing in districts with medium and higher proportion of people with comprehensive knowledge of HIV increased the odds for HIV testing (Odds ratios: 1.76 and 1.89 respectively). Respondents residing in districts with medium and higher proportion of people with no stigma towards people living with HIV had higher odds of testing for HIV than those residing in districts with lower levels of people with no stigma. The intra-class correlation coefficient was ***.

Model 3 introduced demographic individual level variables as controls only and it did not change the significance of the contextual variables whereas age, sex and marital status were associated with HIV testing. When compared to those aged 10 to 19 years, the odds of HIV

testing for other age groups were higher. Those aged 20 to 34 years, 35 to 49 years and 50 to 64 years were more than 22 times, 28 times and 10 times more likely to have tested for HIV when compared to those aged 10 to 19 years. Females were about twice as likely to have tested for HIV that their male counterparts. The married were more than twice as likely to have not tested for HIV as the never married. The model had a proportional reduction change in variance of 16.13% which is lower than that of model 2. Model 4 included the district context variables and introduced socioeconomic individual level variables as controls. The introduction of the socioeconomic individual variables did not change the statistical significance of the district context variables and had a proportional reduction change in variance of 12.9% which is still lower than that of model 2 (see table 3). The odds of HIV testing increased with the level of education. Those with secondary education were 1.4 times more likely to have tested for HIV whereas those with tertiary education were more than 4 times as likely to have tested for HIV as those with primary education or less.

Model 5 introduced sexual behavioral individual variables only as controls and the proportional reduction change in variance was 8.06%. The statistical significance of district context variables did not change and sexual behavior individual level variable associated with HIV testing were consistent condom use during with last three partners during past 12 months (OR: 0.71) and use of condom during first sexual contact with last three partners (OR: 1.49). Model 6 included demographic, socioeconomic and sexual behavioral variables only without the district context variables. The proportional reduction change in variance was 37.1% and individual level variables associated with HIV testing were age, sex, marital status, education, religion, HIV knowledge, HIV stigma and use of condom during first sexual contact with last three partners.

Model 7 was the final multilevel binary logistic regression model and it included the district context variables and all individual level variables as controls (demographic, socioeconomic and sexual behavior). In the final multilevel regressions model, the odds of HIV testing higher for those aged 20 to 34 years (OR: 7.68), 35 to 49 years (OR: 9.25) and 50 to 64 years (OR: 4.03) when compared with those aged 10 to 19 years. Males were more than twice more likely to have tested for HIV as females (OR: 2.77). Respondents with tertiary education were more

likely to have tested for HIV that those with primary or less (OR: 1.38). The married were less likely to have tested for HIV than those never married (OR: 0.59). Those affiliated to other religions other than Christianity were less likely to have tested for HIV (OR: 0.71). The odds of HIV testing decreased with the level of HIV knowledge. Respondents with comprehensive HIV knowledge were less likely to have tested for HIV than those with low HIV knowledge (OR: 0.61). The odds of HIV testing increased with the level of stigma towards people living with HIV. Respondents with medium and high levels of stigma were 1.33 and 1.41 times more likely to have tested for HIV when compared to those with no stigma. Respondents have consistently used a condom during their first sexual encounter with their last sexual partners were more likely to have tested for HIV (OR, 1.41).

With regard to district context, the odds of HIV testing increased with an increase in the levels of HIV knowledge at district level. Residing in a district with medium and high proportion of people with comprehensive knowledge of HIV increased the odds of HIV testing (OR, 1.52 and 1.64). However, the statistical significance of the independent effect of the proportion of people with no stigma at district level vanished and the proportion of people with no risky sexual behaviour at district level did not have any statistical effect on HIV testing. The final model had a proportion change in variance of 22.7%. This reduction in the random intercept variance indicates that the final model has a better fit than the empty model.

DISCUSSIONS

This study sought to investigate the independent effects of the district context of the levels of HIV knowledge, HIV stigma and risky sexual behavior on HIV testing. The study posits that district level context have a bearing in health seeking behavior such as seeking HIV counselling and testing services. It was hypothesized that high levels of HIV knowledge, HIV stigma and risky sexual behavior at district level would have an independent effect on HIV testing on individuals. Results indicate that determinants of HIV testing operate at the individual and at district levels. District level context seem to have an independent effect on HIV testing in Botswana. In particular, residing in districts with higher levels of HIV knowledge increased the odds of HIV testing. Individual level characteristics associated with HIV testing included age,

sex, marital status, education, religion, HIV knowledge, HIV stigma and use of condom during first sexual contact with last three partners.

District level HIV knowledge had an independent effect on HIV testing. This indicates that district kevel context does have an independent effect on HIV testing of individuals. This is consistent with a study by Stephenson and Tsui (2002) who revealed the importance of context in influencing health seeking behaviour. It is crucial to point out that HIV knowledge context seem to have moderated the effect individual level HIV knowledge on HIV testing. In this study, the importance of having comprehensive HIV knowledge at individual level was found be associated with HIV testing in this study. However, HIV knowledge was found to have a positive relationship with HIV testing at bivariate level and in the multivariate analysis where district context variables were not included. This is consistent with studies elsewhere (Godif et al., 2015; Bwambale et al., 2014). However, inclusion of district context variables in the final model changed the direction of the relationship between individual level HIV knowledge and HIV testing. This indicates a possible moderation of the association between individual level characteristics and HIV testing by district context variables.

The context of levels of HIV stigma and risky sexual behaviour did not have an independent effect on HIV testing. At individual level, an increase in age was found to increase odds of HIV testing. This is consistent with findings elsewhere (Takarinda et al., 2014; Wimonsate, 2011; Semali et al., 2014) although others found younger people being more likely to test for HIV (Leta, 2012). Females were found to have higher odds of HIV testing than their male counterparts. This is not surprising as a significant proportion of females are expected to test for HIV as part of the routine services for antenatal care (ANC) services. ANC attendance increases the likelihood of HIV testing as HIV counselling is provided at clinic level during ANC and PMTCT programme in Botswana. Being was found to be negatively associated with HIV testing in this study. There are conflicting studies regarding the relationship between marital status and HIV testing. Some studies found that the never married had lower odds of testing for HIV (Agha, 2012) whereas some found that being never married increased odds of being tested for HIV (Kranzer et al., 2008). In this study, those aged 20 years were less likely to have ever tested for HIV than those aged 20 years and above.

The effect of the level of education on health seeking behaviour has been reiterated in this study. The level of HIV testing increased with the level of education which is consistent with studies elsewhere (Takarinada et al., 2014, Agha, 2012; Burns et al., 2005; Semali et al., 2014). Religion on the other hand was shown to have an influence on HIV. However, interpretation of the effect of religion here should be taken with caution as Christianity as a religion was categorised ion its own and other religions which include Muslims, African Traditional religions and other religions beside Christianity were lumped together for the analysis. Findings in this study reveal that people belonging to other religions were less likely has ever tested for HIV. Religion has been found to be associated with HIV voluntary counselling and testing (Leta, 2012). It has a bearing in the success of HIV programs as it is also associated with perceptions about HIV, HIV treatment and people living with HIV (Zou et al; 2009).

HIV stigma and discrimination towards people living with HIV has been found to be a significant barrier to HIV care and support. Although the district context of HIV stigma did not have an independent effect on HIV testing, individuals with high levels of stigma were found to be less lilely to have ever tested for HIV. This is consistent with findings elsewhere (Godif et al., 2015; Matovu & Makumbi, 2007; Fylkesnes & Siziya, 2004; Bwambale et al., 2008).

The only sexual behaviour variable associated with HIV testing during this study was inconsistent use of condom during the first time sexual contact with the last three sexual partners. It seemed that risky sexual behaviours did not have much bearing on HIV testing. In other studies, inconsistent condom use was found to be associated with non-use of HIV testing services (Morris et al., 2014). The direction of the relationship may also play a part in explaining this relationship. For example, another study found that previous HIV testing has been seen to be a strong predictor of condom use (Agha, 2012).

This study has several limitations that need to be mentioned. The first limitation is the challenges brought about by self reporting of events. This has a bearing on the accuracy of the report being given by the respondents as report cannot be verified. Secondly, the Botswana AIDS Impact Study (BAIS) study data is cross-sectional in nature data which makes provides a challenge to draw causal relationships. Third, the multilevel modelling assumes that all individual level characteristics have been considered. During the multilevel modelling, the

district context effects identified may simply reflect individual level characteristics unaccounted for. Third, Research design is quantitative but lacks insight as it works within a certain set of parameters. The need to have qualitative information explaining pathways in which context may influence HIV testing is of paramount importance. Lastly, the level of measurement for district context characteristics assumes that individuals in any two different districts are exposed to the same disrtict contextual effects.

In conclusion, having high proportions of people with comprehensive knowledge of HIV at district level has a significant effect on HIV testing in Botswana. However, a high proportion of people with no stigma and high proportion of people with no risky sexual behaviour have no influence on HIV testing. This study also indicates that demographic factors are more influential in HIV testing than socioeconomic and behavioral factors. It also shows that district level characteristics are important predictors of HIV testing in Botswana. In particular, people residing in districts with high proportions of people with comprehensive knowledge of HIV have higher odds of testing for HIV.

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Table 3: Multilevel Odds ratios assessing effects of individual and district level characteristics on HIV testing among people who have ever had sex in Botswana.

VARIABLES		MODEL 2		MODEL 3		MODEL 4	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
INDIVIDUAL LEVEL							
Demographic							
Age	10 to 19 years	NI	NA	1		NI	NA
	20 to 34 years	NI	NA	22.85***	19.42-26.87	NI	NA
	35 to 49 years	NI	NA	28.39***	22.87-35.24	NI	NA
	50 to 64 years	NI	NA	10.17***	8.10-12.78	NI	NA
Sex	Male	NI	NA	1		NI	NA
	Female	NI	NA	1.83***	1.60-2.08	NI	NA
Marital Status	Never Married	NI	NA	1		NI	NA
	Married/Cohabiting	NI	NA	0.47***	0.40-0.56	NI	NA
	Formerly Married	NI	NA	0.86	0.56-1.31	NI	NA
Residence	Cities/Towns	NI	NA	1		NI	NA
	Urban Villages	NI	NA	0.94	0.60-1.48	NI	NA
	Rural	NI	NA	0.78	0.50-1.23	NI	NA
Socioeconomic							
Education	None/Primary	NI	NA	NI	NA	1	
	Secondary	NI	NA	NI	NA	1.34***	1.19-1.52
	Tertiary	NI	NA	NI	NA	4.12***	3.31-5.12
Religion	Christian	NI	NA	NI	NA	1	
	Other Religions	NI	NA	NI	NA	1.03	0.77-1.36
	No Religion	NI	NA	NI	NA	1.12	0.91-1.38
Employment Status	Employed	NI	NA	NI	NA	1	
	Unemployed	NI	NA	NI	NA	0.17***	0.16-0.20
HIV Knowledge	Low	NI	NA	NI	NA	1	
	Medium	NI	NA	NI	NA	1.42***	1.20-1.67
	Comprehensive	NI	NA	NI	NA	1.37***	1.14-1.65
HIV Stigma	Low	NI	NA	NI	NA	1	
	Medium	NI	NA	NI	NA	0.91	0.79-1.04
	High	NI	NA	NI	NA	0.49***	0.42-0.56

VARIABLES		MODEL 2		MODEL 3		MODEL 4	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Behavioral							
Number of Sexual Partners last 12 months	0 to1	NI	NA	NI	NA	NI	NA
	2 or more	NI	NA	NI	NA	NI	NA
Always Use Condom	Inconsistent	NI	NA	NI	NA	NI	NA
	Consistent/No Sex	NI	NA	NI	NA	NI	NA
Always Condom First Sexual Contact	Inconsistent	NI	NA	NI	NA	NI	NA
	Consistent/No Sex	NI	NA	NI	NA	NI	NA
Sex under the Influence of Alcohol or Drugs	Had Sex under influence	NI	NA	NI	NA	NI	NA
	Never had sex under influence	NI	NA	NI	NA	NI	NA
DISTRICT LEVEL							
Proportion of People with Comprehensive Knowledge of HIV	Low	1		1		1	
	Medium	1.76***	1.32-2.06	1.44***	1.12-1.74	1.58***	1.23-1.94
	High	1.89***	1.48-2.21	1.61***	1.34-1.98	1.73***	1.45-2.13
Proportion of People with No Stigma towards People Living with HIV	Low	1		1			
	Medium	1.32*	1.08-1.62	1.24	0.96-1.52	1.33*	1.06-1.63
	High	1.41**	1.12-1.79	1.47**	1.12-1.63	1.39**	1.10-1.74
Proportion of People with No Risky Sexual Behaviour	Low	1		1			
	Medium	0.93	0.70-1.22	0.86	0.59-1.27	0.93	0.65-1.32
	High	0.87	0.66-1.13	1.08	0.73-1.59	1.02	0.72-1.44
Intercept		**0.892*** **		**-0.814*** **		**1.562*** **	
% Correctly Predicted		**72.2**		**85.8**		**77.3**	
Random Intercept		**0.044**		**0.052**		**0.054**	
PVC (%) (Empty model is Reference)		**29.03%**		**16.13%**		**12.9%**	

NI – Not Included; NA – Not Applicable

***=P<0.05; **=P<0.01; ***=P<0.001**

Table 4: Multilevel Odds ratios assessing effects of individual and district level characteristics on HIV testing among people who have ever had sex in Botswana.

VARIABLES		MODEL 5		MODEL 6		MODEL 7	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
INDIVIDUAL LEVEL (LEVEL 1)							
Demographic							
Age	10 to 19 years	NI	**NA**	1		1	
	20 to 34 years	NI	**NA**	7.63***	5.68-10.25	7.68***	5.71-10.32
	35 to 49 years	NI	**NA**	9.22***	6.54-12.99	9.25***	6.56-13.05
	50 to 64 years	NI	**NA**	4.01***	2.76-5.84	4.03***	2.77-5.88
Sex	Male	NI	**NA**	1		1	
	Female	NI	**NA**	2.76***	2.31-3.30	2.77***	2.32-3.31
Marital Status	Never Married	NI	**NA**	1		1	
	Married/Cohabiting	NI	**NA**	0.59***	0.49-0.71	0.59***	0.49-0.71
	Formerly Married	NI	**NA**	0.84	0.53-1.31	0.83	0.53-1.30
Residence	Cities/Towns	NI	**NA**	1		1	
	Urban Villages	NI	**NA**	0.83	0.62-1.10	0.86	0.53-1.40
	Rural	NI	**NA**	0.80	0.61-1.05	0.81	0.50-1.33
Socioeconomic							
Education	None/Primary	NI	**NA**	1		1	
	Secondary	NI	**NA**	1.15	0.91-1.46	1.15	0.91-1.45
	Tertiary	NI	**NA**	1.37*	1.02-1.83	1.38*	1.03-1.85
Religion	Christian	NI	**NA**	1		1	
	Other Religions	NI	**NA**	0.70*	0.51-0.97	0.71*	0.51-0.98
	No Religion	NI	**NA**	1.04	0.79-1.37	1.03	0.79-1.36
Employment Status	Employed	NI	**NA**	1		1	
	Unemployed	NI	**NA**	0.92	0.76-1.12	0.92	0.76-1.12
HIV Knowledge	Low	NI	**NA**	1		1	
	Medium	NI	**NA**	1.32*	1.04-1.69	0.94	0.77-1.14
	Comprehensive	NI	**NA**	1.39*	1.06-1.84	0.61***	0.49-0.76
HIV Stigma	Low	NI	**NA**	1		1	
	Medium	NI	**NA**	0.94	0.77-1.15	1.33*	1.04-1.70

VARIABLES		MODEL 5		MODEL 6		MODEL 7	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
	High	NI	NA	0.61***	0.49-0.76	1.41*	1.07-1.85
Behavioral							
Number of Sexual Partners last 12 months	0 to1	1		1		1	
	2 or more	0.81	0.64-1.03	1.09	0.84-1.42	1.09	0.84-1.43
Always Use Condom	Inconsistent	1		1		1	
	Consistent/No Sex	0.71***	0.59-0.85	0.88	0.72-1.07	0.88	0.72-1.08
Always Condom First Sexual Contact	Inconsistent	1		1		1	
	Consistent/No Sex	1.49***	1.18-1.87	1.42**	1.09-1.84	1.41*	1.09-1.82
Sex under the Influence of Alcohol or Drugs	Had Sex under influence	1		1		1	
	Never had sex under influence	1.11	0.82-1.52	0.99	0.72-1.39	0.99	0.72-1.39
DISTRICT LEVEL (LEVEL 2)							
Proportion of People with Comprehensive Knowledge of HIV	Low	1		NI	NA	1	
	Medium	1.70**	1.29-2.06	NI	NA	1.52**	1.28-1.90
	High	1.84***	1.32-2.38	NI	NA	1.64**	1.31-2.07
Proportion of People with No Stigma towards People Living with HIV	Low	1		NI	NA	1	
	Medium	1.28	0.98-1.52	NI	NA	0.99	0.68-1.45
	High	1.39**	1.07-1.68	NI	NA	1.01	0.67-1.53
Proportion of People with No Risky Sexual Behaviour	Low	1		NI	NA	1	
	Medium	0.99	0.68-1.47	NI	NA	0.89	0.68-1.45
	High	1.15	0.78-1.68	NI	NA	1.07	0.67-1.53
Intercept		**1.664*** **		**-0.279*** **		**-0.169 (NS)**	
% Correctly Predicted		**88.0**		**88.3**		**88.3**	
Random Intercept		**0.057**		**0.039**		**0.029**	
PVC (%) (Empty model is Reference)		**8.06%**		**37.1%**		**53.22%**	

NI – Not Included; NA – Not Applicable NS – Not statistically significant

***=P<0.05; **=P<0.01; ***=P<0.001**