

Full Length Research Paper

Risk factors for HIV infection among voluntary counselling and testing clients in Namibia

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In an effort to provide useful information that can guide HIV prevention strategies, this study determined the risk factors for HIV infection in Namibia. It also estimated the disease risk attributable to selected risk factors. The study adopted a cross sectional research design with a sample of 14296 voluntary testing and counseling clients from Oshana, Khomas and Kavango regions for the period of 2009 to 2012. Logistic regression was used to determine the risk factors for HIV infection among VCT clients. Attributable risk measures were then computed for factors amenable to intervention and were used as the basis for selecting risk factors posing the greatest disease burden to the population. From a targeting perspective, sex (OR = 1.3), condom use (OR= 1.7), male circumcision status (OR = 1.5) among others continue to be significant predictors of HIV infection. Not using condoms and not being circumcised are amenable to interventions and eliminating these risk factors can avert up to 22% and 18% of the disease burden respectively. Elimination of both exposures will result in 37% reduction in disease burden. As such, these factors should be the priority for HIV prevention in Namibia. We therefore recommend that the introduction of male circumcision in the country should be done concurrently with a strong condom messaging programme to increase the use of condoms even among circumcised men whilst at the same time addressing other social and structural factors.

Keywords: HIV, prevention, VCT clients, risk factors, logistic regression, attributable risk measures.

INTRODUCTION

Namibia is among the Sub-Saharan African countries which carry the world largest HIV burden (UNAIDS, 2011). The country has a mature epidemic, with HIV primarily transmitted through heterosexual means (MoHSS, 2011). The HIV prevalence rate among adults based on the 2009 estimates was at 13.1 percent (MoHSS, 2011), while the 2012 national HIV Sentinel Survey recorded 18.2 percent HIV prevalence rate among pregnant women (MoHSS, 2012). The country continues to suffer the devastating effects of HIV and AIDS and acknowledges that it is the greatest development challenge facing the country. The MoHSS and UNAIDS (2010) reported that 178 000 adults and

children in Namibia were living with HIV and AIDS in 2009. The Namibia Demographic Health Survey (NDHS) report of 2006/7 recorded that life expectancy in Namibia has drastically dwindled from 61 years in 1991 to 49 years in 2001. It was also stated in the same report that about 17 percent of children under the age of 18 in Namibia were orphaned by at least one parent.

As of 2012, HIV prevalence peaked in the age group of 25-39 years amongst women attending antenatal clinics (MoHSS, 2012). This is worrisome given that this group is the most economically active in the country. This situation prevails despite the Government of the Republic of Namibia (GRN), international partners and the civil society's efforts to curb further spread of HIV. This was evidenced by their efforts in rolling out anti-retroviral treatment (ART), strengthening capacity of those promoting behaviour change, targeting vulnerable popu-

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lations, prevention of transmission in health care settings, schools interventions, youth programmes, social mobilization and awareness activities, workplace programmes, expanded condom promotion, strengthening sexually transmitted infections (STI) management, advocacy for voluntary counselling and testing, safety of blood transfusion products, and addressing vulnerability based on gender inequalities, violence and alcohol abuse (MoHSS, 2006).

With all these concerted efforts, it is disheartening to note that new infections continue to occur and the HIV prevalence remains high, a situation that calls for a relook into prevention strategies to determine if they are primarily addressing the current drivers of the epidemic. It therefore becomes important to re-assess the known and perceived risk factors for HIV infection in order to guide the designing or redesigning and prioritisation of HIV prevention programmes in Namibia.

As rightly stated by MoHSS (2007b) that “aspects of the epidemic change from time to time and scientific, medical and programmatic knowledge of the epidemic progresses, our understanding of the HIV/AIDS epidemic and how best to respond to it continually evolves. This may necessitate changes in Namibia’s response to the epidemic from time to time”. Despite this acknowledgement, there is insufficient evidence to indicate that efforts have been exerted towards continuously re-assessing the drivers of the epidemic. Such assessments are strictly essential as they help to avoid wrong targeting and the one size fits all approach to prevention. Furthermore, there is also lack of evidence to show that the potential for HIV prevention which is measured by attributable risk measures was ever studied in Namibia. According to Hagan (2003), the potential contribution of attributable risk measures to prevention planning and to our understanding of the underlying dynamics of occurrence of HIV in a community may be more relevant now than ever before.

It is against this background, that this study provided a statistical analysis of VCT data to determine the risk factors for HIV infection in the Kavango, Khomas and Oshana regions of Namibia. Specifically the study was aimed at estimating the prevalence of HIV and exposure among VTC clients in Namibia, determining the significant risk factors for HIV infection, and estimating the proportion of disease burden that may be avoided if exposure to risk factors is eliminated among VCT clients. The findings of the study are critically essential to organisations working on HIV prevention and the ministry of health in Namibia and beyond as they reflect on their achievements on the fight against HIV and AIDS, tighten the loose ends and continue the with fight which seems to be far from ending.

METHODS

Study Design

A cross sectional research design was used in this study. This design allowed the researchers to estimate the

prevalence of the disease and exposure of VCT clients to various risk factors. The design further allowed the investigation of possible associations between risk factors (exposures) and disease occurrence.

Population

The population comprised of all the people who were 15 years old and above who got tested at the VCT centres in Namibia from the year 2009 to 2012.

Data

The data used in this study was obtained from IntraHealth International, an international Non-Governmental Organisation (NGO) funded by the United States Agency for International Development (USAID). Intra Health International collected the data from VCT clients who at their own will decided to get tested at the socially marketed VCT centres around the country. In this case, individuals were requested to answer a set of questions after testing for HIV. The variables used in the study were: HIV status, region, sex, age, marital status, level of education, condom use the last time one had sex, male circumcision, and alcohol use. Missing data were assumed to be missing at random and hence all cases with incomplete data were deleted.

Sample size

A sample of 14 296 VCT clients from the Khomas, Kavango and Oshana regions was used and this was arrived at after deleting all cases with incomplete data from a database of VCT clients.

DATA ANALYSIS

Descriptive analysis techniques were used to describe the characteristics of the sample studied. Specifically, the frequency procedure was used to show the prevalence of the disease and the various potential risk factors in the sample studied. Chi-square tests for association were then performed to ascertain if there existed an association between HIV status and individual factors. All variables which were significant at the 0.25 significance level were candidates for the logistic regression analyses. The value of 0.25 was used based on the recommendation by Bendel and Afifi (1997) and Mickey and Greenland (1989) who stated that the use of the traditional level such as 0.05 often fails to identify variables known to be clinically or biologically important. The univariate and multivariate logistic regression models were used to quantify the disease risk associated with various risk factors before and after controlling for other explanatory variables. From these analyses, the odds ratios (OR) and the corresponding 95% confidence intervals (CI) were reported. Using the rare disease assumption introduced by Cornfields (1951) and recommended by Viera (2008), Grimes and Schulz (2008), the odds ratios were used as approximate esti-

Table 1. Distribution of VCT clients by potential risk factors.

Potential Risk Factor	Frequency	Percent
Sex		
Male	6505	45.5
Female	7791	54.5
Age		
15-19		10.8
20-24	1551	28.1
25-29	4022	21.3
30-34	3040	13.8
35-39	1967	9.2
40-44	1319	5.4
45-49	769	4.4
50+	6281000	7.0
Male Circumcision done		
Yes	2747	44
No	3494	56
Level of Education		
None	708	5.0
Primary	2945	20.6
Secondary	8096	56.6
Tertiary	2547	17.8
Marital Status		
Married	2223	15.5
Never married	8192	57.3
Windowed	357	2.5
Cohabiting	3225	22.6
Divorced	299	2.1
Condom use the last time had sex		
Yes	6667	46.6
No	7629	53.4
Alcohol use		
Yes	2939	20.6
No	11357	79.4
Region		
Khomas	2704	18.9
Kavango	10478	73.3
Oshana	1114	7.8
HIV Status		
Positive	1582	11.1
Negative	12714	89.9

mates of relative risks in calculating attributable risk measures. The attributable risk percent (AR%) was then computed to quantify the proportion of disease burden among the exposed that could be attributed to exposure to risk factors (Koepsell and Weiss, 2003). Subsequently, the population attributable risk percent (PAR%) was calculated to ascertain the proportion of the disease burden in the population studied that could be attributed to exposure (Koepsell and Weiss, 2003). Finally, the combined population attributable risk percent (CPAR%) was computed to estimate the disease burden that may be avoided in the population if exposure to all modifiable risk factors is eliminated (Abbas et al., 2007).

RESULTS

Distribution of VCT clients by potential risk factors

Table I presents the distribution of VCT clients from Kavango, Oshana, and Khomas regions by potential risk factors. The results indicate that the majority (73.3%) of the VCT clients were from Kavango region with only 7.8 percent from Oshana region. The results further indicate that the majority (54.5%) of the VCT clients were females. The greatest proportion of VCT clients was in the age group 20 to 29 years with a cumulative percent of 49.4, while the lowest proportion (4.4%) was observed in

Table 2. Relationship between HIV sero-status and potential risk factors.

Potential risk factors	Number	HIV+ (%)	HIV- (%)	Chi-Square value	P-Value
Sex					
Male	6505	9.4	90.6	35.217	<0.001*
Female	7791	12.5	87.5		
Age:					
15-19	1551	3.4	96.6	168.844	<0.001*
20-24	4022	9.2	90.8		
25-29	3040	13.2	86.8		
30-34	1967	14.7	85.3		
35-39	1319	14.3	85.7		
40-44	769	10.8	89.2		
45-49	628	14.3	85.7		
50+	1000	10.7	89.3		
Marital status					
Married	2223	11.7	88.3	245.771	<0.001*
Never married	8192	7.9	92.1		
Divorced	299	21.1	78.9		
Widowed	357	20.7	79.3		
Cohabitation	3225	16.6	83.4		
Education					
None	708	12.3	87.7	281.462	<0.001*
Primary	2945	17.6	82.4		
Secondary	8096	11.0	89		
Tertiary	2547	3.4	96.6		
Region					
Khomas	2704	4.6	95.4	227.986	<0.001*
Kavango	10478	13.5	86.5		
Oshana	1114	4.2	95.8		
Condom use					
Yes	6667	7.3	92.7	182.480	<0.001*
No	7629	14.4	85.6		
Circumcised (men only)					
Yes	2747	8.7	91.3	3.715	0.054*
No	3494	10.1	89.9		
Alcohol use					
Yes	2939	11.6	88.4	0.949	0.33
No	11357	10.9	89.1		

*Significant at 0.25 level

the age group 45 to 49 years. Furthermore, a considerable proportion (56%) of men tested for HIV has not been circumcised. The greatest proportion (56.6%) of the VCT clients had attained secondary education as their highest qualification. Also, over half of the clients (57.3%) engaged in this study never married. More than half (53%) of them did not use condoms the last time they had sex. In addition, about 21 percent of them reported to have been using alcohol at the time the tests were done. Overall, 11.1 percent of the VCT clients engaged in the study were HIV positive.

Bivariate Analysis of HIV Sero-Status and Potential Risk Factors

The relationships between HIV sero-status and various

potential risk factors of interest are presented in Table 2. In the table, HIV+ (%) and HIV- (%) gives the proportion of VCT clients in a potential risk factor category who were HIV positive and negative respectively. The p-value presents the observed significance level corresponding to the Chi-Square test for association between potential risk factors and HIV sero-status. The tests were carried out at the 0.25 level of significance.

From a biological perspective, the results indicate that a significant association existed ($p < 0.001$) between sex and HIV sero-status for VCT the clients. Seropositivity was higher for female clients (12.5%) as compared to their male counterparts (9.4%). Equally important, there was a significant relationship between HIV sero-status and age ($p < 0.001$). Higher seroprevalence above 10 percent was recorded among VCT clients above 25 years of age whilst a relatively lower seroprevalence less than

10 percent was observed among clients who were less than 24 years.

The results further show that marital status was significantly related to HIV sero-status ($p < 0.001$) as evidenced by higher HIV positivity among the divorced (21.1%), widowed (20.7%) and the cohabiting (16.6%) clients. The lowest HIV prevalence rate was recorded among the never married (7.9%) and a little higher among married clients (11.7%). This pattern clearly demonstrates that the married and the singles are less infected by HIV as opposed to the widowed, cohabiting and divorced clients. Table 2 also shows that a significant relationship existed between the highest level of education attained and HIV sero-status ($p < 0.001$). Lower sero-prevalence of about 3.4 percent was found among the most educated with the highest sero-prevalence (17.6%) among those with primary education as their highest level. A clear pattern is evident since lower levels of education were associated with higher HIV sero-positivity.

It is clearly shown in Table 2 that a significant relationship between the regions and HIV sero-status existed ($p < 0.001$). Higher HIV sero-prevalence was observed in Kavango region (13.5%) followed by Khomas region (4.6%) whilst the lowest was observed in Oshana region (4.2%). With respect to condom use a higher HIV prevalence rate of about 14.4 percent was among VCT clients who did not use condoms the last time they had sex as compared to 7.3 percent for those who used one during their last sexual act. This relationship was found to be highly significant (p -value < 0.001).

Among the male VCT clients, an association between HIV sero-status and circumcision was found to be significant ($p = 0.054$). In this case, higher seroprevalence of about 10.1 percent was found among the uncircumcised male as opposed to the circumcised male with an HIV prevalence rate of 8.7 percent. On the contrary, no significant relationship was found between HIV sero-status and alcohol use ($p = 0.33$) among the VCT clients.

Risk Factors for HIV Infection

The results from the multivariate logistic analysis are presented in Table 3. Also presented in the table are the results of the univariate analysis, allowing the comparison of the risk associated with different levels of risk factors before and after controlling for other explanatory variables. However, emphasis is placed on the multivariate logistic regression results as they are more useful when more than one explanatory variable is involved. The point estimates of the odds ratios (OR) and their 95 percent Confidence Intervals (CI) as well as the p -values were also presented.

The results indicate that sex was a significant predictor of HIV infection among VCT clients ($p < 0.001$). An odds ratio of 1.3 demonstrated that being female increased one's risk of HIV infection. Furthermore, the results show that HIV infection was also associated with age. Clients in the age groups of 25-39 and 45-49 were about 5 to 6 times more likely to be infected with HIV as compared to

the 15-19 age group. Overall, VCT clients aged between 25 and 39 years were at higher risks of HIV infection. The results also show increased risk of HIV infection for clients in the age group 20 and 39 years after controlling for other factors as compared to the univariate estimates.

The results further show that marital status was a significant determinant of HIV infection among VCT clients in the three regions ($p < 0.001$). It was shown that VCT clients who were divorced, cohabiting or widowed were at a higher risk of HIV infection. The risk of infection was highest among the divorced (OR = 1.8) and the widowed (OR = 1.7), while slightly lower for those cohabiting (OR = 1.4) and the never married (OR = 1.2). It is interesting to note that the univariate analysis had shown being single (never married) as offering protection to HIV infection, (OR = 0.6) and turned to be a risk factor after controlling for other factors (OR = 1.2). Overall, being married had a protective effect on the risk of contracting HIV among the VCT clients.

The highest level of education attained also proved to be a significant predictor of HIV infection ($p < 0.001$). It was observed that clients with primary education were most at risk of HIV infection as they were four times more likely (OR = 3.7) to be infected with HIV as compared to those with tertiary education. Therefore, having attained tertiary education had a great protective effect on HIV infection. Noticeably, those who had acquired secondary education had a higher risk of contracting HIV (OR = 2.7) than those who had not attained any form of formal education (OR = 2.2). Overall, lower education levels were associated with increased odds of HIV infection among VCT clients.

The results also showed that the region where a client lived was significantly associated with HIV infection ($p < 0.001$). Living in Kavango region increased the risk of HIV infection (OR = 2.7) whilst residing in Oshana region had a protective effect (OR = 0.8). In addition, men who were not circumcised had an increased risk of HIV infection (OR = 1.5), demonstrating that male circumcision was a significant predictor of HIV infection among VCT clients ($p < 0.001$). The strength of this relationship was stronger after controlling for other risk factors since the univariate analysis showed a weak association between male circumcision and HIV sero-status (OR = 1.2).

With respect to condom use, VCT clients who did not use condoms the last time they had sex were twice at risk of HIV infection (OR = 1.7) compared to those who used condoms and this relationship was statistically significant (< 0.001).

Attributable Risk and the Potential for HIV Prevention

Measures of excess risk were only computed for modifiable risk factors with a relative risk of more than one as it does not make sense to eliminate a factor which offer disease protection. Factors such as condom use the last time one had sex and male circumcision were the only risk factors amenable to intervention, thus AR%, PAR % and the CPAR % were only computed for these two risk factors. The results of these computations are presented in Table 4.

Table 3. Univariate and Multivariate Analysis of HIV Risk Factors.

Variable (Factor)	Univariate effect			Multivariate effect		
	Odds ratio	95% CI	P-Value	Odds ratio	95%CI	P-Value
Sex						
Male	1.0	-	<0.001	1.0	-	<0.001
Female	1.4*	1.2 – 1.5		1.3*	1.2 - 1.5	
Age						
15-19	1.0	-	<0.001	1.0	-	<0.001
20-24	2.9*	2.1 - 3.8		3.5*	2.6 - 4.7	
25-29	4.3*	3.2 - 5.8		5.7*	4.2 - 7.8	
30-34	4.9*	3.6 - 6.6		6.3*	4.6 - 8.6	
35-39	4.7*	3.4 - 6.4		5.4*	3.9 - 7.6	
40-4	3.4*	2.4 - 4.9		3.2*	2.3 - 4.8	
45-49	4.7*	3.3 - 6.7		4.6*	3.2 - 6.8	
50+	3.4*	2.4 - 4.8		2.7*	1.9 - 4.0	
Marital status						
Married	1.0	-	<0.001	1.0	-	<0.001
Never married	0.6*	0.6 – 0.8		1.2	1.0 - 1.5	
Divorced	2.0*	1.5 – 2.7		1.8*	1.3 - 2.5	
Widowed	2.0*	1.5 – 2.6		1.7*	1.3 - 2.3	
Cohabitation	1.5*	1.3 – 1.7		1.4*	1.2 - 1.7	
Education						
Tertiary	1.0	-	<0.001	1.0	-	<0.001
Secondary	3.5*	2.8 - 4.4		2.7*	2.1 - 3.4	
Primary	6.1*	4.8 - 7.7		3.7*	2.8 - 4.7	
None	4.0*	2.9 - 5.5		2.2*	1.6 - 3.0	
Region						
Khomas	1.0	-	<0.001	1.0	-	<0.001
Kavango	3.2*	2.7 – 3.9		2.7*	2.2 - 3.2	
Oshana	0.9	0.6 – 1.3		0.8	0.6 - 1.2	
Condom use						
Yes	1.0	-	<0.001	1.0	-	<0.001
No	2.1*	1.9 – 2.4		1.7*	1.5 - 1.9	
Circumcision						
Yes	1.0	-	0.054	1.0	-	<0.001
No	1.2*	1.0 – 1.4		1.5*	1.3 - 1.9	

* Significant at 0.05 level

The results show that the practice of not using condoms during sexual intercourse had a prevalence of 53.4 percent among VCT clients whilst the strength of the relationship between HIV infection and not using condoms stood at 1.7. From these two estimates, the AR% was derived and the result shows that for the VCT clients who reported not to have used a condom the last time they had sex and tested HIV positive, 41.2 percent of them may have contracted HIV because of not using condoms. From a public health perspective, this means that 41.2 percent of the cases of HIV could have been avoided among those who reported not to have used condoms if they had used condoms during sexual intercourse. A corresponding PAR% of 22 for no condom use shows that about 22 percent of the HIV burden in the three study regions could have been avoided if every individual used a condom each time they had sex with an

individual whose status was not known to them assuming all other factors remain the same.

Similarly, the results reveal that the prevalence of male circumcision among VCT clients from the three regions stood at 44 percent whilst the strength of the association between HIV infection and not being circumcised as measured by the odds ratio was 1.47. An AR% of 32 implies that, among the people who were not circumcised and tested positive, 32 percent of them may have been infected with HIV because they were not circumcised. This therefore means that 32 percent of the HIV burden among the uncircumcised VCT clients in the regions under study could have been avoided if they were circumcised. Taking it to the population of people who got tested in the three regions, a PAR% of 18 for circumcision means that approximately 18 percent of the HIV burden in these regions could have been avoided if

Table 4. Attributable Risk Measures.

Risk Factor	Proportion of subjects in the population exposed ^a (p _c)	Relative Risk (RR)	Attributable Risk Percent ^c (AR%)	Population Attributable Risk Percent ^d (PAR%)	Combined Population Attributable Risk Percent ^e (CPAR%)
No condom use	0.534	1.702	41.2	22.0%	36.82%
Not circumcised (men only)	0.560	1.472	32.07	17.97%	

^aProportion of subjects in the population exposed to the risk factor (p_c)

^bRelative risk from multivariate analysis (RR=OR),

^cAR% = (RR-1)×100/RR,

^dPAR% = AR% × p_c

^eCPAR = 1 - (1 - PAR_{mc}%) (1 - PAR_c%)

every male person was circumcised assuming other factors remain unchanged.

In an effort to formulate strategies to respond to the epidemic, it is very useful to understand the risk associated with various risk factors and the prevalence of exposure to those risk factors as expressed by the Population Attributable Risk Percent. This process helps to identify high priority risk factors for prioritisation in the national HIV response. It follows that the elimination of a common risk factor with a large relative risk (higher PAR%) will result in a substantial reduction in the occurrence of the disease. In this study, both, not using condoms and not being circumcised proved to have reasonably high PAR%. However, it is evident that eliminating the risk of not using condoms can avert a greater proportion of the disease burden (22%) compared to male circumcision (18%). A combined PAR% of 37% shows that the elimination of both exposures could have resulted in a 37% reduction of the disease burden in the population.

DISCUSSION

The study has shown an overall HIV prevalence rate of 11.1 percent among VCT clients from Khomas, Kavango and Oshana regions. Due to the fact that testing at VCT centres is voluntary, it is usually the case that VCT data underestimate the true population HIV prevalence since other people get testing services at other facilities such as public and private hospital and clinics or are not tested at all. It is also believed that people who are associated with risky behaviours do not seek HIV testing services (MoHSS, 2009). Furthermore, MoHSS (2009) pointed to the fact that adolescents, the rural population, the married or cohabiting are less likely to seek testing services at the VCT centres. Also apparent is the fact that most of the VCT clients are females, a situation which was highlighted in the 2006/7 Namibia Demographic Survey which recorded about 51 percent of the Namibian

women who were ever tested and received results as compared to only 32 percent of men (MOHSS, 2007).

The study showed that sex and/or gender are significant predictors of HIV infection in Namibia specifically showing that females were more likely to be infected with HIV compared to men. This phenomenon can be explained in various ways including the physiological explanation which states that women are more susceptible to HIV infection because of their greater mucosal surface exposed to pathogens during sexual intercourse (Ipinge, et al, 2004), the lack of respect for women, violence against and low status of women in the Namibian society prevents women from negotiating for safer sex such as using condoms (Mba, 2003).

In addition, this can be explained by wrong beliefs in some Namibian societies where men believes that HIV can be cured by having sex with a virgin and others believing that young girls are free from HIV hence exposing young women to a greater risk of HIV infection (Talavera, 2002). The fact that women are forced to use various economic coping mechanisms which most of the time involve economic dependency on men for a living and to support their families also put them at an increased risk of HIV infection (Pettifor et al, 2005).

According to Ganley (2013), the lack of self-esteem among women makes them to continue in abusive relationships. Ganley added that a woman may come to believe that she somehow deserves the abuse to which she has been subjected and this often leads to the belief that she does not deserve anything better. This lack of self-esteem cuts across racial, ethnic, religious and socioeconomic lines.

Equally important, the study proved that VCT clients in the age group 25 to 39 were at the highest risk of HIV infection compared to those below 20 and above 40 years. This result concur with other studies showing a positive wealth gradient on HIV infection in Sub Saharan Africa, meaning that as people get richer, their risk of HIV infection increases (Fox, 2010). In the Namibian context, it is from the age of 25 that young single people get

employed, become financially stable and begin to experiment with life since they can afford to fund social outings. With increased access to resources at these ages, more partners get attracted to them for financial gains and thus increasing their risk of HIV infection.

The study has also shown that marital status is another significant HIV risk determinant in Namibia. It was demonstrated that cohabiting and being single (never married) increased the risk of HIV infection. Even worse, the widowed and the divorced were at a higher risk of HIV infection. The study also proved that the use of condoms among the cohabiting, the widowed and the divorced is very low suggesting why their risk of infection is high. For the widowed and divorced, it may be that the use of condoms becomes unusual after marriage life which is normally characterized by low uptake of condoms as shown in (Tenkorang, 2014). Tenkorang added that, in Tanzania and Zimbabwe, divorced women had higher risks of HIV infection compared to never-married women concluding that specific HIV programs need to be directed at vulnerable women, in particular the widowed. This finding is worrisome considering that about 59 percent of Namibians above 15 years were never married with about 8 percent cohabiting, 4 percent widowed and 2 percent being divorced (NSA, 2011).

Contrary to many researchers, this study has shown that attaining higher levels of education reduces the risk of HIV infection. This finding contradicts studies which concluded that higher education levels are associated with the risk of HIV infection in Sub Saharan Africa, as professionals were found to be twice to three times more likely to be HIV infected than agricultural workers who are usually uneducated (Fox, 2010). It also violate the postulations that most education environments are not safe especially for young women and men due to sugar mummies and sugar daddies and peer pressure, and hence increasing their risk of HIV infection (Shapumba et al, 2004 and Sabone et al, 2007). Anderson and Beutel, (2007) support this finding with their conclusion that people who have completed higher grades in school may have received more information about HIV and AIDS and that people who are in school have current exposure to HIV education and prevention methods than those who are not.

The study also indicates that living in Kavango region increased the risk of HIV infection whilst residing in Oshana had a protective effect on HIV infection compared to living in the Khomas region. Kavango is second from Caprivi in terms of HIV prevalence in Namibia (MoHSS, 2012). One possible reason why HIV prevalence is so high is that Kavango region borders with the Caprivi region which has a border town of Katima Mulilo which has the highest HIV prevalence in Namibia thus the disease is easily transmitted since the two communities highly interact. Moreover, Rundu town which is the capital of Kavango region is on the Trans-Kalahali highway which leads to the Katima Mulilo boarder post, making it a transit town and thus putting the residents at an increased risk of HIV infection by truck drivers and cross boarder traders who are generally known to have a high HIV seropositivity. Besides,

Kavango region is the poorest region in Namibia and this makes the people especially women devote to dangerous coping mechanisms including exchanging sex for material or financial gains (Van Niekerk and Kopelman, 2005).

In terms of circumcision, the study proved that men who are not circumcised are at an increased risk of HIV infection. The finding concurs with three recent clinical trials which found that men who had been circumcised by trained medical professionals and with appropriate surgical follow-up reduced the risk of acquiring HIV by 60 percent (Auvert et al 2005, Gray et al 2007 and Bailey et al, 2007). In addition, the study found that not using condoms increased the risk of HIV among VCT clients. This finding is worrisome since the use of condoms in Namibia remains limited especially amongst those cohabitating, the widowed and divorced as well as amongst the elderly. This could be mainly due to the complexity in the use of condoms. Even if an individual decides to use a condom as a protective measure, a number of barriers may inhibit the use of it. Low risk perception, past experience and the type of partner or relationship may jeopardise the decision to use a condom (Varga, 2007).

Paradoxically, the study has shown that HIV prevalence is highest in the Kavango region yet male circumcision is highest in the same among the three studied regions. It is important to note that even though male circumcision is high, condom use is low in this region. This observation has also been noted by Desert Soul (2011) pointing out that Kavango has the lowest levels of condom use in the Namibia.

This perfectly agrees with explanations given by Kim and Pang (2007) as well as Taylor et al, (1996) opposing male circumcision citing the negative effects of circumcision on condom use. They argued that male circumcision removes nerves from the penis and causes significant loss of sexual sensitivity and function. For this reason, many circumcised men are reluctant to use condoms and thus have an adverse effect on the overall incidence of HIV infection (Kim and Pang, 2007). Also, the study has proved that alcohol use is not a predictor of HIV infection in Namibia. This finding contradicts findings from other studies such as McEwan et al, (1992) and UNICEF (2004) which present alcohol use as a predictor of HIV infection.

It was also shown that 41.2 percent of the HIV burden among those who have not used condoms the last time they had sex is attributable to their risky behaviors of not using condoms. This brings to the fore the fact that not using condoms is one of the major risky behaviors which if eliminated will prevent a significant proportion of new HIV infections in Namibia. Specifically, the study has proven that about 22 percent of the HIV burden in Kavango, Oshana and Khomas regions could be avoided if every individual used a condom each time they had sex with an individual whose status was not known to them. Similarly, the study revealed that about 33 percent of the HIV burden among the uncircumcised VCT clients could have been avoided if they were circumcised. Inferred to

the studied population, this finding informs us that approximately 18 percent of the HIV burden in these regions could have been avoided if every male person was circumcised.

Since a comparison of the values of population attributable risk percent for selected risk factors can help to identify risk factors that are most important for planning interventions, this study shows that condom use promotion programmes will help reduce a greater burden of HIV compared to male circumcision since PAR% for condom use was found to be higher than that of circumcision. This finding perfectly agrees with Visser (2005) who concluded that HIV and AIDS awareness programmes among people that focus on condom use and behavioural change towards safer sexual practices remain a priority and key means of prevention. Be that as it may, a PAR% of 18 percent for male circumcision cannot be underestimated. This therefore highlights the fact that male circumcision is equally important and its scaling up can help save lives.

The study has demonstrated that programmes that eliminate both risks of not using condoms and being uncircumcised may result in the greatest desired impact (37%). However, as much as male circumcision and condom programmes may be prioritised, programmes which seek to address other social/structural and biomedical factors must not be neglected. This perfectly dovetails with evidence which shows that isolated interventions that seek to prevent the further spread of HIV may not achieve the intended results alone. As such, a new and widely acceptable approach is combination prevention. It entails rights-based, evidence-informed, and community-owned programmes that use a mix of biomedical, behavioural, and structural interventions, prioritized to meet the current HIV prevention needs of particular individuals and communities, so as to have the greatest sustained impact on reducing new infections (UNAIDS, 2010).

Importantly, the study also clearly demonstrated the importance of using attributable risk measures when designing and prioritising public health programmes. The use of such measures provides a solid understanding of priority community health needs that need the most urgent attention.

STUDY LIMITATIONS

The data analysed in this study was obtained from VCT centres in Namibia. It was data collected from volunteers who represent only individuals who chose to get tested at the VCT facilities and therefore it may not be a true representation of the Namibian population. Limitations in recall and recall bias were inevitable as the study used a cross-sectional design.

This is because human beings are limited to varying degrees in their ability to recall information. Data was also expected from VCT centres in all the 14 administrative regions of Namibia, unfortunately, complete data was only available from Kavango, Khomas and Oshana regions, which do not provide a fair

representation of Namibia at large hence generalising of the findings would not be possible.

CONCLUSIONS

This study determined the risk factors for HIV infection in Namibia. It also estimated the disease risk attributable to not using condoms and not being circumcised among men. Results show that sex (and or gender), age, marital status, level of education, region of residence, male circumcision and condom use continue, among others to be significant predictors of HIV infection in Namibia. Among these risk factors, not using condoms and male circumcision are amenable to interventions, and programmes that eliminate exposure to these risk factors will result in a substantial decrease in the disease burden in Namibia. Even though, programmes that aim to increase condom use has the greatest potential to prevent more infections, it is important to address a number of risk factors (biomedical, social/structural and behavioural) concurrently. For instance, the introduction of male circumcision should be done concurrently with a strong condom messaging programme to increase the use of condoms even among the circumcised men whilst at the same time addressing other social and structural factors.

ABBREVIATIONS

AR: Attributable Risk, AR%: Attributable Risk Percent, CI: Confidence Interval, HIV: Human Immunodeficiency Virus, MoHSS: Ministry of Health and Social Services, MC: Male Circumcision, NDHS: Namibia Demographic Health Survey, OR: Odds Ratio, PMTCT: Prevention of Mother to Child Transmission (of HIV), PAR%: Population Attributable Risk Percent, RR: Relative Risk, STI: Sexually Transmitted Infection, SSA: Sub Saharan Africa, UNAIDS: Joint United Nations Programme on HIV/AIDS, UNICEF: United Nations International Children's Emergency Fund, USAID: United States Agency for International Development, VCT: Voluntary Counselling and Testing, WHO: World Health Organisation.

COMPETING INTERESTS

The authors confirm that this study has no conflicts of interest.

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