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HIV prevalence and risk behaviors among self-identified homosexual and bisexual male clients of Botswana's *Tebelopele* Voluntary Counseling and Testing Centers, 2010-2012

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Abstract

HIV prevalence and risk behaviors among self-identified homosexual and bisexual male clients of Botswana's *Tebelopele* Voluntary Counseling and Testing Centers, 2010-2012

By Kaleigh Beronja

Background: Botswana, a country in which one in four adults is living with Human Immunodeficiency Virus (HIV), is ranked among those most affected by the epidemic. Despite the high prevalence, however, there has been limited information describing HIV among key populations, including men who have sex with men (MSM).

Objective: The purpose of this study was to examine the prevalence and risk factors associated with having a positive HIV test result among MSM seeking voluntary counseling and testing (VCT) at one of Botswana's *Tebelopele* centers.

Methods: Information was collected on clients visiting one of Botswana's *Tebelopele* centers from 2010 through 2012. Chi-square analyses were conducted to determine if there was a difference in the risk factors associated with men assumed to be MSM compared to those identifying as heterosexual. Logistic regression was conducted to examine the association between sexual orientation and having a positive HIV test result, after controlling for confounding variables. Factors associated with being HIV positive were compared across Gaborone, Francistown, and Kasane.

Results: Of the 40,733 males included in this analysis, 2,203 identified as homosexual or bi-sexual. Of these, 13.3% had a positive HIV test result, compared to 13.1% of males who identified as heterosexual. Client's age, highest level of education received, reported condom use, and circumcision status were all found to be significant predictors of testing HIV positive. In the multivariate analysis, sexual orientation was not found to be a significant predictor of having a positive HIV test result (aOR=1.06, 95% CI: 0.91, 1.23). Heterosexual males were more likely to have had 2 or more sexual partners in the previous 12 months compared to homosexual or bi-sexual males, but were also more likely to report always using condoms.

Conclusions: Although our analysis did not find a significant difference in HIV prevalence among men assumed to be MSM, compared to heterosexual men, differences in behaviors associated with HIV across the two groups were significantly different. These behaviors, such as reported condom use, are important issues to target in the prevention of HIV among all males.

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Background/Literature Review

Overview of the Epidemic

On June 5, 1981, the Centers for Disease Control and Prevention (CDC) reported a rare case of pneumonia in a group of young homosexual men living in Los Angeles (1). The following year, the CDC established the term 'Acquired Immunodeficiency Syndrome' (AIDS) to identify this illness, which is characterized by a depletion of CD4+ T-lymphocyte cells, and an expansion of CD8+ T-lymphocyte cells, leading to a state of immune suppression (1, 2). In 1982, following the detection of the first known case of AIDS in the U.S., a disease in Africa known as "slim" with similar characteristics, was confirmed to be AIDS (1).

Shortly after the first case was discovered, it became evident that AIDS was progressive, with an extensive lag time between exposure and the state of immune suppression, but it was not known what agent caused the condition (3). Given the evidence that AIDS was characterized by clinical symptoms that didn't develop until years after the infection occurred, it became essential to identify the agent linked to the syndrome. In 1984, at the National Institutes of Health, human immunodeficiency virus (HIV) was discovered through the isolation of the virus from patients with AIDS, as well as through the development of a blood test for HIV, which became available in blood transfusion centers in 1985 (3). The realization that HIV caused AIDS was attributable to the consistent isolation of the virus from patients of different origins who had AIDS, and from the isolation of similar viruses causing AIDS-like syndromes in non-human primates (3). Later that year, the causative relationship between HIV and AIDS was accepted by the

scientific and medical community, and was later confirmed through the isolation of HIV type 2 in West African patients with AIDS (3).

Throughout the three decades since the first reported case, the HIV/AIDS epidemic has become a grave public health threat, emerging as one of the leading causes of mortality and disease burden globally (4). Sub-Saharan Africa (SSA) has been and remains the region most affected by the epidemic. As of 2012, 71% of the total population living with HIV was in SSA (1). Although infection rates have been declining in SSA, from 2.4 million new infections in 2001, to 1.8 million in 2012, this region remains disproportionately affected by HIV compared to the rest of the world, and therefore emphasizes the need to direct prevention efforts to the countries within this region.

High Risk Groups

Despite the decline in infection rates seen in SSA however, HIV rates among the most at risk, or key populations, have been stable or even escalating (5). Key populations refer to those harder to reach subgroups that are at an increased risk for HIV, including men who have sex with men (MSM), female sex workers (FSWs), transgender women, and injection-drug users (IDUs) (6). Globally, MSM are 19 times more likely to have HIV compared to the population as a whole (7). Research has shown that select sexual behaviors and other risk factors among these stigmatized subgroups have been key challenges in controlling the spread of this epidemic (5).

Testing and Treatment

The availability of, and access to, HIV testing and treatment have been crucial aspects to controlling and decreasing rates of transmission. In order to receive proper treatment and information, it is essential for all individuals to know their HIV status. Knowing one's HIV status is critical to controlling the infection, as it allows one to take care of their health, gain access to treatment, and possess the knowledge necessary to prevent HIV transmission (8). Other benefits to knowing one's status include the ability to better cope with HIV infection, help plan for the future, and help communities to reduce the denial, stigma, and discrimination associated with HIV/AIDS (9).

Following the discovery of HIV in the early 1980s, it became essential to design a quality diagnostic test. The first tests implemented for screening and diagnosis looked for the presence of antibodies to HIV in the patient's blood (10). The problem with these enzyme-linked immunosorbent assays (ELISA), however, was that since they required the sample to be transported to central laboratory services, it took anywhere from one to two weeks to get the result (10). In addition to the anxiety caused by this wait time, a more significant problem was that many did not return for their test result. Another issue associated with the ELISA tests was the fact that they were fairly labor-intensive and costly (10). Given these requirements for this test, it became clear that a different test was needed for implementation in lower- and middle-income countries. In the 1990s, point of care (POC) tests were developed specifically for areas that did not have access to laboratory services. Unlike the previously used ELISA tests, POC tests were able to provide test results within a few minutes, thus ensuring clients receive their results (10).

These tests have been crucial in the fight against HIV as they have contributed to a greater number of people knowing their status, and thus, if positive, being able to begin a treatment regimen.

The confirmation in 1983 that HIV was associated with AIDS in a causative way led to the development of antiretroviral (ARV) agents to aid in the treatment of HIV (2). The first ARV agent found to be effective in the treatment of HIV was zidovudine (11). This drug was shown to decrease the opportunistic infections and mortality resulting from HIV. However, limitations of using this agent on its own were later observed, and it was determined that pairing it with another ARV agent was a more effective method of treating HIV (11). This led to the use of combination therapy, which remains the method of treating HIV to this day. Up to this point, there have been 23 ARV agents created, which are classified according to the step in the HIV replication process they inhibit (2). Antiretroviral therapy (ART) is capable of reducing HIV blood concentrations to undetectable levels within the first few weeks of treatment (2). The expansion of ART coverage has been cited as a likely contributor to the gradual evolution of HIV infection to a chronic, typically non-fatal condition (2).

Global Initiatives

The global HIV/AIDS epidemic has been acknowledged as a humanitarian crisis, which has resulted in the implementation of several initiatives and programs. In 2002, the United States established The Global Fund to Fight AIDS, Tuberculosis, and Malaria, which has since invested billions of dollars to assist those countries hit hardest by this

disease. As of June 2013, $22.9 billion has been given to 151 countries by the Global Fund to support large-scale prevention, treatment, and care programs (12, 13).

The most significant player in the elimination of global HIV, however, has been the U.S. President's Emergency Plan for AIDS Relief (PEPFAR). PEPFAR was authorized in 2003 by the *United States Leadership against HIV/AIDS, Tuberculosis and Malaria Act of 2003*, and is the largest component in the U.S. President's Global Health Initiative (14). Congress appropriated $15 billion for the first five years (2003-2008), and in 2008, PEPFAR was reauthorized for another five years for $48 billion (12). In the first couple years after PEPFAR was initiated, the limited data on stigmatized, hard-to-reach populations made it difficult to target resources and implement programs to reduce the burden of HIV among key populations (15). During this time, PEPFAR concentrated most of its efforts on building country-level infrastructure, preventing mother-to-child transmission, supporting the use of ART, and preventing heterosexually transmitted HIV (15). The reauthorization in 2008, however, led to an increased use of methods to provide more accurate estimates of the numbers and characteristics associated with the key populations affected by HIV, and a greater attention to these key populations in countries with generalized and concentrated HIV epidemics (15). The majority of the funding from PEPFAR is allocated to 31 countries, including 15 "focus countries", which are among those most affected by the epidemic (16). These focus countries are Botswana, Cote d'Ivoire, Ethiopia, Guyana, Haiti, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Vietnam, and Zambia (16).

Current Epidemic in Botswana

Botswana is a politically stable, upper middle income country with a population of approximately 2 million people (17). The first case of HIV in Botswana was discovered in 1985 (17). Botswana now has the second highest HIV infection rate in the world, with approximately one in every four adults infected (18). The HIV prevalence among males and females between the ages of 15 and 49 was 18.9% and 28.9%, respectively, between 2007 and 2009 (18).

Throughout the past three decades, factors associated with the spread of HIV in Botswana have been described. These factors include stigma, the relative infrequency of marriage, the vulnerability of women, unprotected sex, poverty, demographic mobility, and the rarity of male circumcision (6, 19). A survey conducted in five districts of Botswana found that the majority of participants believed routine HIV testing in all medical facilities would decrease barriers to testing, increase access to ART, as well as decrease HIV-related stigma and violence towards women (20).

Key populations in Botswana, specifically MSM, are at a higher risk for infection, and exhibit a higher prevalence of HIV than the general population. The individual-level risks for HIV acquisition among MSM include the extent to which they engage in unprotected receptive anal intercourse and/or injection drug use. It has also been determined that MSM who have a high number of male partners, and/or engage in receptive sex with males who have a high viral load, are at greater risk for acquiring HIV (21). The high transmission of HIV among MSM can partially be explained by two factors, as described

by Beyrer. First, the probability of transmission through receptive anal intercourse is approximately 18 times higher than that for vaginal intercourse (21). Second, unlike heterosexual sex, where the insertive and receptive roles are biologically determined, the fact that MSM are likely to engage in both insertive and receptive sex plays a central role in the spread of HIV within MSM networks, as both are risk factors for acquiring and transmitting HIV (21). Similarly, because MSM may also have wives or other female sex partners, the continued spread of HIV is facilitated (21).

The recent recognition that certain sexual and risk behaviors among these populations may be the driving force behind this concentrated epidemic led Botswana's Ministry of Health (MOH) to address the knowledge gap through the first ever mapping, size estimation, and biological and behavioral surveillance (BBSS) among key populations in Botswana (19). The goal of this integrated BBSS was to generate baseline information regarding the prevalence and incidence of HIV and other sexually transmitted infections (STIs), and the risk factors for HIV among MSM, FSWs, and IDUs (19). This was of particular importance in this endemic country, as the information obtained could facilitate improved planning of targeted programs and interventions to reduce the spread of HIV among these subgroups.

The outcome of interest for the BBSS was HIV infection, predicted by variables such as demographics, sexual orientation and experience, sexual behavior in the prior six months, history of HIV testing, circumcision, current partnerships, and self-reported symptoms (17). MSM participating in this study were asked to provide a blood sample, which was

drawn by a phlebotomist in one of the local testing centers. The blood was then tested using the standard rapid test algorithm; the participants were able to access the result of their test on site (17). The HIV prevalence among MSM, 18 years and older, was found to be 13.1%. Although this did not differ greatly from that in the general population (12.9%), the younger mean age among MSM indicate that the HIV prevalence among this subpopulation may not be on the same downward trend as that of the general Botswana population (17). MSM were also found to have a high burden of other STIs, with 11.3% testing positive for chlamydia, which included 5.9% infected with chlamydia in the anus. Other risks found to be associated with MSM in this study were having multiple partners, including female partners, having concurrent partners, selling sex and buying sex from FSWs, and being unaware that anal sex increases the risk of HIV transmission (17). Many MSM in this study noted that they felt uncomfortable discussing HIV testing and sexually transmitted infection (STI) related issues with their health care provider, and, compared to FSWs, they were less likely to receive condoms from healthcare workers (17).

The information obtained from this study highlights the importance of prevention efforts targeting MSM, and the need for sensitization and specialized training as well as the provision of MSM-appropriate services. As part of these efforts, it is vital to provide education about the risks associated with male-to-male sex, improve access to quality health services, and promote safer sex decision-making (17).

Barriers to Testing and Treatment

The annual number of adult deaths in Botswana attributable to AIDS had been rising steadily during the 1980s and 1990s, with a peak of almost 16,000 deaths in 2003. Without the implementation of an ART program, it was estimated that adult deaths due to AIDS would have continued to increase to nearly 23,000 in 2007 (22). As a result of Botswana's treatment program, which has expanded the number of adults receiving ART from 932 in 2000, to 85,497 by the end of 2007, the estimated number of adult AIDS deaths dropped to 7,400 in 2007. Given the positive impact that ART has had on treating those with AIDS, it is evident that the need for early counseling and testing is critical not only to the prevention of new infections, but also to extending the lives of those living with AIDS (22).

Despite the importance of early testing, however, fewer than one in 10 people are aware of their status in many parts of the world most affected by HIV/AIDS, including SSA (9). This can be attributed to poor access to care, as well as the stigma associated with testing positive (9). In a qualitative study conducted in Zambia, in which informants were asked why they would not be tested, many reported a fear of learning their status, despite the fact that they knew people could live for long periods of time with treatment (8).

Among key populations, not only is there fear and stigma associated with receiving a positive test result, but there is also stigma associated with behaviors such as engaging in homosexual sex. Because of the fear of knowing one's status and the stigma associated

with homosexual or bisexual sexual orientation, the goal of preventing and decreasing the incidence of HIV among MSM in countries in SSA, including Botswana, remains a challenge (5). The criminalization of MSM in developing countries has prevented the collection of information regarding behaviors among MSM. Similarly, because the stigma associated with MSM in these countries has led to their hidden nature, studies conducting size estimations are limited (5). According to a three-country study in SSA, the fear of discrimination and blackmail has been associated with reduced willingness to seek care for sexually transmitted infections (STIs). In the same three-country study, any interaction with health care was found to be associated with MSM reporting fear of seeking health care, having been denied health care services, and having been blackmailed. As a result, this discrimination has been associated with reduced willingness to seek care for HIV (5). In order to effectively reduce new HIV infections among key populations, specifically MSM, a focus must be directed at breaking down the barriers to testing and treatment faced by such groups.

Testing Systems in Botswana

In the early 2000s, the CDC, along with the Botswana Government, determined that providing voluntary counseling and testing (VCT) outside the health care system was a crucial step in preventing HIV in Botswana. As a result, *Tebelopele*, or "look into the future," was created in April of 2000. The CDC has funded the testing supplies, staff salaries and training, information systems, and marketing costs (19). Since the opening of *Tebelopele*, a social marketing campaign has encouraged people to get tested at these clinics. *Tebelopele* facilities have been promoted by Botswana leaders, educational and

entertainment sessions, billboards, radio and television announcements, as well as painted vehicles displaying messages that encourage HIV testing (19). In 2004, *Tebelopele* became Botswana's largest non-governmental organization funded the U.S. government, and now has 16 centers, which provide free, anonymous, HIV rapid testing for the public (19).

Tebelopele clinics use standardized counseling and testing protocols, which take approximately 45 minutes. Prior to testing, risk assessments are done, and clients are prepared for receiving their results. Following rapid-testing, counselors discuss risk reduction plans and distribute condoms to the clients. Finally, HIV status is disclosed, and testing of sexual partners and referrals to support groups and health services are discussed as needed (19). The information collected from the clients in these clinics includes demographics, sexual history, reasons for testing, and the result.

Importance of This Analysis

Despite the importance of targeting key populations for prevention efforts, information and studies regarding HIV among MSM in SSA have been limited. This analysis will present the HIV prevalence and risk factors associated with HIV among MSM in Botswana who seek testing and counseling at one of Botswana's 16 *Tebelopele* sites. Because of the large amount of data received by *Tebelopele* clinics between 2010 and 2012 on sexual orientation, this analysis will provide extensive information regarding HIV among this high risk subgroup. The findings from this analysis will be compared to the MOH evaluation of MSM, which will allow for a better understanding of how to

better serve high risk populations in Botswana through the implementation of interventions directed at the prevention of HIV in this subgroup.

Methods

Data Collection and Study Population

Data Collection

This cross sectional study analyzed data collected from 16 *Tebelopele* clinics in Botswana between 2010 and 2012. In April of 2000, the first *Tebelopele* facility was opened in Botswana, after the Government of Botswana and the Centers for Disease Control and Prevention determined that providing voluntary counseling and testing (VCT) outside the health care system was a high priority (19). *Tebelopele* uses a standardized counseling and testing protocol, which takes about 45 minutes. The counseling provided includes a risk assessment and preparing clients for receiving their results, followed by risk reduction plans and condom distribution after the test results have been given (19).

Information, including demographic data, sexual history, potential risk factors for HIV infection, and reasons for seeking testing, is collected from each client during the risk assessment. This information is then entered into an Epi-Info database at each clinic, which is then transmitted to a central database where all the data are merged and reports are produced at the national level (19). Clients are tested using an algorithm for parallel rapid HIV testing, utilizing two different test kits, which has been validated in Botswana by the CDC and Botswana's Ministry of Health (MOH). The sensitivity and specificity of this algorithm compared with ELISA tests were 100% and 99.6%, respectively (19). If the two tests used produce different results, they are repeated. If they continue to be discordant, a third test is used as a tiebreaker (19).

Study Population

Given that clients were not asked about their sexual orientation until 2010, the data obtained from 2008 and 2009 were excluded from the analysis. There were 362,076 recorded client encounters between 2010 and 2012. Many of these client encounters corresponded to repeat testers. To be eligible for the analysis, clients had to meet the following criteria: 1) male, 2) at least 18 years of age, 3) reported their sexual orientation, 4) had an HIV test result, and 5) had not had a previous HIV test. After excluding observations that did not meet the above criteria, there were 40,733 observations in the dataset (Figure 1).

Variables and Measures

Primary Variables of Interest

The dependent variable of interest in this study was HIV status. HIV status was determined by the result of the tests administered at one of Botswana's *Tebelopele* clinics. This outcome assessed was a dichotomous variable, as clients were found to be either HIV positive or HIV negative. Clients that did not have a recorded HIV test result were excluded from this analysis. The primary predictor variable for this analysis was self-reported sexual orientation. Similar to the HIV test result, men who did not report their sexual orientation were excluded for the purpose of this study.

Demographic Characteristics

Demographic variables examined for this analysis included age, highest level of education completed, relationship status, site location, site type, and reason for testing. The types of *Tebelopele* sites are fixed, outreach/mobile clinics, satellites, and mini *Tebelopele*, with fixed sites being the most common.

The clients' ages were broken down into five age groups: 18-24 years, 25-29 years, 30-39 years, 40-49, and 50 years and older. The clients' reason for testing was determined from a question regarding the most important reason that they were visiting *Tebelopele*. The 21 specific reasons were then combined into 11 comprehensive reasons, which included the client partaking in risky behavior, partner partaking in risky behavior, the condom burst, and routine testing.

The main site locations of interest were Gaborone, Francistown, and Kasane since these had been previously examined in the study done by the BBSS.

Sexual Behaviors and Risk Factors

Clients also reported whether or not they had been circumcised, the number of sex partners they had in the previous 12 months, and condom use in the last 12 months. Response options when clients were asked about the number of sex partners they had in the last 12 months, were one, two, three or more, not applicable, or refused to answer. Response options when clients were asked about condom use were never, always, sometimes, or not applicable. For both of these questions, an answer of 'not applicable'

meant that the client had answered ‘no’ to a question asking whether they had sex in the previous 12 months; therefore, not applicable was assumed to mean no partners.

Data Analysis

Data were analyzed using SAS version 9.3 (SAS Institute, Cary, NC). Frequencies and means were obtained to describe the characteristics of men 18 years and older who were first time testers at one of Botswana’s *Tebelopele* clinics between 2010 and 2012. A chi-square test was conducted to determine if demographic characteristics and risk factors differed by sexual orientation.

Bivariate analyses were used to determine if a relationship existed between independent variables and the outcome of interest, i.e., having a positive HIV test result. Variables found to be statistically associated with this outcome, at a *p-value* <0.05, were included in the multivariate model. A logistic regression model was then used to determine the association between sexual orientation and HIV test result among men tested at *Tebelopele* centers in Botswana, after controlling for the variables of interest. After assessing for interaction, the final gold standard model was selected for each of the districts of interest. Confounding was then assessed, and the adjusted odds ratio (aOR) was calculated for the main exposure in the final models.

Finally, the HIV prevalence, and risk factors associated with having a positive HIV test result were examined separately in Gaborone, Francistown, and Kasane.

Results

Demographic Information and Behavioral Characteristics

Between 2010 and 2012, 362,076 HIV tests were performed in one of Botswana's *Tebelopele* clinics. The analysis was restricted to 40,733 observations, which included men 18 years and older who had reported their sexual orientation, had not had a previous HIV test, and had a test result reported (Figure 1). The majority of all men included in this analysis were below 40 years, with an average age of 32, and most of them (78%) had received at least some secondary education. The majority of the men (86%) who came in for testing had not been circumcised, and fewer than half (40%) reported always using condoms (Table 1).

Table 1 summarizes the HIV prevalence and characteristics of all men tested for HIV, by their sexual orientation. The main differences between the homosexual/bi-sexual men and heterosexual men were seen in their relationship status, the type of site where they received their test, their reported condom use in the past 12 months and in their reported reason for getting tested. Of those considered to be MSM, 31.5% noted that they were in an uncommitted relationship, while just 13.7% of heterosexual men were in an uncommitted relationship. The majority of heterosexual males (72%) were tested at one of *Tebelopele's* fixed sites, compared to just 55% of MSM. Similarly, more MSM opted for testing at one of *Tebelopele's* outreach/mobile clinics (41%) than heterosexual males (24%). Compared to heterosexual males (41%), fewer MSM reported always using condoms (20%). Finally, when asked about their reason for being tested, more MSM reported having had risky behavior (55%) then heterosexual men (33%) (Table 1).

Bivariate Analysis

Table 2 displays the results obtained from the bivariate analysis assessing factors associated with having a positive HIV test result. Being homosexual or bisexual, compared to heterosexual, was not found to be a significant predictor of having a positive HIV test result (OR=1.02, 95% CI: 0.90, 1.16). Approximately half of all males tested were below 30 years of age; however the majority of positive HIV tests (77%) were obtained from men at least 30 years of age. Age group was found to be significantly associated with HIV status. Compared to men between the ages of 18 and 24, men of older age groups were all significantly more likely to have received a positive test result. The highest level of education received was also found to be significantly associated with the HIV test result. Overall, having had more education was associated with a lower percentage of having a positive HIV test result. Compared to men who had not received any education, men who had received university education were significantly less likely to have a positive HIV test result (OR=0.21, 95% CI: 0.18, 0.24) (Table 2).

Other factors found to be significantly associated with having a positive HIV test result included whether or not the client is circumcised, condom use, and reported reason for testing. Compared to males who had not been circumcised, having a positive HIV test result was significantly lower among men who had been (OR=0.68, 95% CI: 0.62, 0.75). Men who reported always using condoms were significantly less likely to have a positive HIV test result than those who reported never using condoms (OR=0.41, 95% CI: 0.37, 0.46). Finally, clients who noted that they were being tested because they had a relative

who had HIV, had symptoms of HIV, or died from HIV were significantly more likely to have a positive test, compared to those who didn't (OR=1.84, 95% CI: 1.71, 1.98) (Table 2).

Multivariate Analysis

Table 2 also summarizes the adjusted odds ratios (aOR) that were obtained from the final logistic regression model. The final model controlled for age group, the highest level of education received, relationship status, whether or not the client had been circumcised, the type of site where the client was tested, reported condom use in the previous 12 months, and whether or not the client noted that they were being tested because a relative had HIV, symptoms of HIV, or had died from HIV. After controlling for these factors, sexual orientation was still not found to be a significant predictor of HIV status (aOR=1.06, 95% CI: 0.91, 1.23).

The factors that were found to be significant in the bivariate analysis however, were still significant after controlling for confounders. Older age was associated with a higher probability of having a positive HIV test result. Compared to males aged 18 to 24, men in older age groups were significantly more likely to have a positive test. Males who had received greater levels of education were less likely to have a positive HIV test result. Compared to males who had not had any education, males who had gone to a university were significantly less likely to have a positive HIV test result (aOR=0.22, 95% CI: 0.18, 0.27). Having been circumcised was still found to be protective, with significantly less circumcised males having HIV then those who had not been circumcised (aOR=0.57,

95% CI: 0.51, 0.64). Finally, the multivariate model indicated that, compared to men who never use condoms, those who reported always using condoms are significantly less likely to have HIV (Table 2).

Demographic Information and Behavioral Characteristics by District

Table 3 displays the characteristics of all men by HIV status for each major district (Gaborone, Francistown, Kasane, and all other districts combined). Among men identifying as homosexual or bi-sexual, Gaborone had the highest percentage with a positive HIV test result (14.1%), followed by Francistown (9.7%), and then by Kasane (5.6%). Across all districts, men between the ages of 40 and 49 had the largest percentage of positive HIV test results (Table 3). Having been circumcised was associated with a lower percentage of positive HIV tests in Gaborone, Francistown, and all other districts combined. However, in Kasane, a greater percentage of men who had been circumcised had a positive test (16.8%), compared to men who had not been circumcised (13.5%). The association between test reason and the prevalence of HIV differed across the three districts. In Gaborone, 22% of males who noted that they were being tested to access care and treatment had positive HIV tests; however in Kasane, just 5% of males tested for this reason had positive HIV tests. In Kasane, 34% of males who reported being tested for the purposes of family planning had positive tests; conversely just 15% of males in both Gaborone and Francistown who reported testing for this reason had a positive HIV test result (Table 3).

Discussion

Importance of Study and Key Findings

This study was conducted to determine the prevalence of HIV, and risk factors associated with having a positive HIV test result, among men who have sex with men (MSM) seeking voluntary counseling and testing (VCT) at one of Botswana's 16 *Tebelopele* clinics. Despite the fact that MSM are an important target population in the reduction of HIV, few studies have been conducted regarding HIV among this key subgroup. Evidence has suggested that while HIV rates continue to decline in the general population, rates among key populations are stable or even escalating (5). In addition to the fact that some key populations have a higher prevalence of HIV than the general population, they are also harder to reach because of the stigmatized, criminalized nature of homosexuality and bisexuality in many parts of the world. The population examined in this study represented males of at least 18 years of age who were tested for HIV at a *Tebelopele* clinic between 2010 and 2012. These men were all first time testers, who had disclosed their sexual orientation, and had a recorded HIV test result.

The results obtained from this analysis indicate that, after controlling for potential confounders, compared to men who identified as heterosexual, men who identified as homosexual or bi-sexual, were not significantly more likely to have a positive test result. However, among other variables in the final model, age group, education status, condom use, circumcision status, and test reason were all found to be significantly associated with having a positive HIV test result.

Comparison to Other Studies

Prior to this analysis, Botswana's Ministry of Health (MOH) recognized that even in a generalized epidemic, HIV prevalence may be highly concentrated among key populations including MSM, female sex workers, and injection drug users (17). Given the importance of identifying risk factors and behaviors associated with such groups, the MOH conducted the first ever biological and behavioral surveillance survey (BBSS) among key populations in an attempt to fill this information gap (17). The BBSS concluded that the HIV prevalence among MSM was 13.1% (unadjusted), and 9.2% (adjusted). Our findings regarding HIV prevalence among MSM (13.3%) were consistent with those obtained from the BBSS.

At the district level, Kasane was found to have the highest HIV prevalence (25.9%) among MSM in the BBSS, compared to 12.3% in Gaborone and 11.7% in Francistown (17). These findings differed from those obtained in this analysis. Our results suggested that Gaborone has the highest prevalence of HIV among MSM (14.1%), followed by Francistown (9.7%), and then by Kasane (5.6%). The difference in HIV prevalence across district, when comparing our findings to those of the BBSS, is likely a result of the variation across the two study populations. Although the BBSS found the prevalence of HIV in Kasane to be much higher than indicated by our results, there was a small sample size of 30 MSM, and there was a large confidence interval (95% CI: 9.0%, 42.8%) (17). The average age (23 years) of the MSM sample population used in the BBSS was much younger than that of our population (32 years), which also could have accounted for the difference in prevalence. Finally, the methods of obtaining the study populations varied

across the two studies. While our study analyzed all first time testing males 18 years and older who tested at *Tebelopele* centers between 2010 and 2012, and had reported their sexual orientation, the BBSS conducted random sampling, utilizing a sampling frame with a mapping process to obtain their sample population.

Targeting Risk Behaviors

The results obtained from this study indicate that certain risk behaviors differ greatly between men considered to be MSM and heterosexual men. Over half of men considered to be MSM noted that they were being tested because they had been involved in risky behavior (55.1%), while one third (33.1%) of heterosexual males noted that this was their reason for seeking an HIV test. Similarly, significantly fewer men who identified as homosexual or bi-sexual reported always using condoms in the past 12 months, compared to heterosexual males. These findings suggest that prevention efforts should be focused on encouraging condom use among all men, and reducing risky behaviors. Consistent with our findings, in a systematic review, unprotected sex with a male partner was consistently reported as being associated with a positive HIV status in Thailand (23).

The majority of all men who were tested at *Tebelopele*, both MSM and non-MSM, had not been circumcised (85.8%). This is another critical issue to target when considering prevention efforts in Botswana. There have been other analyses that also suggest that circumcision is associated with lower rates of HIV infection among men. The Cochrane Review, for example, conducted a meta-analysis of three randomized control trials, and

concluded that adult male circumcision reduces the acquisition of HIV in heterosexual men by 54% over a two year period (24).

Finally, the final multivariate model indicated that men in older age groups were at an increased risk for having a positive HIV test. Higher HIV prevalence in older age groups is consistent with information found from other studies. In a cross-sectional assessment conducted among MSM in Swaziland, age was found to be strongly correlated with having a positive HIV test result, with an increased odds ratio for each year of age (25). This significant association, as noted in the study, suggests that the expanding epidemic among MSM in Swaziland represents cumulative HIV acquisition risk exposures (25). As age is typically associated with a greater number of sex partners, our findings are consistent with what one might expect.

Limitations

The findings obtained from this study are subject to several critical limitations. First, because there were no specific questions asked regarding the gender of the clients' sexual partners, men who identified as being homosexual or bi-sexual were assumed to be MSM. Similarly, men who identified as being heterosexual were assumed not to have had sex with men. In addition, we did not have information regarding the role male clients played in sex, whether insertive, receptive, or both, which is important given the higher risk of acquisition among men who are receptive partners.

This analysis relied on self-reported data from the *Tebelopele* clinics. Because being homosexual, or MSM, in Botswana is extremely stigmatized and criminalized, there may have been men who did not accurately report their sexual orientation. The potential of false self-reporting has the ability to skew the data, because, there may be MSM within the group considered not to be MSM. This could cause the two groups of men to appear more similar than they truly are, thus biasing the results.

Recommendations and Future Directions

The results from our analysis suggest that HIV prevalence among MSM may not be much different from that among heterosexual males in Botswana. Despite these findings, however, key populations remain an important target in the prevention of HIV, as their stigmatized nature has been found to decrease their willingness to seek care and get tested (5). A critical step to preventing HIV in countries where the behaviors of MSM continue to be stigmatized and criminalized will be in providing more outreach, and providing greater access to sites where they are more prone to seek care, and services.

For instance, our analysis indicated a significant difference in the type of *Tebelopele* site used by men who identified as homosexual or bi-sexual and men who identified as heterosexual. Almost half (41%) of homosexual men sought counseling and testing at outreach clinics, where less than a quarter of heterosexual men visited these clinics. This underlies the importance of increasing access to such clinics, promoting their use, and making sure they have the resources they need to help educate and inform those more likely to seek testing there.

Finally, this analysis has summarized key risk behaviors among both homosexual/bi-sexual men and heterosexual men found to be significantly associated with having a positive HIV test result. Given the low prevalence of males who reported always using condoms, and the preventive impacts condoms have been found to have on the spread of HIV, educating about the importance of condom use is critical in the prevention of HIV throughout the world.

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List of Tables and Figures

Table 1. Characteristics of males 18+ years who received voluntary counseling and testing at *Tebelopele* centers in Botswana by sexual orientation, 2010-2012 (n=40,733)

Characteristics	All Males	Homosexual or Bi-sexual [n(%)]	Heterosexual [n(%)]	Pr < ChiSquare
Age [mean(SD)]	31.6 (11.8)	32.2 (12.5)	31.6 (11.8)	
Age group				
18-24 years	13,045 (32.0)	685 (31.1)	12,360 (32.1)	0.0222
25-29 years	9,587 (23.5)	525 (23.8)	9,062 (23.5)	
30-39 years	10,522 (25.8)	531 (24.1)	9,991 (25.9)	
40-49 years	3,854 (9.5)	225 (10.2)	3,629 (9.4)	
50+ years	3,725 (9.1)	237 (10.8)	3,488 (9.1)	
Highest Level of Education				
None	3,572 (8.8)	230 (10.4)	3,342 (8.7)	<0.0001
Pre-primary or Primary	5,340 (13.1)	317 (14.4)	5,023 (13.0)	
Junior Secondary	12,849 (31.5)	738 (33.5)	12,111 (31.4)	
Senior Secondary	10,984 (27.0)	546 (24.8)	10,438 (27.1)	
Vocational	3,442 (8.5)	218 (9.9)	3,224 (8.4)	
University	4,546 (11.2)	154 (7.0)	4,392 (11.4)	
Relationship Status				
Not in a relationship	7,727 (19.0)	423 (19.2)	7,304 (19.0)	<0.0001
Uncommitted	5,966 (14.6)	693 (31.5)	5,273 (13.7)	
Committed (not cohabitating)	16,391 (40.2)	554 (25.1)	15,837 (41.1)	
Cohabitating	4,141 (10.2)	231 (10.5)	3,910 (10.1)	
Married	2,192 (5.4)	90 (4.1)	2,102 (5.5)	
Missing	4,316 (10.6)	212 (9.6)	4,104 (10.7)	
Circumcised				
No	34,939 (85.8)	1,831 (83.1)	33,108 (85.9)	<0.0001
Yes	5,175 (12.7)	310 (14.1)	4,865 (12.6)	
Missing	619 (1.5)	62 (2.8)	557 (1.4)	

Characteristics	All Males	Homosexual or Bi-sexual [n(%)]	Heterosexual [n(%)]	Pr < ChiSquare
Site Location				
Gaborone	7,162 (17.6)	99 (4.5)	7,063 (18.3)	<0.0001
Francistown	6,070 (14.9)	62 (2.8)	6,008 (15.6)	
Kasane	965 (2.4)	36 (1.6)	929 (2.4)	
Other	26,536 (65.1)	2,006 (91.1)	24,530 (63.7)	
Site Type				
Fixed	28,910 (71.0)	1,205 (54.7)	27,705 (71.9)	<0.0001
Satellites	1,291 (3.2)	98 (4.4)	1,193 (3.1)	
Outreach/Mobile and Mini Tebelopele	10,301 (25.29)	899 (40.8)	9,402 (24.4)	
Missing	231 (0.6)	1 (0.0)	230 (0.6)	
Number of Sex Partners in Last 12 Months				
No partners	7,226 (17.7)	348 (15.8)	6,878 (17.9)	<0.0001
1 Partner	29,163 (71.6)	1,665 (75.6)	27,498 (71.4)	
2 Partners	2,385 (5.9)	89 (4.0)	2,296 (6.0)	
3 or more Partners	1,186 (2.9)	36 (1.6)	1,150 (3.0)	
Missing	773 (1.9)	65 (3.0)	708 (1.8)	
Reported Condom Use in Last 12 Months				
Never	3,683 (9.0)	163 (7.4)	3,520 (9.1)	<0.0001
Always	16,374 (40.2)	447 (20.3)	15,927 (41.3)	
Sometimes	12,704 (31.2)	1,168 (53.02)	11,536 (29.9)	
No partners	7,112 (17.5)	347 (15.8)	6,765 (17.6)	
Missing	860 (2.1)	78 (3.5)	782 (2.0)	

Characteristics	All Males	Homosexual or Bi-sexual [n(%)]	Heterosexual [n(%)]	Pr < ChiSquare
Reason for testing				
Client risky behavior	13,936 (34.3)	1,213 (55.1)	12,750 (33.1)	<0.0001
Partner had risky behavior	984 (2.4)	72 (3.3)	912 (2.4)	0.0074
A relative had HIV/symptoms/died	6,008 (15.8)	170 (7.72)	5,388 (15.15)	<0.0001
The client is a caregiver	4,982 (12.2)	294 (13.4)	4,688 (12.17)	0.1007
The condom burst	1,277 (3.0)	96 (4.4)	1,131 (2.94)	0.0001
The client was raped	32 (0.1)	2 (0.1)	30 (0.08)	0.8332
Family planning	1,560 (3.8)	51 (2.31)	1,509 (3.92)	0.0001
Client tested as prerequisite	2,018 (5.0)	85 (3.9)	1,933 (5.02)	0.0148
Routine testing/window period	4,545 (11.2)	95 (4.3)	4,450 (11.55)	<0.0001
Client was encouraged to get tested	1,170 (2.9)	47 (2.1)	1,123 (2.91)	0.0328
To access care and treatment	3,765 (9.2)	50 (2.3)	3,715 (9.64)	<0.0001

Table 2. Odds ratios (OR) from bivariate analysis, adjusted odds ratios (aOR) from multivariate analysis, and 95% confidence intervals (CI) of being HIV positive among males tested for HIV in one of Botswana's *Tebelopele* centers, 2010 and 2012 (n=40,733)

	HIV Positive [n(%)]	N	OR (95% Confidence Interval)	aOR (95% Confidence Interval)
Sexual Orientation				
Heterosexual[b]	5,046 (13.1)	38,530	1.00	1.00
Homosexual or Bi-sexual	293 (13.3)	2,203	1.02 (0.90, 1.16)	1.06 (0.91, 1.23)
Age Group				
18-24 years[b]	360 (2.8)	13,045	1.00	1.00
25-29 years	937 (9.8)	9,587	3.82 (3.37, 4.32)	3.51 (3.06, 4.03)
30-39 years	2,318 (22.0)	10,522	9.96 (8.88, 11.16)	8.60 (7.56, 9.69)
40-49 years	1,081 (28.1)	3,854	13.74 (12.11, 15.58)	10.72 (9.22, 12.46)
50+ years	643 (17.3)	3,725	7.35 (6.42, 8.41)	4.59 (3.86, 5.46)
Highest Level of Education				
None[b]	700 (19.6)	3,572	1.00	1.00
Pre-Primary or Primary	1,362 (25.5)	5,340	1.40 (1.27, 1.56)	1.27 (1.12, 1.44)
Junior Secondary	1,872 (14.6)	12,849	0.70 (0.64, 0.77)	0.86 (0.75, 0.97)
Senior Secondary	916 (8.3)	10,984	0.37 (0.34, 0.42)	0.50 (0.44, 0.58)
Vocational	270 (7.8)	3,442	0.35 (0.30, 0.41)	0.38 (0.31, 0.45)
University	219 (4.8)	4,546	0.21 (0.18, 0.24)	0.22 (0.18, 0.27)
Relationship Status				
Not in a relationship	929 (12.0)	7,727	0.70 (0.61, 0.80)	1.62 (1.38, 1.89)
Uncommitted	584 (9.8)	5,966	0.55 (0.48, 0.64)	1.11 (0.94, 1.30)
Committed (not cohabitating)	1,846 (11.3)	16,391	0.65 (0.57, 0.73)	1.19 (1.03, 1.37)
Cohabitating	820 (19.8)	4,141	1.26 (1.10, 1.45)	1.29 (1.11, 1.49)
Married[b]	359 (16.4)	2,192	1.00	1.00

	HIV Positive [n(%)]	N	OR (95% Confidence Interval)	aOR (95% Confidence Interval)
Circumcision Status				
No	4,743 (13.6)	34,939	1.00	1.00
Yes[b]	500 (9.7)	5,175	0.68 (0.62, 0.75)	0.57 (0.51, 0.64)
Site Location				
Gaborone	835 (11.7)	7,162	0.85 (0.79, 0.93)	
Francistown	814 (13.1)	6,070	1.00 (0.92, 1.09)	
Kasane	138 (14.3)	965	1.08 (0.90, 1.30)	
Other[b]	3,552 (13.4)	26,536	1.00	
Site Type				
Fixed[b]	4,048 (14.0)	28,910	1.00	1.00
Satellites	174 (13.5)	1,291	0.96 (0.81, 1.13)	0.66 (0.54, 0.81)
Outreach/Mobile and Mini Tebelopele	1,077 (10.5)	10,199	0.72 (0.67, 0.77)	0.50 (0.46, 0.55)
Number of Sex Partners in Last 12 Months				
No Partners[b]	832 (11.5)	7,226	1.00	
1 Partner	3,873 (13.3)	29,163	1.18 (1.09, 1.27)	
2 Partners	374 (15.7)	2,385	1.43 (1.25, 1.63)	
3 or more Partners	189 (15.9)	1,186	1.46 (1.23, 1.73)	
Reported Condom Use in Last 12 Months				
Never[b]	675 (18.3)	3,683	1.00	1.00
Always	1,392 (8.5)	16,374	0.41 (0.37, 0.46)	0.65 (0.58, 0.73)
Sometimes	2,364 (18.6)	12,704	1.02 (0.93, 1.12)	1.37 (1.22, 1.54)
No partners	823 (11.6)	7,112	0.58 (0.52, 0.65)	0.70 (0.61, 0.80)

	HIV Positive [n(%)	N	OR (95% Confidence Interval)	aOR (95% Confidence Interval)
Reason for testing				
Client risky behavior	1,867 (13.4)	13,963	1.04 (0.98, 1.10)	
Partner had risky behavior	114 (11.6)	984	0.87 (0.71, 1.05)	
A relative had HIV/symptoms/died	1,198 (19.9)	6,008	1.84 (1.71, 1.98)	1.83 (1.68, 2.00)
The client is a caregiver	508 (10.2)	4,982	0.73 (0.66, 0.80)	
The condom burst	98 (8.0)	1,227	0.57 (0.46, 0.70)	
The client was raped	5 (15.6)	32	1.23 (0.47, 3.19)	
Family planning	312 (20.0)	1,560	1.70 (1.49, 1.93)	
Client tested as prerequisite	107 (5.3)	2,018	0.36 (0.29, 0.44)	
Routine testing/window period	450 (9.9)	4,545	0.70 (0.64, 0.78)	
Client was encouraged to get tested	123 (10.5)	1,170	0.77 (0.64, 0.93)	
To access care and treatment	503 (13.4)	3,765	1.02 (0.93, 1.13)	

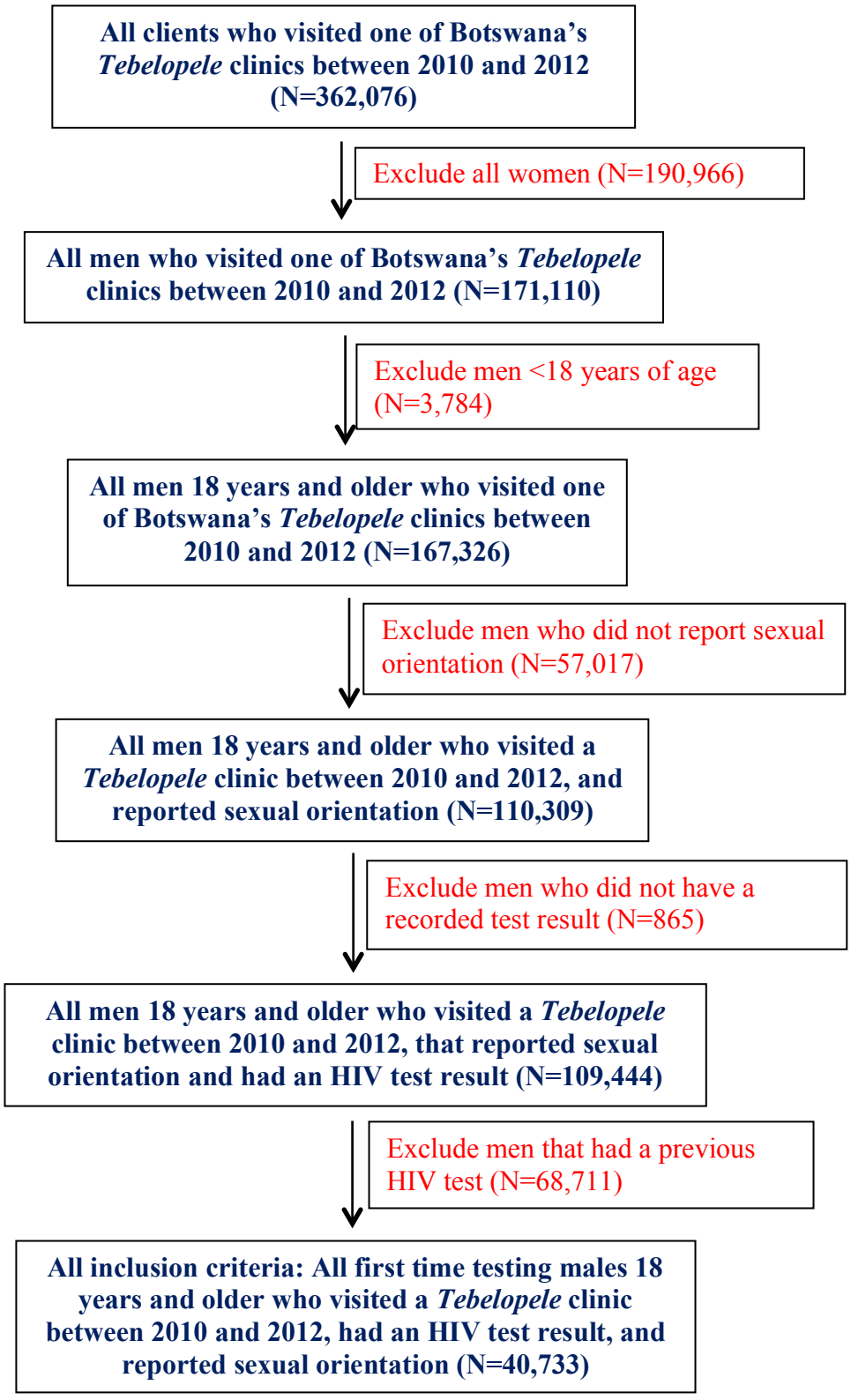
Table 3. HIV status associated with key characteristics and risk behaviors of first time tested males 18+ years who received voluntary counseling and testing at *Tebelopele* clinics between 2010-2012, by district (HIV Positive [n(%)])

MSM Characteristics	Gaborone (N=7,162)	Francistown (N=6,070)	Kasane (N=965)	Other (N=26,536)
Sexual Orientation				
Heterosexual	821 (11.6)	808 (13.5)	136 (14.6)	3,281 (13.4)
Homosexual or Bi-sexual	14 (14.1)	6 (9.7)	2 (5.6)	271 (13.5)
Age Group				
18-24 years	37(1.7)	63 (3.1)	13 (3.5)	247 (2.9)
25-29 years	126 (6.7)	172 (11.0)	18 (8.7)	621 (10.5)
30-39 years	412 (19.5)	327 (21.1)	59 (25.8)	1,520 (22.9)
40-49 years	190 (28.2)	164 (31.6)	37 (35.2)	690 (27.0)
50+ years	70 (23.7)	88 (20.4)	11 (20.4)	474 (16.1)
Highest Level of Education				
None	49 (31.8)	56 (22.0)	13 (32.5)	582 (18.6)
Pre-Primary or Primary	158 (39.3)	183 (30.0)	42 (30.4)	979 (23.4)
Junior Secondary	271 (16.4)	334 (15.8)	50 (13.3)	1,217 (14.0)
Senior Secondary	228 (9.9)	164 (8.1)	23 (8.1)	501 (7.9)
Vocational	50 (6.9)	50 (9.6)	6 (9.5)	164 (7.7)
University	79 (4.1)	27 (4.9)	4 (6.1)	109 (5.5)
Relationship Status				
Not in a relationship	131 (11.0)	127 (13.7)	14 (9.7)	657 (12.0)
Uncommitted	47 (7.0)	69 (8.2)	10 (14.7)	458 (10.5)
Committed (not cohabitating)	351 (9.7)	275 (10.6)	35 (11.5)	1,185 (12.0)
Cohabitating	132 (25.0)	135 (22.6)	34 (21.1)	519 (18.2)
Married	67 (18.4)	56 (18.9)	11 (18.6)	225 (15.3)
Missing	107 (13.5)	152 (18.7)	34 (14.9)	508 (20.4)

MSM Characteristics	Gaborone (N=7,162)	Francistown (N=6,070)	Kasane (N=965)	Other (N=26,536)
Circumcised				
No	740 (12.5)	724 (13.9)	111 (13.5)	3,168 (13.8)
Yes	80 (6.8)	75 (10.1)	22 (16.8)	323 (10.3)
Missing	15 (18.5)	15 (15.0)	5 (45.5)	61 (14.3)
Site Type				
Fixed	807 (12.0)	673 (13.4)	82 (14.5)	2,486 (15.0)
Satellites	0 (0.0)	0 (0.0)	0 (0.0)	174 (13.5)
Outreach/Mobile and Mini Tebelopele	28 (6.9)	141 (13.7)	56 (14.0)	852 (10.1)
Missing	0 (0.0)	0 (0.0)	0 (0.0)	40 (17.3)
Number of Sex Partners in Last 12 Months				
No partners	146 (8.7)	119 (14.6)	16 (13.2)	551 (12.0)
1 Partner	613 (12.9)	636 (13.2)	101 (14.3)	2,523 (13.4)
2 Partners	46 (11.7)	36 (14.8)	15 (19.0)	277 (16.6)
3 or more Partners	16 (8.8)	15 (14.4)	5 (13.5)	153 (17.7)
Missing	14 (9.9)	8 (7.7)	1 (4.6)	48 (9.5)
Reported Condom Use in Last 12 Months				
Never	95 (18.9)	87 (21.0)	26 (23.6)	467 (17.6)
Always	236 (8.2)	244 (8.1)	34 (8.1)	878 (8.7)
Sometimes	344 (17.4)	354 (21.1)	61 (21.0)	1,605 (18.3)
No partners	143 (8.6)	119 (14.7)	16 (13.2)	545 (12.1)
Missing	17 (11.2)	10 (7.3)	1 (4.4)	57 (10.4)

MSM Characteristics	Gaborone (N=7,162)	Francistown (N=6,070)	Kasane (N=965)	Other (N=26,536)
Reason for testing				
Client risky behavior	377 (11.6)	251 (14.7)	47 (13.8)	1,192 (13.8)
Partner risky behavior	15 (10.3)	13 (20.3)	0 (0.0)	86 (11.2)
A relative had HIV/symptoms/died	222 (18.1)	118 (24.2)	40 (25.6)	818 (19.8)
The client is a caregiver	30 (7.7)	152 (10.8)	13 (9.4)	313 (10.3)
The condom burst	25 (5.2)	13 (11.9)	3 (8.3)	57 (9.4)
The client was raped	2 (25.0)	0 (0.0)	0 (0.0)	3 (13.0)
Family planning	42 (15.1)	47 (15.2)	13 (34.2)	210 (22.5)
Client tested as prerequisite	10 (2.3)	13 (5.5)	5 (6.9)	79 (6.2)
Routine testing/window period	34 (6.9)	153 (10.8)	9 (9.3)	254 (10.0)
Client was encouraged to get tested	18 (10.2)	5 (6.0)	4 (13.3)	96 (10.9)
To access care and treatment	52 (22.0)	38 (20.9)	2 (4.6)	441 (12.4)

Figure 1. Exclusion criteria for the analysis of HIV among men who have sex with men in Botswana



Appendix A:
Individual Client Intake Form Manual

INDIVIDUAL INTAKE FORM

#	Variable	Question	Field Type	Length	Valid Options
	SESTYPE	Session type Whether or not the client came in as an individual, child/adolescent or as a couple.	Num	2	1 – Individual 2 – Couple 3 – Child or Adolescent
	SITECODE	Site code The site code is divided into four parts: ▪ The first digit represents the site type: 1 is fixed site, 2 is satellite, 3 is outreach (this includes all outreach and mobile events), and 4 is Mini Tebelopele sites ▪ Digits 2 and 3 identify the site in the order in which the site was established, e.g. 01 is Gaborone, 02 is Francistown, 16 is Mahalapye. ▪ For satellite sites, digits 4 and 5 identify the satellite number the order in which the satellite was assigned, e.g. site codes 201011, 201021, and 201031 are respectively the first, second, and third satellites associated with site 01, Gaborone. For fixed and outreach sites digits 4 and 5 are 00. ▪ The last digit identifies the region (1 is South; 2 is North). *Note*: Once a site code has been assigned, it cannot be used ever again.	Num	6	**Fixed** 101001 -Gaborone 102002 -Francistown 103002 -Selibe Phikwe 104002 -Maun 105001 -Jwaneng 106002 -Kasane 107002 -Serowe 108001 -Lobatse 109002 -Letlhakane 110002 -Palapye 111001 -Ghanzi 112001 -Mochudi 113001 -Kanye 114001 -Molepolole 115001 -Tsabong 116002 -Mahalapye **Satellites** 201011 -UB Satellite 201021 -BCA 201031 -Mogoditshane Village 201041 –Prisons **201051 – Tlokweng Project** 202012 -Tonota Collecge of Education 202022 -Masunga Village 202032 -Bus Rank 202042 -Tati Nickel 202052 -Dikgatlhong F/town 203012 -Dikgatlhong Phikwe 203022 -Botshabato 205011 -Jwaneng VCTC

					208011 -Otse Village 208021 -Ramotswa Village 208031 -Borolong 208041 -Lobatse Prison 209012 -Orapa 211011 -Ghanzi State Prison 212011 -Oodi Village 212021 -Glen Valley 213011 -Moshupa SDA Clinic 214011 -Letlhakeng Village 214021 -Gamodubu 216012 -Mahalapye Prison **Outreach/Mobile** 301001 -Gaborone Mobile 302002 -Ftown Mobile 303002 -Sphikwe Mobile 304002 -Maun Mobile 305001 -Jwaneng Mobile 306002 -Kasane Mobile 307002 -Serowe Mobile 308001 -Lobatse Mobile 309002 -Letlhakane Mobile 310002 -Palapye Mobile 311001 -Ghanzi Mobile 312001 -Mochudi Mobile 313001 -Kanye Mobile 314001 -Molepolole Mobile 315001 -Tsabong Mobile 316002 -Mahalapye Mobile **Mini Tebelopele** 401011 -Tirisano Catholic-Mogodithane 402012 -Top Banana_Tshesebe 402022 -Roman Catholic-F/town 402032 -Pelegano 403012 -Bobirwa Home Based Care 408011 -Otse Home Based Care 414011 -Bocaip 414021 -Tsholofelo Trust

					414031 -Monageng Counseling Centre
	DISTRICT	District A code assigned to each administration district based on the National District Numbers.	Num	2	1 – Gaborone 2 - Francistown 3 - Lobatse 4 - Selibe-Phikwe 5 - Orapa 6 - Jwaneng 7 - Sowa 10 - Ngwaketse 11 - Barolong 20 - South East 30 - Kweneng 40 - Kgatleng 50 - Central Serowe 51 - Central Mahalapye 52 - Central Bobonong 53 - Central Boteti 54 - Central Tutume 60 - North East 70 - Ngamiland 72 - Chobe 80 - Ghanzi 90 – Kgalagadi
	COUNSEL	Counselor code *Note:* Once a code has been assigned to a Counselor, it cannot be given to a new Counselor.	Alpha	3	
	VDATE	Visit date	Date	dd/mm/yyyy	
	CLIENT	Client code A unique code that is assigned to each client that defines that particular client. *Note:* The first 3 digits of the client code are the fixed site code. The last 6 digits begin from 1 at each site and continue consecutively.	Num	9	
1	FNAME	First name	Alpha	30	

2	MNAME	Middle name	Alpha	30	
3	SNAME	Last name	Alpha	30	
4	NATION	Nationality of client	Num	2	1 – Citizen 2 – Non-Citizen
4a	OMANG	National identity number	Num	9	
4b	PASSPORT	Passport number	Alpha	15	
5	BIRTH	Clients date of birth	Date	dd/mm/yyyy	
6	AGE	Client's age	Num	2	
7	SEX	Client's gender Biological definition classified on the basis of their reproductive organs.	Num	2	1 – Male 2 – Female
8	DISABLE	Does the client have a hearing or speech disability	Num	2	0 – No 1 – Yes
9a	DISABLO1	Does the client have any other disability: Sight	Num	2	0 – No 1 – Yes
9b	DISABLO2	Does the client have any other disability: Mentally disabled	Num	2	0 – No 1 – Yes
9c	DISABLO3	Does the client have any other disability: Physically disabled	Num	2	0 – No 1 – Yes
10	ATTEND	Attend group session Whether or not the client attended a group session. *Note*: Group is defined as more than 1 person.	Num	2	0 – No 1 – Yes
11	STATUS	Current relationship status Current state relating to sexual or non-sexual relationship.	Num	2	1 – Not in a relationship 2 – Uncommitted relationship(s) 3 – Committed relationship (not living together) 5 - Cohabitating 6 – Married 7 – Married [polygamous] 98 – N/A
12	EDUCATIO	Educational status	Num	2	0 – None

		Highest qualification one has completed. If a person just completed Junior Secondary and is currently enrolled in Senior Secondary, you would indicate 3 – Junior Secondary because that is the level they completed.			1 – Pre-primary 2 – Primary 3 – Junior Secondary 4 – Senior Secondary 5 – Vocational 6 – University
13	EMPLOYED	Are you employed	Num	2	0 – No 1 – Yes
14	EMPLOYER	Current employer	Num	2	1 – Government 2 – Private 3 – Self-employed 4 – Parastatal
15	OCCUPATI	Occupation Type of activity pursued as a livelihood. Artisan – someone with a certificate Professional – diploma Entrepreneur – owns their own business Disciplined forces – police, BDF	Num	2	1 – Unskilled 2 – Artisan 3 – Professional 4 – Entrepreneur 5 – Disciplined forces 6 – Student 7 – Housewife/husband 8 – Farmer/Rancher
16	REASON	The most important reason the client is visiting Tebelopele that day. Significant other includes parents or partner of client.	Num	2	1 – Client engaged in risky behavior 2 - Partner engaged in risky behavior 3 – Partner is HIV+ 4 – Partner is HIV- 5 – Client was exposed to blood 6 – Condom burst 7 – Client was sexually abused/rape 8 – Significant other has symptoms/died 9 – Family planning 10 – Prerequisite: Employment, education, other etc. 11 – Prerequisite: circumcision 12 – Marriage 13 – New relationship 14 – Client is pregnant. 15 – Routine testing 16 - 2nd test (window period) 17 – Client is a caregiver 18 – Parent/guardian encouraged them to

					get tested. 19 – Partner encouraged them to get tested 20 – Accessing care and treatment 21 – Parent is HIV+
17	PRTESTED	Has client previously tested for HIV	Num	2	0 – No 1 – Yes (HIV+) 2 – Yes (HIV-)
17a	PRTMM	Date of prior HIV test: month	Num	2	
17a	PRTYR	Date of prior HIV test: year	Num	4	
17b	WHEPTEST	Where was last test taken Location where the client had his/her previous HIV test	Num	2	1 – This TVCT 2 – Other TVCT sites 3 – Public Health Facilities 4 – Private Health Facilities 5 – Other VCT sites 6 – Door to door facilities 7 – Mini Tebelopele 99 – Other
18	ALCOHOLO	Do you use alcohol or drugs?	Num	2	0 – No 1 – Yes
19	ALCOHOLM	In the past 3 months, have you used alcohol or drugs?	Num	2	0 – No 1 – Yes
20	ALCOHOLC	Do you have an alcohol and or drug consumption problem to the point where it interferes with your daily work or impairs your judgment?	Num	2	0 – No 1 – Yes 98 – N/A
21	CIRCUM	Is the client circumcised Whether or not the client's foreskin has surgically been removed(includes traditional foreskin removal)	Num	2	0 – No 1 – Yes 98 – N/A
21a	CIRCUMYY	Circumcision year	Num	4	
22	EVERSEX	Has client ever had sex Sex is defined as penetration of the penis into the anus/vagina or oral sex of any kind since s/he was born.	Num	2	0 – No 1 – Yes
23	SEXO	What is your sexual orientation Homosexual – sex with someone of the same biological gender Heterosexual – sex with someone of a different biological gender Bi-sexual – sex with both males and females	Num	2	1 – Homosexual 2 – Heterosexual 3 – Bi-sexual 4 – Refuse to answer 98 – N/A

24	PREGNANT	Is client pregnant	Num	2	1 – No 2 – Yes 3 – Don't know 98 – N/A
25	SEX12	Has client had sex in the past 12 months	Num	2	0 – No 1 – Yes
26	SEXPART	How many sex partners has the client had in the past 12 months	Num	2	1 – 1 partner 2 – 2 partners 3 – 3 or more partners 4 – Refuse to answer 98 – N/A
27	CONCURR	Were any of the aforementioned relationships concurrent	Num	2	0 – No 1 – Yes 98 – N/A
28a	RELATIO	What is your relationship with your partner?	Num	2	0 - Husband/Wife 1 - Cohabitating 2 - Boyfriend/Girlfriend 3 - Casual Acquaintance 4 - Strictly Sex Partner 5 – Other 98 - N/A
29a	COND12	In the past 12 months, how often did you use a condom with your partner	Num	2	0 - Never 1 - Always 2 - Sometimes 98 – N/A
30a	CONDLAST	The last time you had sex, did you use a condom with partner	Num	2	0 – No 1 – Yes 98 – N/A
31a	ALCOHOL	Were you and/or your partner under the influence of alcohol/drugs the last time you had sex	Num	2	0 - No we were not 1 - Yes I was 2 - Yes my partner was 3 - Yes we were 98 – N/A
32a	HIVSTAT	Do you know the HIV status of your partner(s)	Num	2	0 - None of them 1 - Some of them 2 - All of them 98 - N/A
28b	RELATIO2	What is your relationship with your partner	Num	2	0 - Husband/Wife 1 - Cohabitating 2 - Boyfriend/Girlfriend

					3 - Casual Acquaintance 4 - Strictly Sex Partner 5 – Other 98 - N/A
29b	COND122	In the past 12 months, how often did you use a condom with your partner	Num	2	0 - Never 1 - Always 2 - Sometimes 98 – N/A
30b	CONLAST2	The last time you had sex, did you use a condom with partner	Num	2	0 – No 1 – Yes 98 – N/A
31b	ALCOHOL2	Were you and/or your partner under the influence of alcohol/drugs the last time you had sex	Num	2	0 - No we were not 1 - Yes I was 2 - Yes my partner was 3 - Yes we were 98 – N/A
32b	HIVSTAT2	Do you know the HIV status of your partner(s)	Num	2	0 - None of them 1 - Some of them 2 - All of them 98 - N/A
28c	RELATIO3	What is your relationship with your partner	Num	2	0 - Husband/Wife 1 - Cohabitating 2 - Boyfriend/Girlfriend 3 - Casual Acquaintance 4 - Strictly Sex Partner 5 – Other 98 - N/A
29c	COND123	In the past 12 months, how often did you use a condom with your partner	Num	2	0 - Never 1 - Always 2 - Sometimes 98 – N/A
30c	CONLAST3	The last time you had sex, did you use a condom with partner	Num	2	0 – No 1 – Yes 98 – N/A
31c	ALCOHOL3	Were you and/or your partner under the influence of alcohol/drugs the last time you had sex	Num	2	0 - No we were not 1 - Yes I was 2 - Yes my partner was 3 - Yes we were 98 – N/A
32c	HIVSTAT3	Do you know the HIV status of your	Num	2	0 - None of them

		partner(s)			1 - Some of them 2 - All of them 98 - N/A
33	HIV	Today's result	Num	2	0 – HIV- 1 – HIV+ 2 – Counseling only 3 – In determinant 98 – N/A
34a	COUGH	TB SYMPTOMS: Coughs> 2weeks	Num	2	0 – No 1 – Yes
34b	BLOOD	TB SYMPTOMS: Coughing out blood	Num	2	0 – No 1 – Yes
34c	FEVER	TB SYMPTOMS: Fever > 2weeks	Num	2	0 – No 1 – Yes
34d	LYMPH	TB SYMPTOMS: Enlarged lymph nodes	Num	2	0 – No 1 – Yes
34e	NSWEATS	TB SYMPTOMS: Night sweats	Num	2	0 – No 1 – Yes
34f	WTLOSS	TB SYMPTOMS: Unexplained weight loss	Num	2	0 – No 1 – Yes
34g	TBHIST	Family history of TB	Num	2	0 – No 1 – Yes
35a	USECOND	Risk Reduction Plan: Always use condoms	Num	2	0 – No 1 – Yes
35b	UNIPREC	Risk Reduction Plan: Universal precautions	Num	2	0 – No 1 – Yes
35c	REDALC	Risk Reduction Plan: Reduce consumption of alcohol and/or other drugs	Num	2	0 – No 1 – Yes
35d	REDSEX	Risk Reduction Plan: Reduce number of concurrent partners	Num	2	0 – No 1 – Yes
35e	DISCUSS	Risk Reduction Plan: Discuss safe sex and/or encourage partner to be tested for HIV	Num	2	0 – No 1 – Yes
35f	FAITHFUL	Risk Reduction Plan: Be faithful	Num	2	0 – No 1 – Yes
35g	ABSTAIN	Risk Reduction Plan: Abstain	Num	2	0 – No 1 – Yes
35h	STISCREE	Risk Reduction Plan: Seek screening/treatment for STIs	Num	2	0 – No 1 – Yes

35i	CIRCUM	Risk Reduction Plan: Seek circumcision and consistent condom use	Num	2	0 – No 1 – Yes
35j	PARTSMC	Risk Reduction Plan: Encourage partner to get circumcised.	Num	2	0 – No 1 – Yes
36a	TBSCREEN	Client Referred For: TB screening	Num	2	0 – No 1 – Yes
6b	PMTCT	Client Referred For: PMTCT	Num	2	0 – No 1 – Yes
36c	ARV	Client Referred For: ARV evaluation	Num	2	0 – No 1 – Yes
6d	PSYC	Client Referred For: Psychosocial support	Num	2	0 – No 1 – Yes
36e	CIRC	Client Referred For: Circumcision	Num	2	0 – No 1 – Yes
36f	STI	Client Referred For: STI screening	Num	2	0 – No 1 – Yes
36g	COUTEST	Client Referred For: Couple testing	Num	2	0 – No 1 – Yes
36h	FPLAN	Client Referred For: Family planning	Num	2	0 – No 1 – Yes
36i	SUPPORT	Client Referred For: Supportive counseling	Num	2	0 – No 1 – Yes
36j	CERVICAL	Referred For: Cervical screening	Num	2	0 – No 1 – Yes
36k	WELFARE	Referred For: Social Welfare Services	Num	2	0 – No 1 – Yes
37a	HLTHFAC	Referred To: Public/Private Health facility	Num	2	0 – No 1 – Yes
37b	PLWA	Referred To: PLWH/A Association	Num	2	0 – No 1 – Yes
37c	DSS	Referred To: Department of Social Welfare Services	Num	2	0 – No 1 – Yes
37d	RELIGION	Referred To: Religious Institution	Num	2	0 – No 1 – Yes
37e	PTC	Referred To: Post Test Club	Num	2	0 – No 1 – Yes
37f	YOUTH	Referred To: Youth Services	Num	2	0 – No 1 – Yes
38	OPTIN	Opt In	Num	2	0 – No

					1 – Yes
39	LANG	Language	Num	2	1 – English 2 – Setswana
40	PCELL	Primary Cell Phone Number	Alpha	15	
41	SCELL	Secondary Cell Phone Number	Alpha	15	

Appendix B:
Thesis SAS Code

```
***THESIS DATA- HIV IN BOTSWANA***;

libname kaleigh 'h:/Thesis';

**Temporary thesis dataset;
data temp;
      set kaleigh.thesis;
run;

*******************************FORMATS*********************************;
proc format;
      value hiv          0= "HIV negative"
                         1= "HIV positive";

      value sexo         1= "Homosexual"
                         2= "Heterosexual"
                         3= "Bi-sexual";

      value educatio   0= "None"
                       1= "Pre-primary or primary"
                       2= "Junior secondary"
                       3= "Senior secondary"
                       4= "Vocational"
                       5= "University";

      value prtested   0= "No"
                       1= "Yes (HIV-)";

      value status     1= "Not in a relationship"
                       2= "Uncommitted relationship(s)"
                       3= "Committed relationship (not living together)"
                       5= "Cohabitating"
                       6= "Married";

      value circumsi     0= "No"
                         1= "Yes";

      value distgroup  1= "Gabrone"
                       2= "Francistown"
                       3= "Other district";

      value sexpart      1= "1 partner"
                         2= "2 partners"
                         3= "3 or more partners"
                         4= "Refuse to answer";

      value agegroup   1= "18-24"
                       2= "24-29"
                       3= "30-39"
                       4= "40-49"
                       5= "50+";

      value sitedist   1= "Gaborone"
                       2= "Francistown"
                       3= "Kasane"
                       4= "Other";
```

```
value sitetype  1= "Fixed"
                2= "Satellite"
                3= "Outreach/Mobile and mini-Tebelopele";

value hetero    1= "MSM"
                0= "Non-MSM";

value sexpart   0= "No partners"
                1= "1 partner"
                2= "2 partners"
                3= "3 or more partners";

value reasonone   1= "Client risky behavior"
                  2= "Not";

value reasontwo   1= "Partner risky behavior"
                  2= "Not";

value reasonthree 1= "Somone HIV+/has symptoms/died"
                  2= "Not";

value reasonfour  1= "Client is caregiver"
                  2= "Not";

value reasonfive  1= "Condom burst"
                  2= "Not";

value reasonsix   1= "Client was raped"
                  2= "Not";

value reasonseven 1= "Family planning"
                  2= "Not";

value reasoneight 1= "Prerequisite"
                  2= "Not";

value reasonten   1= "Routine testing/window period"
                  2= "Not";

value reasoneleven 1= "Someone encouraged testing"
                   2= "Not";

value reasontwelve 1= "Accessing care and treatment"
                   2= "Not";

value condom      0= "Never"
                  1= "Always"
                  2= "Sometimes"
                  9= "No partners";

value relatio     0= "Husband/Wife"
                  1= "Cohabitating"
                  2= "Boyfriend/Girlfriend"
                  3= "Casual Acquaintance"
                  4= "Strictly sex partner"
                  5= "Other"
                  98= "Not applicable";
```

```
      value sitenum     1= "Gabrone"
                        2= "Francistown"
                        3= "Selibe Phikwe"
                        4= "Maun"
                        5= "Jwaneng"
                        6= "Kasane"
                        7= "Serowe"
                        8= "Lobatse"
                        9= "Letlhakane"
                        10= "Palapye"
                        11= "Ghanzi"
                        12= "Mochudi"
                        13= "Kanye"
                        14= "Molepolole"
                        15= "Tsabong"
                        16= "Mahalapye";

run;

**************************DATA CLEANING**************************;
*Keep only necessary variables, and delete invalid observations, and
women;
data thesis;
set temp (keep= vyear empstat sitecode district nation age attend sex
educatio occupati reason prtested sestype status eversex circumsi hiv
discord usecond disablo2 alcoholm alcoholc sex12 sexpart relatio cond12
alcohol hivstat noparts hivpart1 sexo site sestype);
if district in (0, 8, 9, 12, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41,
42, 43, 44, 45, 46, 47, 48, 49, 55, 66, 71, 81, 91, 92, 93, 99, 213,
312, 317, 410, 413, 416, 417, 418, 420, 431) then district=.;
if age>99 then age=.;
if attend>1 then attend=.;
if educatio>6 then educatio=.;
if occupati in(0, 9, 98) then occupati=.;
if reason in (0, 22, 98) then reason=.;
if prtested> 2 then prtested=.;
if status in (0, 21) then status=.;
if eversex in (2, 99, 2009, 9999) then eversex=.;
if circumsi in (9, 98) then circumsi=.;
if usecond>1 then usecond=.;
if sexpart=0 then sexpart=.;
if relatio in (6, 198) then relatio=.;
if cond12 in (3, 99) then cond12=.;
if condlast=2 then condlast=.;
if hivstat=3 then hivstat=.;
if status in (4, 98) then status=.;

**Delete people who visited Tebelopele in 2008 and 2009;
if vyear=2008 or vyear=2009 then delete;

*Delete all women from dataset;
if sex=2 then delete;

*Delete observations where age <18;
if age<18 then delete;
```

```
**drop variables that don't have responses for sexual orientation;
if sexo=0 then delete;
if sexo=. then delete;
if sexo=98 then delete;
if sexo=4 then delete;

*Delete observations that did not have a HIV test result;
if hiv>1 then delete;
if hiv=. then delete;

*Delete observations that had a previous HIV test;
if prtested=1 then delete;
if prtested=2 then delete;

*Create agegroup to group ages;
if 18 le age lt 25 then agegroup=1;
else if 25 le age lt 30 then agegroup=2;
else if 30 le age lt 40 then agegroup=3;
else if 40 le age lt 50 then agegroup=4;
else if age ge 50 then agegroup=5;

*Create grouping for site district: Gabrone(sitedist=1),
Francistown(sitedist=2), Kasane(sitedist=3);
if sitecode=101001 or sitecode=301001 then sitedist=1;
else if sitecode=102002 or sitecode=302002 then sitedist=2;
else if sitecode=106002 or sitecode=306002 then sitedist=3;
else sitedist=4;

*Create grouping for site type: fixed, satellite, outreach, and mini
tebelopele;
if sitecode in (101001, 102002, 103002, 104002, 105001, 106002, 107002,
108001, 109002, 110002, 111001, 112001, 113001, 114001, 115001, 116002)
then sitetype=1;

if sitecode in (201011, 201021, 201031, 201041, 201051, 202012, 202022,
202032, 202042, 202052, 203012, 203022, 204012, 205011, 208011, 208021,
208031, 208041, 209012, 211011, 212011, 212021, 213011, 214011,
214021, 216012) then sitetype=2;

if sitecode in (301001, 302002, 303002, 304002, 305001, 306002, 307002,
308001, 309002, 310002, 311001, 312001, 313001, 314001, 315001, 316002)
then sitetype=3;

if sitecode in (401011, 402012, 402022, 402032, 403012, 408011, 414011,
414021, 414031) then sitetype=4;

if sexo=1 or sexo=3 then hetero=1;
if sexo=2 then hetero=0;

if reason=1 then testreason=1;
if reason=2 then testreason=2;
if reason=3 or reason=4 or reason=8 or reason=21 then testreason=3;
if reason=5 or reason=17 then testreason=4;
if reason=6 then testreason=5;
if reason=7 then testreason=6;
if reason=9 then testreason=7;
if reason=10 or reason=11 or reason=12 or reason=13 then testreason=8;
```

```
if reason=14 then testreason=9;
if reason=15 or reason=16 then testreason=10;
if reason=18 or reason=19 then testreason=11;
if reason=20 then testreason=12;

if testreason=9 then testreason=.;

**Delete people who have been previously tested;
if prtested=1 then delete;

run;

*****************************FINAL MODEL*****************************;
***Create new variables for final logistic regression model***;
data final;
set thesis;
*Include polygamous with other married men;
_status=status;
if status =7 then _status=6;

**Combine mini Tebelopele with outreach/mobile;
_sitetype=sitetype;
if sitetype=4 then _sitetype=3;

**Combine education variables;
if educatio =0 then _educatio=0;
else if educatio in (1,2) then _educatio=1;
else if educatio =3 then _educatio=2;
else if educatio =4 then _educatio=3;
else if educatio =5 then _educatio=4;
else if educatio =6 then _educatio=5;

**Make serparate variables for test reason;
if testreason=1 then testreason1=1; else testreason1=2;
if testreason=2 then testreason2=1; else testreason2=2;
if testreason=3 then testreason3=1; else testreason3=2;
if testreason=4 then testreason4=1; else testreason4=2;
if testreason=5 then testreason5=1; else testreason5=2;
if testreason=6 then testreason6=1; else testreason6=2;
if testreason=7 then testreason7=1; else testreason7=2;
if testreason=8 then testreason8=1; else testreason8=2;
if testreason=10 then testreason10=1; else testreason10=2;
if testreason=11 then testreason11=1; else testreason11=2;
if testreason=12 then testreason12=1; else testreason12=2;

**Combine variables for number of sex partners;
if sex12=0 then _sexpart=0;
else if sexpart=1 then _sexpart=1;
else if sexpart=2 then _sexpart=2;
else if sexpart=3 then _sexpart=3;
else _sexpart=.;

**Combine variables use condom use in the past 12 months;
if cond12=0 then _cond12=0; *Never;
else if cond12=1 then _cond12=1; * Always;
else if cond12=2 then _cond12=2; * Sometimes;
else if _sexpart=0 then _cond12=9; * No partners;
```

```
else _cond12=.;


_site=substr (sitecode,2,2);
_sitenum=_site*1;

run;

********TABLE ONE: DESCRIPTIVE ANALYSES BY SEXUAL ORIENTATION*******;
**Mean age by sexual orientation status;
proc means data=final;
      var age;
run;
proc means data=final;
      var age;
      where hetero=0 ;
run;
proc means data=final;
      var age;
      where hetero=1;
run;
**Age group by sexual orientation status;
proc freq data=final;
      tables agegroup*hetero/missing chisq;
      format hetero hetero. agegroup agegroup.;
run;

**Highest level of education by sexual oreintation status;
proc freq data=final;
      tables _educatio*hetero/missing chisq;
      format hetero hetero. _educatio educatio.;
run;

**Relationship status by sexual orientation status;
proc freq data=final;
      tables _status*hetero/missing chisq;
      format hetero hetero. _status status.;
run;

**Circumcision status by sexual orientation status;
proc freq data=final;
      tables circumsi*hetero/missing chisq;
      format hetero hetero. circumsi circumsi.;
run;

**Site location by sexual orientation status;
proc freq data=final;
      tables sitedist*hetero/missing chisq;
      format hetero hetero. sitedist sitedist.;
run;

**Site type by sexual orientation status;
proc freq data=final;
      tables _sitetype*hetero/missing chisq;
      format hetero hetero. _sitetype sitetype.;
run;
```

```
**Number of sex partners by sexual orientation status;
proc freq data=final;
      tables _sexpart*hetero/missing chisq;
      format hetero hetero. _sexpart sexpart.;
run;

**Condom use by sexual orientation status;
proc freq data=final;
      tables _cond12*hetero/missing chisq;
      format hetero hetero.;
run;

**Reason for testing by sexual orientation status (TEST REASON ONE-
CLIENT RISKY BEHAVIOR);

proc freq data=final;
      tables testreason1*hetero/missing chisq;
      format hetero hetero. testreason1 reasonone.;
run;

**Reason for testing by sexual orientation status (TEST REASON TWO-
PARTNER RISKY BEHAVIOR);
proc freq data=final;
      tables testreason2*hetero/missing chisq;
      format hetero hetero. testreason2 reasontwo.;
run;

**Reason for testing by sexual orientation status (TEST REASON THREE-
RELATIVE HAD HIV/SYMPTOMS/DIED);
proc freq data=final;
      tables testreason3*hetero/missing chisq;
      format hetero hetero. testreason3 reasonthree.;
run;

**Reason for testing by sexual orientation status (TEST REASON FOUR-
CLIENT IS CAREGIVER);
proc freq data=final;
      tables testreason4*hetero/missing chisq;
      format hetero hetero. testreason4 reasonfour.;
run;

**Reason for testing by sexual orientation status (TEST REASON FIVE-
CONDOM BURST);
proc freq data=final;
      tables testreason5*hetero/missing chisq;
      format hetero hetero. testreason5 reasonfive.;
run;

**Reason for testing by sexual orientation status (TEST REASON SIX-
CLIENT WAS RAPED);
proc freq data=final;
      tables testreason6*hetero/missing chisq;
      format hetero hetero. testreason6 reasonsix.;
run;
**Reason for testing by sexual orientation status (TEST REASON SEVEN-
FAMILY PLANNING);
proc freq data=final;
```

```
      tables testreason7*hetero/missing chisq;
      format hetero hetero. testreason7 reasonseven.;
run;

**Reason for testing by sexual orientation status (TEST REASON EIGHT-
CLIENT TESTED AS PREREQUISITE);
proc freq data=final;
      tables testreason8*hetero/missing chisq;
      format hetero hetero. testreason8 reasoneight.;
run;

**Reason for testing by sexual orientation status (TEST REASON TEN-
ROUTINE TESTING/WINDOW PERIOD);
proc freq data=final;
      tables testreason10*hetero/missing chisq;
      format hetero hetero. testreason10 reasonten.;
run;

**Reason for testing by sexual orientation status (TEST REASON ELEVEN-
CLIENT ENCOURAGED TO GET TESTED);
proc freq data=final;
      tables testreason11*hetero/missing chisq;
      format hetero hetero. testreason11 reasoneleven.;
run;

**Reason for testing by sexual orientation status (TEST REASON TWELVE-
ACCESS CARE AND TREATMENT);
proc freq data=final;
      tables testreason12*hetero/missing chisq;
      format hetero hetero.;
run;


**************TABLE 2: DESCRIPTIVE ANALYSES BY HIV STATUS*************;
*TABLE 2: HIV Status by Sexual Orientation;
proc freq data=final;
      tables sexo*hiv/missing;
      format hiv hiv. sexo sexo.;
run;

**TABLE 2: Mean age by All males;
proc means data=final;
      var age;
run;

**TABLE 2: Mean age by HIV Status;
proc means data=final;
      var age;
      where hiv=1;
      format hiv hiv.;
run;
proc means data=final;
      var age;
      where hiv=0;
      format hiv hiv.;
run;
```

```
*TABLE 2: Distribution of age group by HIV Status;
proc freq data=final;
      tables agegroup*hiv/ missing;
      format hiv hiv. agegroup agegroup.;
run;

*TABLE 2: Relationship status by HIV Status;
proc freq data=final;
      tables _status*hiv/ missing;
      format hiv hiv. _status status.;
run;

*TABLE 2: Education level by HIV Status;
proc freq data=final;
      tables _educatio*hiv/ missing;
      format hiv hiv. _educatio educatio.;
run;

*TABLE 2: Circumsision status for by HIV Status;
proc freq data=final;
      tables circumsi*hiv/ missing;
      format hiv hiv. circumsi circumsi.;
run;

*TABLE 2: Site Location by HIV Status;
proc freq data=final;
      tables sitedist*hiv/ missing;
      format sitedist sitedist. hiv hiv.;
run;

*TABLE 2: Site type (fixed, satellite, outreach, and mini tebelopele)
by HIV Status;
proc freq data=final;
      table _sitetype*hiv/ missing;
      format _sitetype sitetype. hiv hiv.;
run;

*TABLE 2: Number of sex partners by HIV status;
proc freq data=final;
      tables _sexpart*hiv/ missing;
      format _sexpart sexpart. hiv hiv.;
run;

**Reason for testing by sexual orientation status (TEST REASON ONE);
proc freq data=final;
      tables testreason1*hiv/missing;
      format hiv hiv. testreason1 reasonone.;
run;

**Reason for testing by sexual orientation status (TEST REASON TWO);
proc freq data=final;
      tables testreason2*hiv/missing;
      format hiv hiv. testreason2 reasontwo.;
run;
**Reason for testing by sexual orientation status (TEST REASON THREE);
proc freq data=final;
      tables testreason3*hiv/missing;
```

```
      format hiv hiv. testreason3 reasonthree.;
run;

**Reason for testing by sexual orientation status (TEST REASON FOUR);
proc freq data=final;
      tables testreason4*hiv/missing;
      format hiv hiv. testreason4 reasonfour.;
run;

**Reason for testing by sexual orientation status (TEST REASON FIVE);
proc freq data=final;
      tables testreason5*hiv/missing;
      format hiv hiv. testreason5 reasonfive.;
run;

**Reason for testing by sexual orientation status (TEST REASON SIX);
proc freq data=final;
      tables testreason6*hiv/missing;
      format hiv hiv. testreason6 reasonsix.;
run;

**Reason for testing by sexual orientation status (TEST REASON SEVEN);
proc freq data=final;
      tables testreason7*hiv/missing;
      format hiv hiv. testreason7 reasonseven.;
run;

**Reason for testing by sexual orientation status (TEST REASON EIGHT);
proc freq data=final;
      tables testreason8*hiv/missing;
      format hiv hiv. testreason8 reasoneight.;
run;

**Reason for testing by sexual orientation status (TEST REASON TEN);
proc freq data=final;
      tables testreason10*hiv/missing;
      format hiv hiv. testreason10 reasonten.;
run;

**Reason for testing by sexual orientation status (TEST REASON ELEVEN);
proc freq data=final;
      tables testreason11*hiv/missing;
      format hiv hiv. testreason11 reasoneleven.;
run;

**Reason for testing by sexual orientation status (TEST REASON TWELVE);
proc freq data=final;
      tables testreason12*hiv/missing;
      format hiv hiv.;
run;

*TABLE 2: Condom usage by HIV status;
proc freq data=final;
      tables _cond12*hiv/ missing;
      format hiv hiv.;
run;
```

```
**********TABLE 2: BIVARIATE ANALYSES**********;
*TABLE 2: OR and confidence intervals for sexual orientation;
proc genmod data=final descending order=formatted;
      class hetero (param=ref ref="0");
      model hiv=hetero/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for age group;
proc genmod data=final descending order=formatted;
      class agegroup (param=ref ref=first);
      model hiv=agegroup/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for education status;
proc genmod data=final descending order=formatted;
      class _educatio (param=ref ref=first);
      model hiv=_educatio/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for relationship status;
proc genmod data=final descending order=formatted;
      class _status (param=ref ref=last);
      model hiv=_status/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for curcumsized;
proc genmod data=final descending order=formatted;
      class circumsi (param=ref ref=first);
      model hiv=circumsi/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for site location;
proc genmod data=final descending order=formatted;
      class sitedist (param=ref ref="4");
      model hiv=sitedist/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for site type;
proc genmod data=final descending order=formatted;
      class _sitetype (param=ref ref="1");
      model hiv=_sitetype/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals number of sex partners;
proc genmod data=final descending order=formatted;
      class _sexpart (param=ref ref=first);
      model hiv=_sexpart/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
1);
proc genmod data=final descending order=formatted;
      class testreason1 (param=ref ref=last);
      model hiv=testreason1/link=logit dist=binomial;
run;
*TABLE 2: OR and confidence intervals for reason for testing (reason
2);
```

```
proc genmod data=final descending order=formatted;
      class testreason2 (param=ref ref=last);
      model hiv=testreason2/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
3);
proc genmod data=final descending order=formatted;
      class testreason3 (param=ref ref=last);
      model hiv=testreason3/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
4);
proc genmod data=final descending order=formatted;
      class testreason4 (param=ref ref=last);
      model hiv=testreason4/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
5);
proc genmod data=final descending order=formatted;
      class testreason5 (param=ref ref=last);
      model hiv=testreason5/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
6);
proc genmod data=final descending order=formatted;
      class testreason6 (param=ref ref=last);
      model hiv=testreason6/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
7);
proc genmod data=final descending order=formatted;
      class testreason7 (param=ref ref=last);
      model hiv=testreason7/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
8);
proc genmod data=final descending order=formatted;
      class testreason8 (param=ref ref=last);
      model hiv=testreason8/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
10);
proc genmod data=final descending order=formatted;
      class testreason10 (param=ref ref=last);
      model hiv=testreason10/link=logit dist=binomial;
run;
*TABLE 2: OR and confidence intervals for reason for testing (reason
11);
proc genmod data=final descending order=formatted;
```

```
      class testreason11 (param=ref ref=last);
      model hiv=testreason11/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for reason for testing (reason
12);
proc genmod data=final descending order=formatted;
      class testreason12 (param=ref ref=last);
      model hiv=testreason12/link=logit dist=binomial;
run;

*TABLE 2: OR and confidence intervals for condom use;
proc genmod data=final descending order=formatted;
      class _cond12 (param=ref ref=first);
      model hiv=_cond12/link=logit dist=binomial;
run;

****Determine if the variables are associated with HIV status****;
proc freq data=final;
      tables agegroup*hiv/chisq;
      tables _educatio*hiv/chisq;
      tables _status*hiv/chisq;
      tables circumsi*hiv/chisq;
      tables sitedist*hiv/chisq;
      tables _sitetype*hiv/chisq;
      tables _sexpart*hiv/chisq;
      tables testreason1*hiv/chisq;
      tables testreason2*hiv/chisq;
      tables testreason3*hiv/chisq;
      tables testreason4*hiv/chisq;
      tables testreason5*hiv/chisq;
      tables testreason6*hiv/chisq;
      tables testreason7*hiv/chisq;
      tables testreason8*hiv/chisq;
      tables testreason10*hiv/chisq;
      tables testreason11*hiv/chisq;
      tables testreason12*hiv/chisq;
      tables _cond12*hiv/chisq;
run;
***All values are statistically significant;

************TABLE THREE: CHARACTERISTICS BY DISTRICT************;
**TABLE 3: Sexual orientation status by district- Gabrone;
proc freq data=final;
      tables hetero*hiv/missing;
      where sitedist=1;
      format hetero hetero. hiv hiv.;
run;
**TABLE 3: Sexual orientation status by district- Francistown;
proc freq data=final;
      tables hetero*hiv/missing;
      where sitedist=2;
      format hetero hetero. hiv hiv.;
run;
**TABLE 3: Sexual orientation status by district- Kasane;
proc freq data=final;
      tables hetero*hiv/missing;
```

```
      where sitedist=3;
      format hetero hetero. hiv hiv.;
run;
**TABLE 3: Sexual orientation status by district- All other;
proc freq data=final;
      tables hetero*hiv/missing;
      where sitedist=4;
      format hetero hetero. hiv hiv.;
run;

**TABLE 3: Age group among MSM by district- Gabrone;
proc freq data=final;
      tables agegroup*hiv/missing;
      where sitedist=1;
      format agegroup agegroup. hiv hiv.;
run;
**TABLE 3: Age group among MSM by district- Francistown;
proc freq data=final;
      tables agegroup*hiv/missing;
      where sitedist=2;
      format agegroup agegroup. hiv hiv.;
run;
**TABLE 3: Age group among MSM by district- Kasane;
proc freq data=final;
      tables agegroup*hiv/missing;
      where sitedist=3;
      format agegroup agegroup. hiv hiv.;
run;
**TABLE 3: Age group among MSM by district- All other;
proc freq data=final;
      tables agegroup*hiv/missing;
      where sitedist=4;
      format agegroup agegroup. hiv hiv.;
run;

**TABLE 3: Education status among MSM by district- Gabrone;
proc freq data=final;
      tables _educatio*hiv/missing;
      where sitedist=1;
      format _educatio educatio. hiv hiv.;
run;
**TABLE 3: Education status among MSM by district- Francistown;
proc freq data=final;
      tables _educatio*hiv/missing;
      where sitedist=2;
      format _educatio educatio. hiv hiv.;
run;
**TABLE 3: Education status among MSM by district- Kasane;
proc freq data=final;
      tables _educatio*hiv/missing;
      where sitedist=3;
      format _educatio educatio. hiv hiv.;
run;
**TABLE 3: Education status among MSM by district- All other;
proc freq data=final;
      tables _educatio*hiv/missing;
      where sitedist=4;
```

```
      format _educatio educatio. hiv hiv.;
run;

**TABLE 3: Relationship status among MSM by district- Gabrone;
proc freq data=final;
      tables _status*hiv/missing;
      where sitedist=1;
      format _status status. hiv hiv.;
run;
**TABLE 3: Relationship status among MSM by district- Francistown;
proc freq data=final;
      tables _status*hiv/missing;
      where sitedist=2;
      format _status status. hiv hiv.;
run;
**TABLE 3: Relationship status among MSM by district- Kasane;
proc freq data=final;
      tables _status*hiv/missing;
      where sitedist=3;
      format _status status. hiv hiv.;
run;
**TABLE 3: Relationship status among MSM by district- All other;
proc freq data=final;
      tables _status*hiv/missing;
      where sitedist=4;
      format _status status. hiv hiv.;
run;

**TABLE 3: Circumcision status among MSM by district-Gabrone;
proc freq data=final;
      tables circumsi*hiv/missing;
      where sitedist=1;
      format circumsi circumsi. hiv hiv.;
run;
**TABLE 3: Circumcision status among MSM by district-Francistown;
proc freq data=final;
      tables circumsi*hiv/missing;
      where sitedist=2;
      format circumsi circumsi. hiv hiv.;
run;
**TABLE 3: Circumcision status among MSM by district-Kasane;
proc freq data=final;
      tables circumsi*hiv/missing;
      where sitedist=3;
      format circumsi circumsi. hiv hiv.;
run;
**TABLE 3: Circumcision status among MSM by district-All other;
proc freq data=final;
      tables circumsi*hiv/missing;
      where sitedist=4;
      format circumsi circumsi. hiv hiv.;
run;

**TABLE 3: Site type among MSM by district-Gabrone;
proc freq data=final;
      tables _sitetype*hiv/missing;
      where sitedist=1;
```

```
      format _sitetype sitetype. hiv hiv.;
run;
**TABLE 3: Site type among MSM by district-Francistown;
proc freq data=final;
      tables _sitetype*hiv/missing;
      where sitedist=2;
      format _sitetype sitetype. hiv hiv.;
run;
**TABLE 3: Site type among MSM by district-Kasane;
proc freq data=final;
      tables _sitetype*hiv/missing;
      where sitedist=3;
      format _sitetype sitetype. hiv hiv.;
run;
**TABLE 3: Site type among MSM by district-All other;
proc freq data=final;
      tables _sitetype*hiv/missing;
      where sitedist=4;
      format _sitetype sitetype. hiv hiv.;
run;

**TABLE 3: Number of sex partners among MSM by district- Gabrone;
proc freq data=final;
      tables _sexpart*hiv/missing;
      where sitedist=1;
      format _sexpart sexpart. hiv hiv.;
run;
**TABLE 3: Number of sex partners among MSM by district- Francistown;
proc freq data=final;
      tables _sexpart*hiv/missing;
      where sitedist=2;
      format _sexpart sexpart. hiv hiv.;
run;
**TABLE 3: Number of sex partners among MSM by district- Kasane;
proc freq data=final;
      tables _sexpart*hiv/missing;
      where sitedist=3;
      format _sexpart sexpart. hiv hiv.;
run;
**TABLE 3: Number of sex partners among MSM by district- All other;
proc freq data=final;
      tables _sexpart*hiv/missing;
      where sitedist=4;
      format _sexpart sexpart. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
ONE);
proc freq data=final;
      tables testreason1*hiv/missing;
      where sitedist=1;
      format testreason1 reasonone. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
ONE);
proc freq data=final;
      tables testreason1*hiv/missing;
```

```
      where sitedist=2;
      format testreason1 reasonone. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
ONE);
proc freq data=final;
      tables testreason1*hiv/missing;
      where sitedist=3;
      format testreason1 reasonone. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
ONE);
proc freq data=final;
      tables testreason1*hiv/missing;
      where sitedist=4;
      format testreason1 reasonone. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
TWO);
proc freq data=final;
      tables testreason2*hiv/missing;
      where sitedist=1;
      format testreason2 reasontwo. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
TWO);
proc freq data=final;
      tables testreason2*hiv/missing;
      where sitedist=2;
      format testreason2 reasontwo. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
TWO);
proc freq data=final;
      tables testreason2*hiv/missing;
      where sitedist=3;
      format testreason2 reasontwo. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
TWO);
proc freq data=final;
      tables testreason2*hiv/missing;
      where sitedist=4;
      format testreason2 reasontwo. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
THREE);
proc freq data=final;
      tables testreason3*hiv/missing;
      where sitedist=1;
      format testreason3 reasonthree. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
THREE);
proc freq data=final;
```

```
      tables testreason3*hiv/missing;
      where sitedist=2;
      format testreason3 reasonthree. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
THREE);
proc freq data=final;
      tables testreason3*hiv/missing;
      where sitedist=3;
      format testreason3 reasonthree. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
THREE);
proc freq data=final;
      tables testreason3*hiv/missing;
      where sitedist=4;
      format testreason3 reasonthree. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
FOUR);
proc freq data=final;
      tables testreason4*hiv/missing;
      where sitedist=1;
      format testreason4 reasonfour. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
FOUR);
proc freq data=final;
      tables testreason4*hiv/missing;
      where sitedist=2;
      format testreason4 reasonfour. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
FOUR);
proc freq data=final;
      tables testreason4*hiv/missing;
      where sitedist=3;
      format testreason4 reasonfour. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
FOUR);
proc freq data=final;
      tables testreason4*hiv/missing;
      where sitedist=4;
      format testreason4 reasonfour. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
FIVE);
proc freq data=final;
      tables testreason5*hiv/missing;
      where sitedist=1;
      format testreason5 reasonfive. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
FIVE);
```

```
proc freq data=final;
      tables testreason5*hiv/missing;
      where sitedist=2;
      format testreason5 reasonfive. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
FIVE);
proc freq data=final;
      tables testreason5*hiv/missing;
      where sitedist=3;
      format testreason5 reasonfive. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
FIVE);
proc freq data=final;
      tables testreason5*hiv/missing;
      where sitedist=4;
      format testreason5 reasonfive. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
SIX);
proc freq data=final;
      tables testreason6*hiv/missing;
      where sitedist=1;
      format testreason6 reasonsix. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
SIX);
proc freq data=final;
      tables testreason6*hiv/missing;
      where sitedist=2;
      format testreason6 reasonsix. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
SIX);
proc freq data=final;
      tables testreason6*hiv/missing;
      where sitedist=3;
      format testreason6 reasonsix. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
SIX);
proc freq data=final;
      tables testreason6*hiv/missing;
      where sitedist=4;
      format testreason6 reasonsix. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
SEVEN);
proc freq data=final;
      tables testreason7*hiv/missing;
      where sitedist=1;
      format testreason7 reasonseven. hiv hiv.;
run;
```

```
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
SEVEN);
proc freq data=final;
      tables testreason7*hiv/missing;
      where sitedist=2;
      format testreason7 reasonseven. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON
SEVEN);
proc freq data=final;
      tables testreason7*hiv/missing;
      where sitedist=3;
      format testreason7 reasonseven. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
SEVEN);
proc freq data=final;
      tables testreason7*hiv/missing;
      where sitedist=4;
      format testreason7 reasonseven. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON 8);
proc freq data=final;
      tables testreason8*hiv/missing;
      where sitedist=1;
      format testreason8 reasoneight. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
8);
proc freq data=final;
      tables testreason8*hiv/missing;
      where sitedist=2;
      format testreason8 reasoneight. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON 8);
proc freq data=final;
      tables testreason8*hiv/missing;
      where sitedist=3;
      format testreason8 reasoneight. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
8);
proc freq data=final;
      tables testreason8*hiv/missing;
      where sitedist=4;
      format testreason8 reasoneight. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
10);
proc freq data=final;
      tables testreason10*hiv/missing;
      where sitedist=1;
      format testreason10 reasonten. hiv hiv.;
run;
```

```
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
10);
proc freq data=final;
      tables testreason10*hiv/missing;
      where sitedist=2;
      format testreason10 reasonten. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON 10);
proc freq data=final;
      tables testreason10*hiv/missing;
      where sitedist=3;
      format testreason10 reasonten. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
10);
proc freq data=final;
      tables testreason10*hiv/missing;
      where sitedist=4;
      format testreason10 reasonten. hiv hiv.;
run;


**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
11);
proc freq data=final;
      tables testreason11*hiv/missing;
      where sitedist=1;
      format testreason11 reasoneleven. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
11);
proc freq data=final;
      tables testreason11*hiv/missing;
      where sitedist=2;
      format testreason11 reasoneleven. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON 11);
proc freq data=final;
      tables testreason11*hiv/missing;
      where sitedist=3;
      format testreason11 reasoneleven. hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
11);
proc freq data=final;
      tables testreason11*hiv/missing;
      where sitedist=4;
      format testreason11 reasoneleven. hiv hiv.;
run;

**TABLE 3: Reason for testing among MSM by district-Gabrone (REASON
12);
proc freq data=final;
      tables testreason12*hiv/missing;
      where sitedist=1;
      format hiv hiv.;
run;
```

```
**TABLE 3: Reason for testing among MSM by district-Francistown (REASON
12);
proc freq data=final;
      tables testreason12*hiv/missing;
      where sitedist=2;
      format hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-Kasane (REASON 12);
proc freq data=final;
      tables testreason12*hiv/missing;
      where sitedist=3;
      format hiv hiv.;
run;
**TABLE 3: Reason for testing among MSM by district-All other (REASON
12);
proc freq data=final;
      tables testreason12*hiv/missing;
      where sitedist=4;
      format hiv hiv.;
run;

**TABLE 3: How often use condoms among MSM by district-Gabrone;
proc freq data=final;
      tables _cond12*hiv/missing;
      where sitedist=1;
      format hiv hiv.;
run;
**TABLE 3: How often use condoms among MSM by district-Francistown;
proc freq data=final;
      tables _cond12*hiv/missing;
      where sitedist=2;
      format hiv hiv.;
run;
**TABLE 3: How often use condoms among MSM by district-Kasane;
proc freq data=final;
      tables _cond12*hiv/missing;
      where sitedist=3;
      format hiv hiv.;
run;
**TABLE 3: How often use condoms among MSM by district-All other;
proc freq data=final;
      tables _cond12*hiv/missing;
      where sitedist=4;
      format hiv hiv.;
run;

**********MULTIVARIATE ANALYSIS**********;

****Final Logistic regression Model****;
****FULLY ADJUSTED****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason1 testreason2 testreason3 testreason4
      testreason5 testreason6 testreason7 testreason8 testreason10
      testreason11 testreason12 circumsi (ref=first)/param=ref;
```

```
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason1 testreason2 testreason3
      testreason4 testreason5 testreason6 testreason7 testreason8
      testreason10 testreason11 testreason12 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 12****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason1 testreason2 testreason3 testreason4
      testreason5 testreason6 testreason7 testreason8 testreason10
      testreason11 circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason1 testreason2 testreason3
      testreason4 testreason5 testreason6 testreason7 testreason8
      testreason10 testreason11 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 11****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason1 testreason2 testreason3 testreason4
      testreason5 testreason6 testreason7 testreason8 testreason10
      circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason1 testreason2 testreason3
      testreason4 testreason5 testreason6 testreason7 testreason8
      testreason10 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 6****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason1 testreason2 testreason3 testreason4
      testreason5 testreason7 testreason8 testreason10  circumsi
      (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason1 testreason2 testreason3
      testreason4 testreason5 testreason7 testreason8 testreason10
      circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 1****;
```

```
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason2 testreason3 testreason4 testreason5
      testreason7 testreason8 testreason10 circumsi
      (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason2 testreason3 testreason4
      testreason5 testreason7 testreason8 testreason10 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 10****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason2 testreason3 testreason4 testreason5
      testreason7 testreason8 circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason2 testreason3 testreason4
      testreason5 testreason7 testreason8 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 5****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason2 testreason3 testreason4 testreason7
      testreason8 circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason2 testreason3 testreason4
      testreason7 testreason8 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 4****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason2 testreason3 testreason7 testreason8
      circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason2 testreason3 testreason7
      testreason8 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 2****;
```

```
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason3 testreason7 testreason8 circumsi
      (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status sitedist
      _sitetype _sexpart _cond12 testreason3 testreason7 testreason8
      circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove site location****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      _sitetype (ref=first) _sexpart (ref=first) _cond12 (ref=first)
      testreason3 testreason7 testreason8  circumsi
      (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status _sitetype
      _sexpart _cond12 testreason3 testreason7 testreason8 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 8****;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      _sitetype (ref=first) _sexpart (ref=first) _cond12 (ref=first)
      testreason3 testreason7 circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status _sitetype
      _sexpart _cond12 testreason3 testreason7 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

****Remove test reason 7****;
proc logistic data=final descending;
      class agegroup (ref='1') _educatio (ref='0')  _status (ref='6')
      _sitetype (ref='1') _sexpart (ref='0') _cond12 (ref='0')
      testreason3 (ref='2') circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status _sitetype
      _sexpart _cond12 testreason3 circumsi;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

*****************************BEST MODEL*****************************;
****Remove sex partners from the model****;
proc logistic data=final descending order=formatted;
      class agegroup (ref=first) _educatio  _status _sitenum _sitetype
      (ref=first) _cond12 (ref=first) testreason3 circumsi
      (ref=first)/param=ref;
        model hiv (ref='0') = hetero agegroup _educatio _status
      _sitetype _cond12 testreason3 circumsi;
```

```
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

******CRUDE MODEL*******;
proc logistic data=final descending order=formatted; format _sitenum
sitenum.;
      class agegroup (ref=first) _educatio prtested  _status _sitenum
      sitedist _sitetype (ref=first) _sexpart (ref=first) _cond12
      (ref=first) testreason1 testreason2 testreason3 testreason4
      testreason5 testreason6 testreason7 testreason8 testreason10
      circumsi (ref=first)/param=ref;
      model hiv (ref='0') = hetero ;
      contrast 'OR comparing HIV among MSM vs. non-MSM' hetero
      1/estimate=exp;
run;

************USE BEST MODEL TO GET ADJUSTED ODDS RATIOS*************;
proc logistic data=final descending ;
      class agegroup (ref='1') _educatio (ref='0') _status (ref='6')
      _sitetype (ref='1') _cond12 (ref='0') testreason3 (ref='2')
      circumsi (ref='0')/param=ref;
      model hiv (ref='0') = hetero agegroup _educatio _status _sitetype
      _cond12 testreason3 circumsi;
run;
```