CHAPTER 1

1.0 INTRODUCTION

1.1 General HIV situation in Sub-Saharan Africa

HIV/AIDS remains one of the most devastating diseases of this century. The joint United Nations Programme for HIV/AIDS (UNAIDS) and World Health Organization (WHO) revised report estimated that the number of people world wide living with HIV in 2007 was 33.2 million (95% CI: 30.6-36.2 million). An estimated 22.5 million (95% CI: 20.9-24.3 million) people were infected with HIV in the Sub-Saharan African region in 2007[56]. Sub-Saharan Africa, particularly Southern Africa, continues to be the region most affected by the HIV/AIDS pandemic. The Southern African sub-region accounts for 35% of all HIV infections, and 32% of all new HIV infections, and 32% of all deaths from AIDS globally in 2007[56]. According to a 2005 South African national population-based survey among people aged two years and older, 4.8 million (95% CI: 4.2-5.3 million) people in South Africa are HIV positive, with an overall prevalence of 10.8%[52].

UNAIDS further reported that, in Sub-Saharan Africa, women accounted for 61% of adults living with HIV/AIDS in 2007[56]. However, there is evidence of a declining trend of HIV prevalence among some Southern African countries, particularly Zimbabwe, from antenatal sentinel surveillance (see Figure 1.1). HIV prevalence among antenatal clinic attendees in Zimbabwe significantly declined from 26% in 2002 to 18% in 2006[56]. In South Africa, HIV prevalence from antenatal data indicated that infection among pregnant women is stabilising, with prevalence at 30% in 2005 and 29.1% in 2006[40, 56].

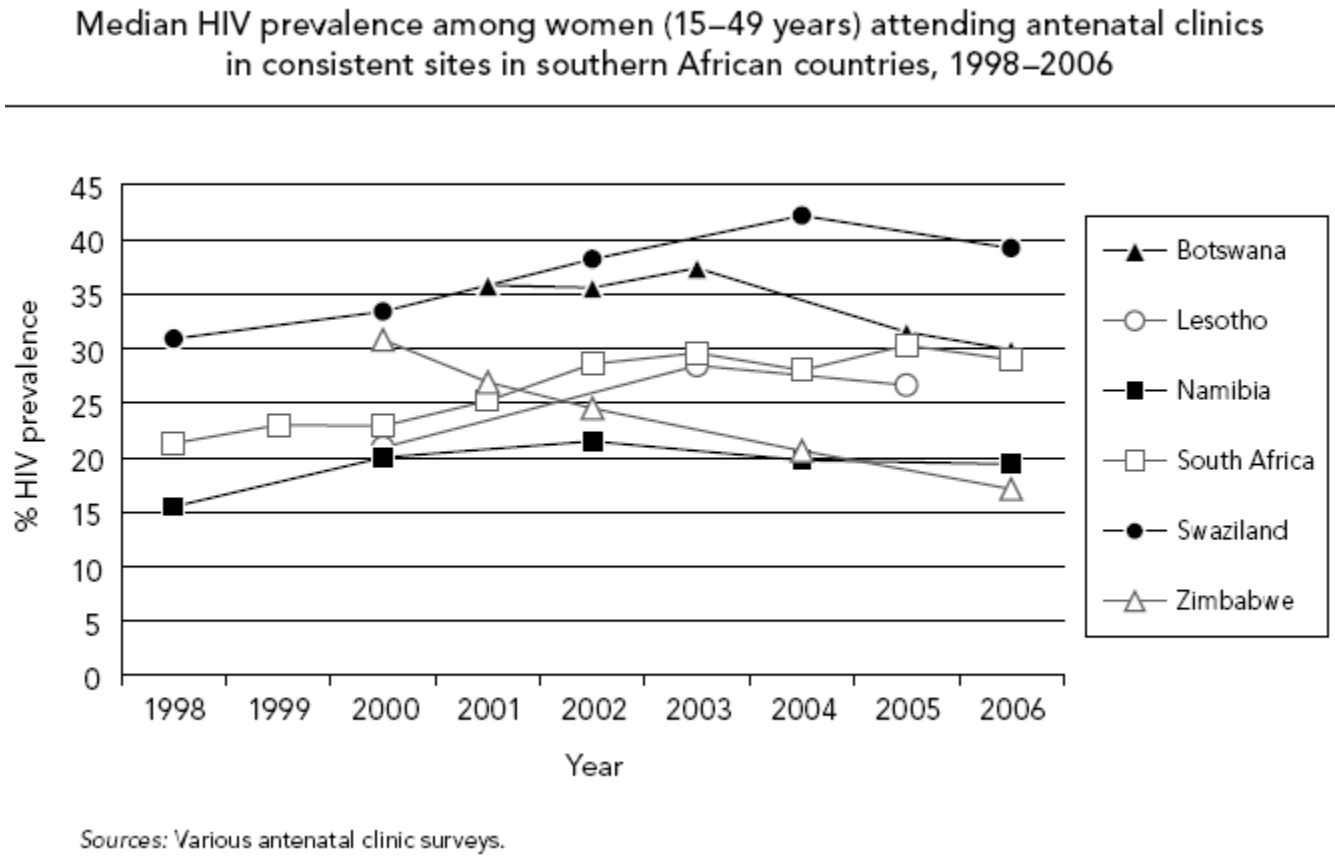

Figure 1.1: Median HIV prevalence among women (15 to 49 years) attending antenatal clinics in consistent sites in Southern African countries, 1998-2006

1.2 Variation of HIV prevalence among young men and young women

Epidemiological evidence has shown that the prevalence of HIV infection in Africa is substantially higher among young women than their counterpart young men. A cross-sectional study conducted in August 1998 in the Carletonville district (South Africa) reported that the HIV prevalence for people aged 20 years was 7.9% among men and 39.3% among women (OR=7.5, p<0.0001)[30]. In Mutaso (Zimbabwe), the prevalence among men was 2.7% and 17.8% among women (OR=7.8, p<0.0001)[30]. In rural Zimbabwe, women aged 15 to 24 years were more likely to be infected than men of the same age (age-adjusted odds ratio 4.62 [95% CI 3.65-5.84]; p<0.001)[17]. In another cross-sectional study conducted in Kisumu, Kenya and Ndola, Zambia, the prevalence of HIV among women of 15 to 19

years was six times higher than among men of the same age, and three times that of men aged 20 to 24[16]. Studies in rural Uganda revealed a consistent trend of higher HIV sero-prevalence among young women than in young men[24]. The national 2003 survey of HIV and sexual behaviour among young South Africans aged 15 to 24 years old revealed that overall the prevalence of HIV was 10.2% (95% CI: 9.3-11.3). The prevalence of HIV infection among young men was 4.8% (95% CI: 3.9-5.9) while among young women it was 15.5% (95% CI: 13.7-17.6)[45].

A recent population-based South African National HIV Survey conducted in 2005, for the first time, analysed concurrently both prevalence and incidence. The South African National HIV Survey is one of its kind in Sub-Saharan Africa, as it reflects not only the prevalence of HIV but also the incidence of HIV and as it represents the entire country and all age groups two years and above[52]. The limitation of the survey is that there was no representation of the homeless; those living in police and military barracks, prisons or hospitals; those in educational instate; and children < 2 years. Another recent South African study conducted during 2005, an annual longitudinal population-based serological survey, reported that population-based surveillance underestimates the HIV prevalence due to unrepresentative testing by age, residence and also probably by HIV status, while ANC sentinel surveillance overestimates the prevalence due to selection bias in terms of age of sexual debut and contraceptive use[50]. The overall HIV prevalence was 10.3% among 15 to 24-year-old youth, with the highest prevalence reported in KwaZulu-Natal (16.1%) and the lowest in Western Cape (2.3%), while the prevalence of HIV for the same age group in Limpopo Province was 7.4%. However, the alarming finding of the National HIV Survey of 2005 was that young women aged 15 to 24 have a four times higher HIV prevalence (16.9% versus 4.4%) and an eight times higher HIV incidence than young men (6.5% compared to 0.8%). The incidence of HIV infection is increasing at

an alarming rate for black South African young women aged 15 to 24 compared to black South African young men in the same age group, as pointed out by the 2005 survey, while the overall prevalence of HIV has declined from 6.2% to 0.6% among white and from 6.1% to 1.9% among coloured people[52]. However, there was no analysis in the 2005 survey that compared the prevalence and incidence of HIV infection among 15 to 24-year-old young women and young men among the white, coloured and Indian population groups. The 2006 survey indicated that the incidence of HIV had dropped from 15.9% in 2005 to 13.7% in the 2006 survey among teenage girls and this might indicate that the new infection rate is stabilising[40].

In Sub-Saharan Africa, two main explanations have been sought to answer why the prevalence of HIV-1 infection rises more rapidly at young ages in women than in men: 1. biological explanations relating to differences in female and male genital physiology and the subsequent difference of susceptibility to infection, and 2. social or behavioural explanations related to the natural history (pattern) of sexual relationships among young people[30].

1.3 Biological explanation

Several studies in Africa and elsewhere tried to identify possible factors that have resulted in the gender variation of HIV prevalence and incidence among young people[9, 30, 37, 53, 58]. One of the main factors implicated by these studies is biological difference between the two sexes in the transmission of HIV. The two major biological reasons implicated in a potentially higher transmission probability in women than men are: 1) genital contact surface differences which make coital tearing and injury more common in women than in men, and 2) during unprotected intercourse, women's genitals have a greater contact surface area than men[30].

The above biological factors might be affected by the infectiousness of HIV-1 infected index case, the mode of sexual contact, and the susceptibility of uninfected partner to the virus[58]. Specific biological factors that are associated with increased excretion of HIV virus in the genital tract of both sexes include: 1. conditions that increase the viral burden in blood (vaccines or systemic infection); 2. an advanced stage of immunodeficiency that might influence the functional or anatomical integrity of genital mucosa; 3. acute HIV infection, which also results in increased viral burden and transmission; 4. cervical local factors such as local cytokines, which increase replication of HIV, and sexually transmitted infections (STIs), which increase tissue necrosis factor and interleukin 8; and 5. a variety of viral factors that are implicated in playing a role in the infectiousness of HIV, which include viral envelope protein required for transmission, genetic factors that affect replicative capacity and "fitness" of the virus, and resistance to antiretroviral drugs[9, 48, 53, 58]. In contrast, highly active antiretroviral treatment of HIV infection results in suppression of seminal shedding of the HIV and further contributes to decreased HIV transmission and improves quality of life[38, 57].

1.3.1 Variation of genital tracts of men and women and HIV infection

A systemic review of published literatures compared variation of men and women's genital tract HIV-1 shedding and microbiological correlates[9, 53, 58]. A different sampling technique from the cervix improved the understanding of HIV-1 shedding. HIV-1 RNA levels are the highest in swab, cytobrush and Sno-strip® samples and lowest in cervicovaginal lavage (CVL) samples in women[9]. However, the male genital tract is inaccessible for direct sampling unlike the female genital tract, and direct detection and quantification of HIV-1 is dependent on semen. Semen consisted of cellular and cell-free components (plasma)[9].

HIV-1 detection and quantification are greatest in the cervix and least in the vagina[9]. Similarly, proviral DNA was detected more frequently in endocervical than vaginal swabs (46% versus 17%)[9]. Prospective studies lasting eight to ten weeks reported that viral RNA was detected continuously in 28% to 37% of seminal plasma samples, intermittently in 39% to 44% of samples, and never in 24% to 28% of samples from HIV-1 infected men while from women's genitals viral RNA was detected continuously in 29% of samples, intermittently in 58% of samples, and never in 13% of samples. HIV is cultured less frequently from the female genital tract than the male genital tract (20-50%). HIV is cultured more frequently from cellular fraction (90%) and less from cell-free seminal fluid (10%)[9]. A number of studies reported that HIV RNA levels are generally higher in blood than in both male and female genital tracts although, occasionally, increased HIV RNA levels have been seen in CVL and in semen[9, 53, 58]. HIV RNA levels in blood and genital fluids are moderately correlated and similar between women and men. Generally, high seminal viral burden suggested efficient heterosexual transmission of HIV-1 rather than low seminal viral load[9, 53, 58].

The important risk factors of infection in men include the presence of Langerhans cells in the foreskin, with the extension to the ampulla or receptive environment of the coronal sulcus, and there is interplay between genital ulcerative disease, poor genital hygiene, intact skin, and penile mucosal disruption and acquired heterosexual HIV infection. On the other hand, the principal routes of infection in women are through disruption of the vaginal epithelia layers, infection at the level of ecto- and endocervix, and, possibly, the endometrium, with migration of the virus from mucosal site in dendritic cells to potential lymphoid sites of CD4 cell infection[9].

1.3.2 Interaction between STIs and HIV in the genital tracts of men and women

Several studies have reported that there is a great interaction between STIs and HIV in terms of susceptibility and infectiousness in both the female and male genital tracts[1, 5, 19, 20, 23, 27, 42, 44, 58, 64]. It is an established fact that genital ulcerative disease increases susceptibility to HIV infection more efficiently than non-ulcerative disease by disruption of mucosal membrane, which provides a direct site of entry for the HIV. Women are more susceptible to STIs than men at early adolescence. Cervical os of young women comprises squamocolumnar junction, which supports the growth of chlamydia and gonorrhoea and is easily penetrated by these organisms[64]. However, little is known about biological susceptibility of the male genital tract, except that circumcision decreases HIV, STI and human papilloma virus (HPV) infection[64] This may be because, as histopathological studies of the genital tract have reported, the inner surface of the male foreskin is far more susceptible to HIV-1 infection than is the female cervix[43]. Furthermore, randomised controlled trials have demonstrated that male circumcision significantly reduces acquisition of HIV-1 infection in Africa among men[2, 3].

Several studies in Africa have reported that the three most prevalent genital ulcer diseases (GUD) are HSV-2, Haemophilus ducreyi, and syphilis[1, 23, 27]. It is estimated that a single episode of sexual intercourse has a 60% to 90% risk of women contracting gonorrhoea from their male partners, whereas the risk for men of contracting gonorrhoea from women is 20% to 30%. For instance, the reported chlamydia rate in Canada was 211.8/100,000 among women while it was 89.1/100,000 among men in the year 2000 ($p < 0.001$). However, the reported rates of gonorrhoea and syphilis were much higher among males than females and this could be due to gonorrhoea being much more difficult to diagnose clinically and being more asymptomatic in women than in men[64].

Human herpes simplex virus type 2 (HSV-2) is the most common STI globally[28, 63] and is uniformly higher in women than in men in developing and developed countries[1, 11, 23, 28, 31, 63, 64]. HSV-2 infection increases with age and the prevalence is the highest among female sex workers[10, 63]. The prevalence of HSV-2 in Sub-Saharan Africa is the highest, ranging from 30% to 80% in women and from 10% to 50% in men[63]. The risk of herpes simplex virus type 2 (HSV-2) transmission from male to female is higher than from female to male (19% versus 5%).

HSV-2 may play a key role in HIV transmission in many parts of Africa. Several studies examined whether genital HSV-2 increases genital HIV-1 shedding and showed conflicting results[14, 28, 60]. Recent meta-analysis revealed that HSV-2 infection is a significant risk factor for increased HIV acquisition among both men (age-adjusted RR=2.7; 95% CI: 1.9-3.9) and women (age-adjusted RR=3.1; 95% CI: 1.7-5.6) in the general population[14, 60]. However, the association between HSV-2 and HIV acquisition was conflicting among women unlike men, with RR ranging from 0.5 to 6.3. For instance, a study conducted among sex workers in rural Zimbabwe and women attending the Central National Referral STIs/AIDS Clinic of Bangui (Central Republic of Africa) did not show significant difference in HIV-1 shedding among women shedding HSV-2 and women not shedding HSV-2[10, 34, 36]. This variation could be due to methodological differences in collection and analysis of cervical samples[9, 29, 36, 57]. Another reason could be study design, including different levels of adjustment for sexual exposure for HIV such as other STIs and other sexual behaviour risks[14, 60].

Generally, a number of studies and meta-analysis indicated that HSV-2 infection is a risk factor for the spread of HIV among both sexes[1, 10, 11, 14, 23, 27, 28, 31, 60, 63, 64]. Furthermore, a randomised, double-blinded, placebo-controlled clinical trial with acyclovir treatment showed significant reduction of

both genital and plasma HIV-1 viral load[38]. These results and the results from other studies provide a basis for the conclusion that increased genital HIV-1 infectiousness exists during HSV-2 genital co-infection.

1.4 Socio-demographic characteristics

Although the above biological factors might be important, several studies have also indicated that socio-demographic factors might play important roles directly or indirectly in the observed increased HIV prevalence among young women than young men. In addressing these issues, the influence of education, marriage and poverty in selecting or avoiding certain sexual behaviours has been suggested as being potentially important [25, 30, 37, 41, 42, 47, 51, 54].

1.4.1 Education

Gender inequality in education affects a woman's ability to take informed decisions on risk reduction of HIV infection[54]. A study carried out in the rural villages of Cameroon and Tanzania pointed to a significantly increased HIV prevalence amongst educated women than amongst men[41, 47]. However, recent data from a number of other African countries, including Tanzania, indicated that increased education attainments are associated with low risk of HIV infection compared to those with no education[25, 37, 42, 51, 54]. For instance, the study undertaken by Kilian et al. in Uganda found that HIV-1 prevalence declined steadily from 32% in 1991 to 10.3% in 1997 after adjusting for education and marital status[25]. This significant downward trend in HIV-1 prevalence was more prominent from 1993 to 1997 (p=0.00005) among the younger age group of 15 to 19 years old. The significantly steady decline was found to be strongest among young women with a secondary education, followed by those with a primary education. The observed decline could be explained by behavioural changes

such as high levels of knowledge amongst the educated (social vaccine), positive attitudes towards HIV prevention, and increased use of condoms[25, 37, 51, 54].

1.4.2 Marriage

The 2003 national survey of HIV and sexual behaviour among young South Africans aged 15 to 24 had reported a very low rate of marriage, especially among men (1%) in comparison with women (3%)[46] Generally, men married at an older age than women and as a result more men than women had non-spousal partners[4, 13, 15, 16]. More young women (40%) than young men (4%) were married in the age group 15 to 19 years old and, further, marriage was implicated as a risk factor for HIV in men[16, 37]. However, it is necessary to interpret with great caution that marriage was associated with increased risk of HIV infection among young men, as the number of HIV-positive individuals was too small to provide a significant association using percentage. Other studies have pointed out that in sero-discordant married couples women are twice as likely as men to be infected, probably because of increased biological susceptibility and men's extra-marital sexual behaviour[4, 15].

1.4.3 Poverty

Poverty and food insecurity might increase sexual risk taking, particularly among women, who might engage in transactional sex so that they can provide for their basic needs such as food and clothing. Significant socio-economic inequalities between women and men play a great role in increasing vulnerability and exposure to HIV infection[33, 54]. Hargreaves et al. pointed out that young women aged 15 to 24 years with low socio-economic status (SES) were associated with an increased risk of HIV infection (OR adjusted for age and ethnicity, comparing high SES with low SES: 0.52; 95% CI, 0.31-0.88)[18]. Others argue that at macro level there is a weak positive relationship between national

wealth and HIV prevalence across countries in Sub-Saharan Africa. Higher HIV prevalence is seen in the wealthier countries of Southern Africa such as South Africa, Botswana and Namibia while in the relatively poorer countries of Eastern Africa such as Ethiopia, Somalia and Tanzania the prevalence of HIV is much lower.

1.5 Sexual behavioural risk factors and HIV

The above socio-demographic factors might influence HIV infection directly or indirectly through their influence on different sexual behaviours. These sexual behaviours and spousal and non-spousal partners' factors might play important roles for the observed increased HIV prevalence among young women over young men. In addressing these issues, a number of studies examined different risk factors at various levels. In these studies risk factors such as the influence of age at first sexual encounter, the probability of infection per partnership, the age differences between partners, extramarital sex, alcohol consumption, poverty, and sex with commercial sex workers have been suggested as being potentially important[17, 20, 24, 30, 42, 47, 52].

1.5.1 Sexual debut

Early sexual debut is implicated as a risk factor for increased HIV-1 infection among young women. Young women may be more at risk of developing increased HIV infection than older women as a result of a larger area of cervical ectopia and trauma to the immature genital tract during sex[9, 42]. Data from Carletonville, South Africa[30] did not find an association between the age at sexual debut and a higher prevalence of HIV infection in young women; this study used the proportion who answered that they had penetrative sex and probability density function for those who answered how old they were when they first had sex. The Population-based National South African Prevalence and

Incidence Survey[52], the 2003 national survey of HIV and sexual behaviour among young South Africans[46], and data from rural Zimbabwe[17] reported that the median age of sexual debut did not vary between young men and young women, and these surveys did not analyse whether early sexual debut was associated with increased HIV prevalence among young women. However, a cross-sectional study in Zimbabwe pointed out that sexual debut at the age of ≤ 15 years (54.6%) was associated with increased risk of HIV infection compared to sexual debut of > 15 years (38.2%) and that mean years since sexual debut (9.4 years versus 7.4 years; $P < 0.001$) was also associated with increased HIV infection[46]. This study further indicated that early sexual debut was associated with more than one lifetime sexual partner, not completing high school, and having engaged in commercial sex. Nevertheless, this study was conducted only among women aged 18 to 35 years and as a result did not examine directly whether early sexual debut could explain the increased prevalence of HIV infection among young women than among young men. It is essential to examine in this study whether early sexual debut could explain the observed increased HIV prevalence among young women than among young men.

1.5.2 Age difference and HIV infection

Data from a number of studies reported that young women with older partners are at greater risk of acquiring HIV infection than young men with similar aged or younger partners[17, 24, 30, 42, 47, 52]. Data from a randomised community-based trial was used to assess the association between age difference in sexual partners and HIV-1 infection in rural Uganda. This study showed that the age difference between young women and their male partners is a significant HIV risk factor [24]. This study tried to demonstrate that as the age difference was widened the risk of HIV would increase. An increased proportion of partners ten years older or more was seen among women aged 15 to 19 years old

(11.8%) and women aged 20 to 24 years old (18.6%), suggesting that high HIV prevalence in young women was caused partly by transmission from older male partners. The adjusted prevalence risk ratio was 2.04 (95% CI: 1.29-3.22) among women aged 15 to 19 years old with age difference of ten years older or more, and a prevalence risk ratio of 1.24 (95% CI: 0.96-1.60) for women aged 20 to 24 with partners ten years older or more. The above findings attributed the infections of many of the HIV-positive young women to older husbands[24]. Similarly, the Population-based National South African Prevalence and Incidence Survey reported that the risk of HIV prevalence was significantly higher among respondents that were young women aged 15 to 19 years (29.5%) and 20 to 24 years (34.9%) than their counterpart young men for those reporting sexual partners > 5 years older[52]. The 2003 national survey of HIV and sexual behaviour among young South Africans aged 15 to 24 reported that the interquartile range (IQR) for the age difference between partners for men ranged from two years younger to the same age (no age difference) while for women it ranged from two to six years older. Further, this survey reported that 0.5% of men reported having had a partner ten or more years their senior compared to 6% of women among youth who had had sex in the past year[46].

1.5.3 Sexual partnership and HIV infection

Several studies indicated an increased risk of HIV-1 sero-prevalence in those reporting higher numbers of lifetime partners[7, 17, 24, 37, 30, 42, 47]. In a case-control study undertaken in rural Tanzania, increasing lifetime partners was significantly associated with increasing HIV prevalence, after adjusting for confounders ($p< 0.001$). There was a seven-fold increase in the prevalence of HIV-1 infection in those women reporting ten or more lifetime partners. The population-attributable fraction of women with ten or more lifetime partners (9.8%) in Tanzania was similar to family planning clinic attendees in Nairobi (9.4%)[47]. In rural Zimbabwe and the rural Kilimanjaro region of Tanzania,

increased lifetime partners was associated with a higher risk of contracting HIV-1 infection among women[17, 37]. In addition, a study in Carletonville, South Africa pointed out that the risk of HIV infection per partnership is approximately three times higher for women than it is for men, as the risks of infection depend upon the person's vulnerability to infection and the prevalence of HIV infection among their sexual partners[30]. The Population-based National South African Prevalence and Incidence Survey reported that more young men had more than one partner than young women did. Although higher HIV prevalence was found for those reporting more than one sexual partner (20.6%) than for those reporting one partner (16.3%) among respondents aged 15 years and older, the survey did not compare the prevalence of HIV between males and females among those aged 15 to 24 years[52].

1.5.4 Condom use

Consistent condom use is one of the important methods of prevention of HIV and STIs infection. However, gender power imbalance is seen as one of the important factors that influence condom use[20, 28, 42]. Data from South Africa and Botswana shows that men are more likely to refuse to use a condom when the age difference between them and their female partners is greater than ten years, and if they are married and have no open communication about HIV/AIDS between them and their partners. Furthermore, the South African and Botswana studies indicated that men with multiple partners are more likely to refuse condom use[20, 28]. Similarly, the South African 2003 National Household Survey pointed out that inconsistent condom users were more likely to have low condom use self-efficacy, to have a relationship with an older partner, to be married, to report early sexual debut, not to have completed high school, to experience frequent sex with their partner, not to discuss use of condoms with their partners, to have been forced to have sex by their most recent partner, to

perceive themselves as being at high risk of HIV infection, and to be in the older age group (20 to 24 years)[20, 42].

Significant increase of condom use was observed among educated Zambians aged 15 to 24, particularly among educated rural young women (22% condom use in 1995 compared to 70% in 2003; p = 0.009) and a marked decline in HIV prevalence was reported in educated young people in the same survey[51]. Kilian et al. in a study conducted in Uganda reported a similar decreased trend of HIV prevalence among young women and this was linked with increased condom use[25]. The 2003 national survey of HIV and sexual behaviour among young South Africans pointed out that condom use at last sex was almost identical among men and women in the 15 to19 year old age group; nevertheless, among those aged 20 to 24, women were significantly less likely to report using condoms at last sex compared to men of the same age (44% vs. 57%, P < 0.01). Furthermore, 26% of men and 41% of women aged 20 to 24 reported that their last partner was a regular partner and that they had not used a condom the last time they had had sex. The above finding of low condom use might explain the increased level of HIV prevalence among women aged 20 to 24, although this report did not link condom use to HIV prevalence[46]. The South African 2005 population-based survey reported that condom use increased from 57.1% for men and from 46.1% for women in 2002 to 72.8% for men and 55.7% for women in 2005 among youth aged 15 to 24 years[52]. Although this report did not link condom use to HIV prevalence and incidence, the survey revealed increased trends of condom use, which plays a great role in HIV prevention.

1.5.5 Alcohol consumption

Alcohol consumption is linked to reduced rational judgement as it affects safe sexual practice, and has implications for HIV risk. A number of studies showed that alcohol is highly associated with increased risk of HIV prevalence[35, 37, 62]. A population-based study in Botswana showed that heavy alcohol consumption was associated with higher odds of unprotected sex, multiple partners, and paying for sex among men. Similarly, heavy alcohol intake was associated with increased risk of unprotected sex, multiple partners, and selling sex among women[62].

1.6 Justification

A number of studies explored possible risk factors that resulted in the prevalence of HIV infection being higher among young women than among young men. These studies explored several risk factors, ranging from the complex biological variations of genital tract to STIs, socio-demographic characteristics, and sexual behavioural patterns among both young women and men. However, most of these studies were cross-sectional and targeted at investigating a particular risk factor(s). They did not examine all possible risk factors, and only a few of them were prospective and interventional trials. Nevertheless, none of the studies considered a prospective, randomised, controlled, and community-matched intervention trial that evaluated the cause of HIV infection being higher among young women than among young men.

This study examined the influence of age at first sexual encounter, the probability of infection per partnership, the age differences between partners, influence of life style risk factors, level of education, impact of marital status, influence of financial support from the sexual partners, and effect of employment and food shortage on the prevalence of HIV infection among young women and men.

This is a secondary-data analysis of baseline data collected for the purpose of a community trial in Limpopo Province, South Africa. It is important to evaluate the effect of interventions (intersectoral collaboration, integrating participatory education, and microfinance programme) on the HIV epidemic at the community level, especially among young women. Thus, this study-report forms a platform of baseline results from which the impact of community-based intervention can be evaluated.

1.7 Study objectives

The aim of this study is to investigate differences in HIV prevalence between males and females aged 14 to 25 years in Limpopo Province, South Africa. Further, this study aims to identify risk factors that might explain gender differences of HIV prevalence among younger age groups.

1.7.1 General objective

- To explore gender-related differentials of HIV prevalence in Limpopo Province.

1.7.2 Specific objectives

- To determine HIV prevalence by age and sex among individuals aged 14 to 25 years in Limpopo Province.
- To identify risk factors that are associated with HIV infection by sex in this population.
- To examine whether men and women experience the identified risk factors associated with HIV infection in similar or different ways in relation to their behaviours.

CHAPTER 2

2.0 METHODS

2.1 Study design

This is a secondary data analysis of baseline data collected during 2001 for the purpose of a community trial in Limpopo Province, South Africa. The data set collected by the Rural Aids and Development Action Research Program (RADAR) was used. The data represents a cross-sectional study of gender-differential and HIV infection.

2.2 Sampling strategy

Data was collected from eight rural villages in the Sekhukhuneland region of South Africa's Limpopo Province. The eight villages involved in the study encompassed 9500 households, with a population over 50,000 people. A sampling frame that included all the households within recognised boundaries of eight study villages was generated. Households outside the eight study village boundaries were not included in the sampling frame.

A household in this study was defined as a group of people who are permanently resident on the same property and who eat from the same pot of food, including those household members currently staying away from home (de-jure population). Two hundred households were randomly selected in each of the eight study villages. A total of 1640 households were visited, out of which 1482 households enumerated. Of the remaining 158 households, some were empty and others refused to participate in the survey; reasons for the refusal of the participants were not known. The total expected sample size, including adjustment for people who refused to participate and those who could not be traced, was 3000. In the survey, which took three months and covered all the villages,

2859 (95.3%) young people aged 14 to 35 were successfully interviewed. Using specially designed collection devices (OraSure), samples of Oral Mucosal Transudate (OMT) were collected from 2400 (80%) study respondents, for testing for the presence of antibodies to HIV. Reasons for refusal of the interview and testing for HIV were not known. Out of the above 2400 OMT collected, 2379 (99.1%) samples were successfully processed for detection of HIV antibodies. As the study was concerned with a younger age group, characteristics of those under the age of 26 years were considered throughout the study. Out of the total of 2,859 respondents who were successfully interviewed, 73% (n=2,092) were under the age of 26 years. Out of 2,092 study recruits aged 14 to 25 years, 1,790 (85.56%) agreed to provide OMT and were successfully tested for HIV while 302 (14.44%) refused to be tested.

2.3 Data collection

Two types of questionnaires were used, i.e. Household Details and Young Person questionnaires. Each of these questionnaires has four parts: 1. Interview set up, 2. Interview introduction with consent form, 3. Interview details, and 4. Interview closure. For the purpose of this study, 22 variables were selected from both the Household Details and Young Person questionnaires as presented in Appendix A. The Household Details Questionnaire consisted of socio-demographic profiles. The Young Person Questionnaire consisted of general background information/lifestyle, sexual behaviour, spousal partners' relationship, non-spousal partners' relationship and, finally, sample collection procedures with informed consent.

After the questionnaires were designed, piloting was conducted extensively at different settings such as market stalls, hospital waiting rooms and in the eight villages. Pilot interviews were observed, and

structured notes were taken on the reception of respondents to the questions and how the questions were asked. Discussions on relevance, cultural appropriateness, and relative value and time of administration of individual questions were considered in the development of the questionnaires.

Field workers were recruited in an open process through advertisements placed in each study village. Those field workers chosen had been educated to at least matriculant level. All interviews were carried out in the preferred language of the respondent. Primary training on questionnaire administration took four weeks, including one week of HIV counseling/gender awareness training, two weeks of classroom-based training on questionnaire administration, and one week of field-based training in local villages. All field workers were required to pass an assessment before being allowed to interview participants or administer the questionnaires.

A specially designed collection device (OraSure) was used to collect samples of Oral Mucosal Transudate (OMT) in order to test for the presence of HIV antibodies. In order to identify the presence of HIV, a standard test, Vironostika HIV Uni-Form II Oral Fluid, was used. This is an enzyme-linked immunosorbent assay (ELISA) used for the qualitative determination of antibodies to human immunodeficiency virus type 1 and/or 2 (anti-HIV-1, anti-HIV-2 and anti-HIV-1 group O). Out of 2400 OMT samples collected, 2379 (99.1%) samples were successfully processed for detection of HIV antibodies.

2.4 Quality control

Field workers in the study and the data they collected were monitored at all stages of the data-collecting process. Field workers were monitored through weekly supervisor meetings at which questionnaires were checked and problems discussed, including discussions on issues coming up in

the field. A number of steps were used to ensure high quality data capture and analysis stages. This included eyeball checking of all questionnaires from the field before acceptance for data entry. The interviewer, another field team interviewer, and a "central" checker reviewed all questionnaires. Additional spot-checks and interviews attended by the supervisor ensured that the quality of data was high and that results were reproducible.

2.5 Ethical issues

A copy of the research protocol was submitted to the Human Research Ethics Committee (HREC) at the University of the Witwatersrand in South Africa. The ethical committee approved the study, with Certificate Protocol Number M050435, and a copy of the certificate is presented in Appendix B. Throughout the study, the results were stored in such a way as to de-link HIV status information and demographic information. All the results were kept confidential from those who were involved in collecting the data, and from those involved in conducting the laboratory procedures, including the investigators. The operation of this study has been in compliance with principles of the Helsinki Declarations[55] and Guidelines for Good Practice of the Conduct of Clinical Trials in Human Participants in South Africa[12].

2.6 Stage of data analysis

This section discusses the stage of data analysis. Variables of interest are defined and the processes of variable re-grouping are discussed. Detailed stages of data analysis are also highlighted.

2.6.1 Data collected

Data generated from the questionnaires and the laboratory results from OraSure were entered on Microsoft Access. STATA (version 9.1) was used to analyse the gender-related differentials of HIV in Limpopo Province. As the aim of the study is to focus on the younger age groups, the actual proportion of the study recruits was restricted to the 14 to 25 years age group. The proportion of the participants who responded to the questionnaire and those who provided OMT for the HIV antibody test was calculated for comparison with those who did not provide OMT for the HIV test, to evaluate the effect of refusal.

2.6.2 Prevalence of HIV infection

Overall age and sex-specific prevalence of HIV infection was calculated. Odds ratio (OR) was used to estimate the strength of association using logistic regression and the results were presented in tables and graphs.

2.6.3 Risk factors for HIV infection among young men and women

Potential risk factors that could influence differences in HIV prevalence were thought to differ in important ways among young men and young women. The potential risk factors were divided into three explanatory groups (variables), and these explanatory variables were further reclassified when the number was too small to analyse. These three groups of classification of the explanatory variables were also used to form the basis of the conceptual hierarchical framework for further analysis.

I. Under the socio-demographic profile and lifestyle section variables were reclassified as follows: 1. Marriage was divided into “unmarried”, “married”, and “ever married” (widowed and/or divorced);

however, “ever married” was not included in the analysis as the number was too small and the men’s value was zero. 2. Education was classified as “no education” (no formal schooling, illiterate and, literate), “primary education” (some primary and completed primary), “secondary education” (some secondary and completed secondary), and “tertiary education” (attended technical/vocational training college and/or attended university). 3. Income from work/employment was classified as “self-employed”, “student”, “salaried worker”, “unemployed” and “unable to work” (unwilling to work, retired, too young to work, or unable to work) 4. The age group variable was generated and coded (1. “14-16”, 2. “17-19”, 3 “20-22”, and 4 “23-25”). 5. Lifestyle variables selected under this section included: “sleeping away from house” and “sleeping at the house”, “overnight trip to a large city”, “shortage of food”, and “frequency/length of staying last year here in months”. (See Appendix A for a detailed presentation of the questionnaires.)

II. Under the sexual behaviour section, the following variables were generated from the questionnaires: 1. Age at sexual debut ≤ 16 years and > 16 years were generated and the median age was used as a cut-off-point, and “sexual debut” was defined as age the first time the respondent had sexual intercourse. 2. A binary variable was developed for lifetime sexual partners after collapsing into 2-by-2 tables (1. “1-4” & 2. “> 4” lifetime sexual partners), as the numbers in some of the exposure levels might be small, and this might make it difficult to ascertain whether or not the proportions increased in linear fashion. 3. “Number of sexual partners that are not married to and have never lived with” was classified as “0 partner” and “1-7 partner”.

III. Non-spousal partners’ characteristics are relevant only to individuals reporting a partner in the last 12 months, and relate only to the last sexual partner reported by these individuals. Under non-

spousal partners' characteristics: 1. A variable of non-spousal partner's age was generated and coded as 1. "11-21", 2. "22-26", and 3. "27-67", and this was defined as the age of the study respondents' sexual partner for both sexes in the study, not the age of the study respondent. 2. The age difference variable was generated separately for young men (1. "-11.75 to -4.6", 2. "-4.59 to -3", 3. "-2.99 to -0.6", and 4. "-0.59 to 14.55") and young women (1. "-7.56 to 1.79", 2. "1.8 to 2.99", 3. "3 to 9.99" 4. "10 to 45.72"). The age difference is defined as non-spousal partners' ages minus the study respondents' ages, and the cut-off points were derived from the median and interquartile age range as the age differences were not evenly distributed and were wide. The rest of the variables were used, based on the questionnaires as presented in Appendix A. The major outcome variable of the study was coded as 0 for HIV-negative and 1 for HIV-positive study population.

Dummy variables were generated using XI command at each stage of the analysis, so that each category would be compared to the baseline category. The analysis was restricted to those whose HIV statuses were known, to their category of conceptual framework, and to those aged 14 to 25 years old. Logistic regression was used to test whether there were significant differences in the levels of risk factors between young men and young women, adjusting for age.

2.6.4 Association of risk factors and HIV infection among men and women

Once all possible potential risk factors were identified by sex in the age group 14 to 25, risk factors for HIV infection were examined, using multiple logistic regression models. The statistical significance of each explanatory risk factor was assessed, using the likelihood ratio test by fitting a logistic model by sex. A Multivariate Model was developed, using a combination of automated reverse stepwise logistic regression and a conceptual hierarchical framework, controlling for each

potential explanatory risk factor, including age. Stepwise regression alone gives an over-optimistic impression; regression coefficients will be too large; p-values for selected variables could be too small; and confidence intervals would be too narrow, etc[26]. Thus, the conceptual hierarchical frameworks for the relationships of potential explanatory variables[26, 59] were developed with the potential explanatory risk factors that are related conceptually and that had a similar number of the study sample. Socio-demographic and lifestyle explanatory variables were considered here as the distal determinants which may affect directly or indirectly the subsequent inter-related proximate determinants[58] (income and education as distal determinants may affect young women in certain ways in terms of sexual behaviours and selection of an older partner who is a potential risk for HIV infection) and risk of developing HIV infection. Certain patterns of sexual behaviours may in turn directly affect the acquisition of HIV infection or indirectly through the selection of a partner who is infected. On the basis of the above concept, three principal models were developed.

Model 1 includes socio-demographic profile variables and lifestyle variables (constructed for all study respondents in the sample, which consisted of 796 men and 984 women). This model assessed only for the effect of socio-demographic and lifestyle explanatory factors as both sexual behaviours and non-spousal partners' characteristics are partly determined by socio-demographic profile. Model 2 considers mainly sexual behaviour characteristics and is restricted to those who had experienced sexual intercourse, excluding those who answered "no sexual intercourse", "don't know" and "no response given"; as a result the sample dropped to 463 men and 704 women. This model considers the effect of sexual behaviours and adjusted for confounding role of socio-demographic and lifestyle. Model 3 is constructed for non-spousal partners' characteristics, and these refer to individuals' characteristics in the last 12 months. For this model, the sample further dropped for various reasons

(excluding spousal partners, those who answered “don’t know” and “no response”) to 417 men and 535 women. The effect of non-spousal partners’ characteristics was assessed in the presence of socio-demographic and sexual behaviours. In the above way pathway variables would be avoided.

Spousal partners’ characteristics were not included in the analysis as the number was too small to analyse and also, during analysis, categories with zero or very small numbers were avoided. Age was always adjusted for each fitted model. Risk factors higher in the hierarchy (based on the above three orders of the hierarchical conceptual model) that significantly improved the models were retained at each level when risk factors lower in the hierarchy were examined[59]. Odds ratios were calculated, adjusting only for risk factors above them in the hierarchy, using 95% confidence intervals (CI). The association of potential risk factors that were significant for HIV sero-prevalence is further presented using tables by sex in Chapter 3.

CHAPTER 3

3.0 RESULTS

3.1 Data collected

Out of 2,092 study respondents aged 14 to 25 years, 1,790 (85.56%) agreed to provide OMT and were successfully tested for HIV while 302 (14.44%) refused to be tested. Overall, 156 (16.35%) of the young men and 146 (12.83%) of the young women aged 14 to 25 years who were interviewed did not provide an OMT sample for detection of HIV antibodies. Table 3.1 compares socio-demographic characteristics in the study respondents who were interviewed and tested with those who were interviewed but declined HIV testing in the age group 14 to 25 by sex. A higher percentage of men (35.5%) and women (30.5%) in the younger age group 14 to 16 were tested than men (19.2%) and women (22.6%) who declined HIV testing. On the other hand, a lower percentage of men (13.8%) and women (16.8%) aged 23 to 25 were tested than men (26.9%) and women (21.2%) who refused HIV testing. Those who declined the HIV test tended to report a higher proportion of tertiary education than those who opted to be tested for HIV. More students were likely to agree to be tested for HIV than those who declined the HIV test among both sexes. More married women (13.8%) refused the HIV test than married women (7.2%) who agreed to the test.

Table 3.1: Socio-demographic characteristics between those who provided OMT and those who did not by sex in Limpopo Province, RSA

Socio-demographic characteristics	Provided OMT			Did not provide OMT		
	Total N (%)	Men N (%)	Women N (%)	Total N (%)	Men N (%)	Women N (%)
Total	1,790	798 (44.58)	992 (55.42)	302	156 (51.66)	146 (48.34)
Age group						
14-16	586 (32.7)	283 (35.5)	303 (30.5)	63 (20.9)	30 (19.2)	33 (22.6)
17-19	525 (29.3)	237 (29.7)	288 (29.0)	80 (26.5)	44 (28.2)	36 (24.7)
20-22	402 (22.5)	168 (21.0)	234 (23.6)	86 (28.5)	40 (25.6)	46 (31.5)
23-25	277 (15.5)	110 (13.8)	167 (16.8)	73 (24.2)	42 (26.9)	21 (21.2)
Education						
No education	6 (0.3)	3 (0.4)	3 (0.3)	2 (.7)	0 (0.0)	2 (1.4)
Primary	380 (21.2)	2 05 (25.7)	175 (17.6)	57 (18.9)	35 (22.4)	22 (15.1)
Secondary	1,368 (76.5)	573 (71.9)	795 (80.1)	222 (73.5)	111 (71.1)	111 (76.0)
Tertiary	35 (2.0)	16 (2.0)	19 (1.9)	21 (6.9)	10 (6.4)	11 (7.5)
Employment						
Self-employed	27 (1.5)	10 (1.2)	17 (1.7)	8 (2.6)	4 (2.6)	4 (2.7)
Student	1,144 (63.9)	561 (70.3)	583 (58.8)	151 (50.0)	79 (50.6)	72 (49.3)
Salaried/domestic worker	50 (2.8)	34 (4.3)	16 (1.6)	13 (4.3)	10 (6.4)	3 (2.0)
Unemployed	552 (30.8)	184 (23.1)	368 (37.1)	122 (40.4)	59 (37.8)	63 (43.1)
Unable to work	17 (0.9)	9 (1.1)	8 (0.8)	8 (2.6)	4 (2.6)	4 (2.7)
Marital status†						
Single	1,702 (95.5)	789 (98.9)	913 (92.8)	280(93.0)	155 (99.4)	125 (86.2)
Married	80 (4.5)	9 (1.1)	71 (7.2)	21 (7.0)	1 (0.6)	20 (13.8)

† Ever married was not included as the number is too small & the male value is zero

3.2 HIV prevalence

Among those aged 14 to 25 years, the overall prevalence of HIV infection in rural Limpopo Province was 9.4% (169/1,790). Table 3.2 and Figure 3.2 depict the relationship between sex and HIV infection by age group. Young women (12.4%) aged 14 to 25 years had a significantly higher prevalence of HIV infection than young men (5.8%) [Age adjusted OR=2.19; 95% CI: 1.53-3.12, p<0.001]. Prevalence of HIV infection generally increases across the age group as age increases, from 7.3% for women and 2.5% for men aged 14 to 16 years old to 21.6% for women and 14.5% for men aged 23 to 25 years old. Females aged 14 to 16 years (age adjusted OR=3.15, 95% CI: 1.32-7.50; p=0.010) and aged 20 to 22 years (age adjusted OR=3.03, 95% CI: 1.51-6.09; p=0.002) were

more likely to be infected than their male counterparts as illustrated in Table 3.2 and Figure 3.2 below

Table 3.2: Prevalence of HIV infection by age group and sex

Age group	Sex	HIV +V N (%)	HIV –V N (%)	OR† (95% CI)	*P-value*
14-16	Women	22 (7.3%)	281 (92.7%)	3.15 (1.32-7.50)	*0.010*
	Men	7 (2.5%)	276 (97.5%)		
17-19	Women	24 (8.3%)	264 (91.7%)	1.63 (0.80-3.35)	*0.181*
	Men	12 (5.1%)	225 (94.9%)		
20-22	Women	41 (17.5%)	193 (82.5%)	3.03 (1.51-6.09)	*0.002*
	Men	11 (6.5%)	157 (93.4%)		
23-25	Women	36 (21.6%)	131 (78.4%)	1.63 (0.86-3.12)	*0.137*
	Men	16 (14.5%)	94 (85.4%)		
Total	Women	123 (12.4%)	869 (87.6%)	2.19 (1.53-3.12)	*<0.001*
	Men	46 (5.8%)	752 (94.2%)		

† Age adjusted odds ratio

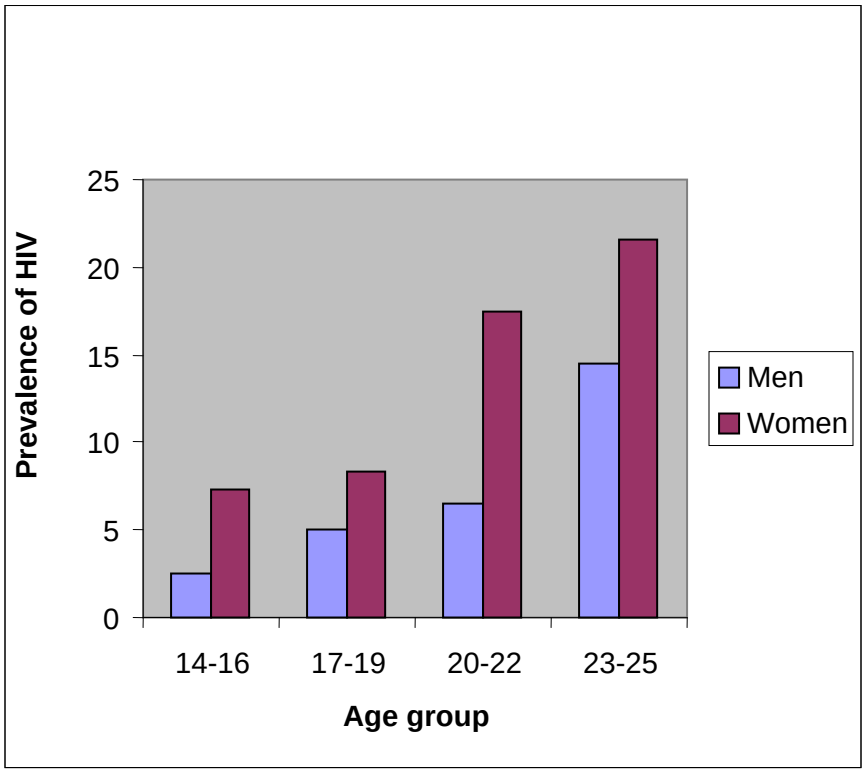

Figure 3.2: Prevalence of HIV infection by age group and sex

3.3 Risk factors for HIV infection among young men and women

Tables 3.3.1a and 3.3.1b present bivariate analysis of the effects of socio-demographic factors and life style on the risk of HIV infection among young men and women aged 14 to 25 years. The prevalence of HIV infection increased significantly across the age groups for both sexes ($P_{trend} < 0.001$). Attending secondary education was reported by the vast majority of the study respondents among both men (71.9%) and women (80.1%). Prevalence of HIV infection was much lower for those who had attended primary education (3.9%) compared to those with no education (33.3%) among men without any apparent significant statistical association (OR=0.12, CI: 0.01-1.57; p=0.106). Furthermore, the prevalence of HIV infection was higher for students and unemployed women than for men, with no significant associations across the levels of employment among both sexes.

Table 3.3.1a: Associations between socio-demographic characteristics and life style and HIV infection among men in Limpopo Province, RSA

Socio-demographic characteristics & life style	Total N (%)	Prevalence of HIV	Adjusted OR† 95% CI	P-value
Age group				
14-16	283 (35.5)	2.5	1.00	-
17-19	237 (29.7)	5.1	2.10 (0.81-5.43)	0.125
20-22	168 (21.0)	6.5	2.76 (1.05-7.27)	< 0.001
23-25	110 (13.8)	14.5	6.71 (2.61-16.81)	< 0.001
Education				
No education	3 (0.4)	33.3	1.00	-
Primary	205 (25.7)	3.9	0.12 (0.01-1.57)	0.106
Secondary	573 (71.9)	6.1	0.12 (0.01-1.49)	0.100
Tertiary	16 (2.0)	12.5	0.16 (0.01-2.90)	0.216
Employment				
Self-employed	10 (1.2)	10.0	1.00	-
Student	561 (70.3)	3.0	0.52 (0.06-4.82)	0.568
Salaried/domestic worker	34 (4.3)	2.9	0.26 (0.01-4.63)	0.360
Unemployed	184 (23.1)	13.6	1.58 (0.19-13.14)	0.671
Unable to work	9 (1.1)	22.2	3.14 (0.23-43.04)	0.391
Marital status				
Single	789 (98.9)	5.7	1.00	-
Married	9 (1.1)	11.1	0.82 (0.10-6.91)	0.855
Sleeping home last month	723 (90.6)	5.5	1.00	-
Sleeping away last month	75 (9.4)	8.0	0.93 (0.37-2.33)	0.870
Overnight trip to large city‡				
No	547 (68.5)	5.8	1.00	-
Yes	251 (31.4)	5.6	0.66 (0.34-1.29)	0.226
Frequency of months staying here‡				
0-4 months	43 (5.4)	4.6	1.00	-
5-8 months	45 (5.6)	6.7	1.62 (0.25-10.43)	0.609
9-11 months	89 (11.2)	5.6	1.62 (0.30-8.92)	0.576
12 months	619 (77.8)	5.8	2.42 (0.54-10.81)	0.246
Food shortage past month				
Never	281 (35.3)	5.0	1.00	-
Once only	56 (7.0)	7.1	1.38 (0.43-4.46)	0.591
A few times	177 (22.2)	7.3	1.44 (0.65-3.16)	0.369
Often	283 (35.5)	5.3	1.06 (0.50-2.26)	0.881

† Adjusted for age
‡ During the last year

Table 3.3.1b: Associations between socio-demographic characteristics and life style and HIV infection among women in Limpopo Province, RSA

Socio-demographic characteristics & life style	Total N (%)	Prevalence of HIV	Adjusted OR† 95% CI	P-value
Age group				
14-16	303 (30.5)	7.3	1.00	-
17-19	288 (29.0)	8.3	1.16 (0.64-2.12)	0.627
20-22	234 (23.6)	17.5	2.71 (1.57-4.70)	< 0.001
23-25	167 (16.8)	21.6	3.51 (1.99-6.20)	< 0.001
Education				
No education	3 (0.3)	33.3	1.00	-
Primary	175 (17.6)	12.6	0.32 (0.03-3.97)	0.379
Secondary	795 (80.1)	12.2	0.21 (0.02-2.55)	0.223
Tertiary	19 (1.9)	15.8	0.16 (0.01-2.59)	0.198
Employment				
Self-employed	17 (1.7)	11.8	1.00	-
Student	583 (58.8)	8.2	1.32 (0.28-6.37)	0.725
Salaried/domestic worker	16 (1.6)	0.0	- -	-
Unemployed	368 (37.1)	19.3	2.08 (0.46-9.39)	0.341
Unable to work	8 (0.8)	25.0	3.98 (0.43-36.81)	0.223
Marital status				
Single	913 (92.8)	12.0	1.00	-
Married	71 (7.2)	15.5	0.78 (0.39-1.58)	0.498
Sleeping home last month	925 (93.2)	12.3	1.00	-
Sleeping away last month	67 (6.7)	13.4	0.85 (0.40-1.79)	0.666
Overnight trip to large city‡				
No	728 (73.4)	15.5	1.00	-
Yes	264 (26.6)	11.3	1.18 (0.77-1.79)	0.445
Frequency of months staying here‡				
0-4 months	46 (4.6)	15.2	1.00	-
5-8 months	40 (4.0)	17.5	1.23 (0.38-3.93)	0.731
9-11 months	89 (9.0)	12.4	0.88 (0.31-2.50)	0.816
12 months	814 (82.3)	12.0	1.03 (0.44-2.42)	0.946
Food shortage past month				
Never	390 (39.3)	11.0	1.00	-
Once only	69 (7.0)	11.6	1.13 (0.50-2.55)	0.770
A few times	233 (23.5)	11.2	0.97 (0.57-1.63)	0.899
Often	300 (30.2)	15.3	1.42 (0.90-2.23)	0.133

† Adjusted for age
‡ During the last year

Table 3.3.2: Association of potential risk factors for HIV and unemployment by sex

Risk factors	Unemployed men		Unemployed women	
	Number	%	Number	%
Non-spousal partners' age				
11-21	159	90.7	25	8.6
22-26	15	8.6	124	42.9
27-67	1	0.6	140	48.4
Age difference (men)				
-11.75 to -4.6	77	44.0	-	-
-4.59 to -3	41	23.4	-	-
-2.99 to -0.6	48	27.4	-	-
-0.59 to 14.55	9	5.1	-	-
Age difference (women)				
-7.56 to 1.79	-	-	54	18.7
1.8 to 2.99	-	-	56	19.4
3 to 9.99	-	-	147	50.9
10 to 45.72	-	-	32	11.1
Provide financial support				
Yes	127	69.0	54	17.5
No	57	31.0	255	92.5
Receive financial support				
Yes	85	46.2	241	78.0
No	99	53.8	60	22.0

However, 42.9% and 48.4% of unemployed women had relations with older non-spousal men aged 22 to 26 and 27 to 67 years respectively, compared to 90.7% of unemployed men who had relations with younger non-spousal women aged 11 to 22 years. Furthermore, Table 3.3.2 shows that unemployed women were more commonly to deny provisions of financial support and more readily to admit reception of financial support, and that the greater majority had an age difference of three to 9.99 years than men. Similarly, marital status was not associated with HIV infection among both sexes, although the prevalence of HIV infection was much higher in married young men (11.11%) than in unmarried young men (5.70%). In both sexes, sleeping away from home and an overnight trip to a large city were less commonly reported than sleeping at home and no overnight trip respectively, without any statistical association with the level of HIV infection.

Tables 3.3.3a and 3.3.3b show the selected sexual behaviours that were associated with HIV infection by sex. Among the 14 to 25-year-old study respondents (n=1,790) whose HIV statuses were known, 37 (7.4%) of the 503 men and 108 (15.0%) of the 719 women reporting ever having had sex were HIV positive, nine (3.1%) of the 293 men and 15 (5.5%) of the 273 women reporting never having had sex were HIV positive and two men did not respond. This section categorically deals only with those who reported sexual intercourse and ever had sex is defined as being sexually active. Sexual debut at the age of ≤ 16 was associated with an increased risk of HIV infection for both young men (OR=4.80, 95% CI: 1.98-11.66; p=0.001) and young women (OR= 1.95, 95% CI: 1.25-3.05; p=0.003) compared to those with a sexual debut at an age of > 16 years. However, among the 23 to 25-year-old women, the risk of HIV infection was the most marked for those who reported a sexual debut at the age of ≤ 16 years compared to those with a sexual debut at an age of > 16 years (OR=5.46, 95% CI: 2.35-12.69; p < 0.001) as illustrated in Figure 3.3.1.

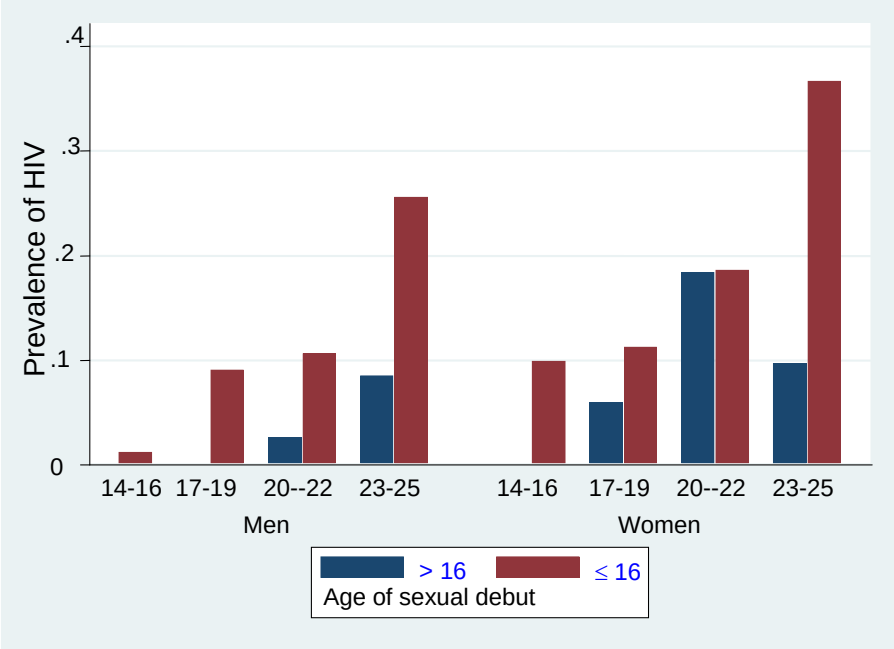

Figure 3.3.1: Association of age of sexual debut and HIV infection by age group and sex

Among women, reporting more than four lifetime sexual partners was highly associated with an increased risk of HIV infection (OR=3.86, 95% CI: 2.27-6.57; p < 0.001) compared to those with one to four sexual partners. The risk of HIV infection was strikingly higher among women with more than four lifetime sexual partners in the age groups 17 to 19, 20 to 22, and 23 to 25 (as illustrated in Figure 3.3.2) than those who had one to four lifetime sexual partners. The risk of HIV infection was the highest among the age group 20 to 22 for women with more than four lifetime sexual partners (age adjusted OR=4.92, 95% CI: 2.15-11.29; p<0.001) compared to those

Table 3.3.3a: Association between reported sexual behaviours and HIV infection among men in Limpopo Province, RSA

Sexual behaviours	Total N (%)	Prevalence of HIV	Adjusted OR† 95% CI	P-value
Ever had sexual intercourse				
No	293 (36.8)	3.1	1.0	-
Yes	503 (63.2)	7.4	1.22 (0.52-2.87)	0.653
Age of sexual debut				
> 16	178 (36.2)	3.9	1.0	-
≤ 16	313 (63.7)	9.6	4.80 (1.98-11.66)	0.001
Describe first sexual experience				
Wanted to have sex	397 (78.9)	7.6	1.0	-
Didn't want but happened	98 (19.5)	7.1	1.14 (0.48-2.72)	0.770
Forced to have sex	8 (1.6)	0.0	- - -	-
Lifetime sexual partner				
1-4 partner	325 (66.5)	7.1	1.0	-
> 4 partner	164 (33.5)	8.5	0.82 (0.39-1.70)	0.588
Had sex in the last 12 months				
No	46 (9.2)	15.2	1.0	-
Yes	454 (90.8)	6.6	0.31 (0.13-0.79)	0.014
No. of partners living as spouse‡				
0 partner	491 (98.0)	7.1	1.0	-
1 partner	10 (2.0)	20.0	1.68 (0.33-8.59)	0.531
Number of sexual partners not married to & never lived with‡				
0 partners	50 (10.0)	16.0	1.0	-
1-7 partners	450 (90..0)	6.4	0.35 (0.15-0.83)	0.017

† Adjusted for age
‡ In the last 12 months

Table 3.3.3b: Association between reported sexual behaviours and HIV infection among women in Limpopo Province, RSA

Sexual behaviours	Total N (%)	Prevalence of HIV	Adjusted OR† 95% CI	P-value
Ever had sexual intercourse				
No	273 (27.5)	5.5	1.0	-
Yes	719 (72.5)	15.0	1.76 (0.93-3.37)	0.084
Age of sexual debut				
> 16	316 (44.2)	12.3	1.0	-
≤ 16	399 (55.8)	17.0	1.95 (1.25-3.05)	0.003
Describe first sexual experience				
Wanted to have sex	369 (51.4)	16.0	1.0	-
Didn't want but happened	295 (41.1)	13.2	0.83 (0.53-1.29)	0.412
Forced to have sex	54 (7.5)	18.5	1.48 (0.69-3.18)	0.308
Lifetime sexual partner				
1-4 partner	639 (89.5)	12.4	1.0	-
> 4 partner	75 (10.5)	38.7	3.86 (2.27-6.57)	< 0.001
Had sex in the last 12 months				
No	63 (8.8)	17.5	1.0	-
Yes	655 (91.2)	14.8	0.75 (0.38-1.51)	0.422
No. of partners living as spouse‡				
0 partner	644 (89.9)	15.1	1.0	-
1 partner	72 (10.1)	15.3	0.74 (0.37-1.49)	0.397
Number of sexual partners not married to & never lived with‡				
0 partners	135 (18.9)	16.3	1.0	-
1-7 partners	580 (81.1)	14.8	1.03 (0.61-1.74)	0.903

† Adjusted for age
‡ In the last 12 months

with one to four lifetime sexual partners. Reporting sex in the last 12 months and reporting "1-7" "sexual partners not married to & never lived with" in the last 12 months were associated with a reduced risk of HIV infection in young men, although the vast majority reported sexual activity and "1-7" sexual partners respectively. "Wanted to have sex" was more commonly reported in men (78.9%) than in women (51.4%) and "didn't want but happened" and "forced to have sex" were reported predominantly by women. In women, "forced to have sex" showed increased likelihood of HIV infection compared to "wanted to have sex", although this was statistically not significant (OR =

1.48, CI: 0.69-3.18; p = 0.308.). Among men, respondents living with their spouse had increased risk of HIV infection compared to those reporting "0 partner" without any apparent statistical significance.

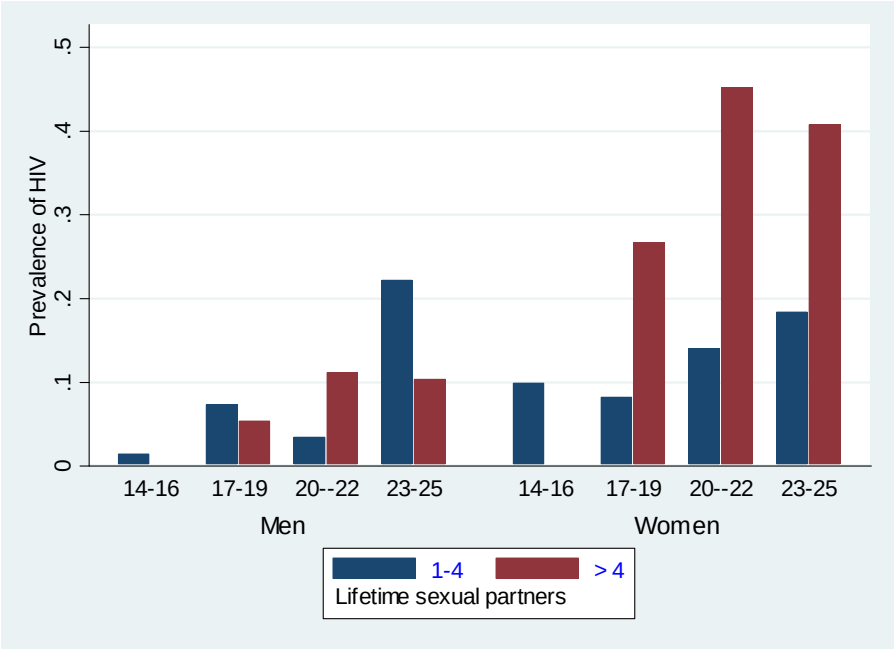

Figure 3.3.2: Association between lifetime sexual partners and HIV infection by age group and sex

Tables 3.3.4a and 3.3.4b depict the association of non-spousal sexual characteristics and HIV infection by sex. Out of 1,035 study respondents whose HIV status was known, 982 (94.88%) reported that their non-spousal sexual partners were aged between 11 and 67 years, whereas 51 (4.93%) of them answered "don't know", one (0.10%) didn't respond and one (0.10%) reported "2 years old" (could be a recording error). Among women respondents aged 20 to 25, having a non-spousal sexual partner aged 22 to 26 and 27 to 67 was more likely to be associated with an increased risk of HIV infection compared to those reporting a non-spousal sexual partner aged 11 to 21. Figure 3.3.3 shows that the higher the age of the non-spousal partner, the higher the likelihood of increased HIV prevalence among young women study respondents aged 20 to 25.

Among women aged 14 to 19, reporting a non-spousal partner aged 22 to 26 was strikingly associated with significantly increased risk of HIV infection compared to those with a non-spousal partner with the age of 11 to 21 (age adjusted OR=6.23, 95% CI: 2.0-19.44; p=0.002).

Table 3.3.4a: Association between non-spousal partners' characteristics and HIV infection among men in Limpopo Province, RSA

Non-spousal partners' characteristics[§]	Total N (%)	Prevalence of HIV	Adjusted OR[†] 95% CI	P-value
Non-spousal partners' age[‡]				
11-21	408 (93.8)	6.13	1.00	-
22-26	23 (5.3)	13.04	0.99 (0.26-3.78)	0.985
27-67	4 (0.9)	0.00	- - -	-
Age difference∗				
-11.75 to -4.6	97 (22.3)	11.3	1.00	-
-4.59 to -3	108 (24.8)	8.3	1.19 (0.44-3.23)	0.729
-2.99 to -0.6	188 (43.2)	3.2	0.65 (0.20-2.15)	0.485
-0.59 to 14.55	42 (9.7)	4.8	0.76 (0.15-3.84)	0.741
Provide financial support				
No	170 (37.5)	7.1	1.00	-
Yes	283 (62.5)	6.0	0.63 (0.28-1.39)	0.254
Receive financial support				
No	248 (54.7)	6.8	1.00	-
Yes	205 (45.2)	5.8	0.78 (0.36-1.71)	0.541
Frequency of sex				
Once only	33 (7.3)	3.0	1.00	-
2-5 times	146 (32.4)	3.4	0.92 (0.10-8.29)	0.941
6-20 times	133 (29.5)	10.5	2.69 (0.33-21.75)	0.353
> 20 times	139 (30.8)	6.5	1.27 (0.15-10.81)	0.828
Frequency of condom use				
Never	217 (48.0)	7.4	1.00	-
< half times	99 (21.9)	4.0	0.44 (0.14-1.37)	0.156
≥ half times	56 (12.4)	3.6	0.37 (0.08-1.69)	0.199
Always nearly always	80 (17.7)	8.7	0.97 (0.37-2.51)	0.948
Used condom last time had sex				
No	278 (88.0)	6.5	1.00	-
Yes	38 (12.0)	5.3	0.77 (0.17-3.50)	0.734

§ Partners during past 12 months
† Adjusted for age
∗ Age difference = non-spousal partners' age – age of respondents
‡ Non-spousal partner's age defined as age of respondents' partner (could be either male or female) and not the age of the study respondent

Table 3.3.4b: Association between non-spousal partners' characteristics and HIV infection among women in Limpopo Province, RSA

Non-spousal partners' characteristics§	Total N (%)	Prevalence of HIV	Adjusted OR† 95% CI	P-value
Non-spousal partners' age‡				
11-21	169 (30.9)	3.5	1.00	-
22-26	208 (38.0)	20.3	4.56 (1.77-11.76)	0.002
27-67	170 (31.1)	18.2	3.01 (1.03-9.83)	0.045
Age difference∗				
-7.56 to 1.79	147 (26.9)	8.2	1.00	-
1.8 to 2.99	108 (19.7)	16.7	2.21 (1.00-4.89)	0.049
3 to 9.99	252 (46.1)	17.5	2.08 (1.04-4.13)	0.037
10 to 45.72	40 (7.3)	12.5	1.13 (0.36-3.51)	0.835
Provide financial support				
No	498 (85.7)	15.7	1.0	1.0
Yes	83 (14.29)	9.6	0.52 (0.24-1.13)	0.098
Receive financial support				
No	98 (16.9)	14.3	1.00	-
Yes	483 (83.1)	14.9	1.08 (0.58-2.03)	0.808
Frequency of sex				
Once only	33 (5.7)	18.2	1.00	-
2-5 times	160 (27.8)	11.2	0.51 (0.18-1.45)	0.210
6-20 times	188 (32.6)	14.4	0.55 (0.20-1.52)	0.253
> 20 times	195 (33.8)	17.9	0.66 (0.24-1.78)	0.409
Frequency of condom use				
Never	277 (47.8)	16.2	1.00	-
< half times	137 (23.6)	10.2	0.62 (0.32-1.19)	0.153
≥ half times	78 (13.4)	17.9	1.09 (0.55-2.14)	0.807
Always nearly always	88 (15.2)	14.8	0.93 (0.47-1.85)	0.843
Used condom last time had sex				
No	361 (87.2)	14.7	1.00	-
Yes	53 (12.8)	11.3	0.99 (0.39-2.51)	0.990

§ Partners during past 12 months

† Adjusted for age

∗ Age difference = non-spousal partners' age – age of respondents

‡ Non-spousal partner's age defined as age of respondents' partner (could be either male or female) and not the age of the study respondent

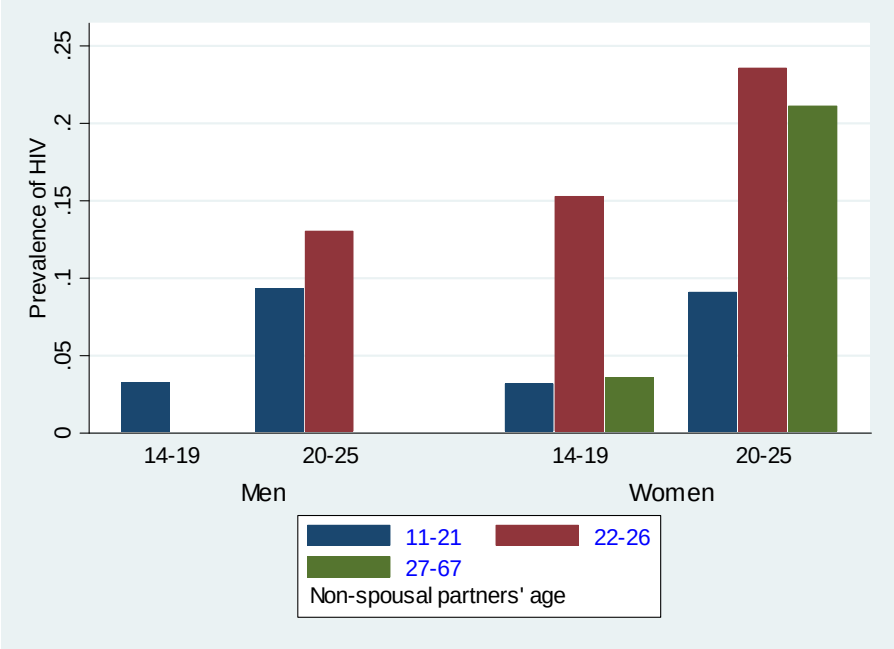

Figure 3.3.3: Association of non-spousal partners' age with prevalence of HIV infection by age group and sex

The Sex-specific age difference variable was generated from non-spousal partners after subtracting the age of the study respondents from the age of their non-spousal partners. Age difference of the study respondents was negatively skewed among young men, while it was positively skewed among young women. The median and IQR difference for women was 3.33 years and 1.72 to 6.02 years respectively while for men the median and IQR difference was -2.96 and -4.59 to -1.61 years respectively (see Figure 3.3.4). Age difference of three to 9.9 years was significantly associated with an increased prevalence of HIV infection among women compared to the age difference of -7.56 to 1.79 years (OR=2.08, 95% CI: 1.04-4.13); p=0.037). The association of age difference with increased prevalence of HIV infection becomes weak as the age difference increases beyond ten years.

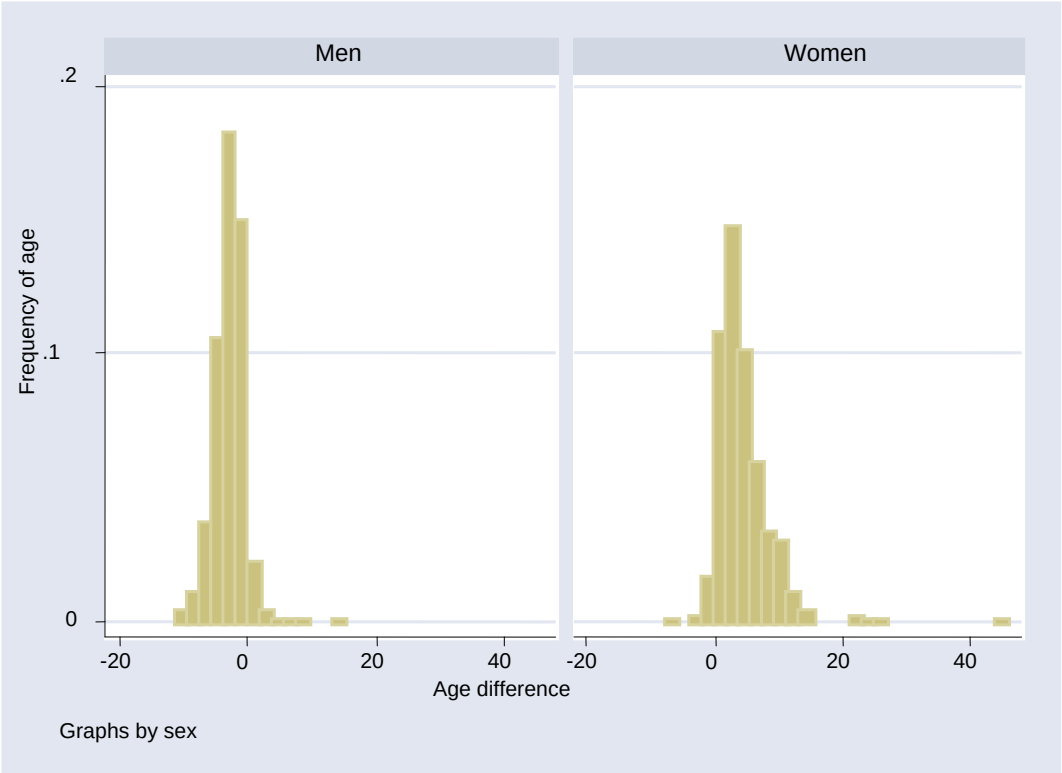

Figure 3.3.4: Frequency of age difference between non-spousal partners' age and respondents' age by sex

The proportion of respondents reporting, "used condom last time had sex" was much lower than those who had not used a condom in the last 12 months among both sexes. The proportion of respondents who reported never using a condom in the last 12 months with his or her non-spousal partner was similar among both men (48.0%) and women (47.8%). Frequency of "sexual intercourse", "frequency of condom use" and "use of a condom the last time had sex" between men and women in the last 12 months was not associated with HIV infection among both sexes, although the prevalence of HIV was notably much higher among men reporting frequency of sex of "6-20 times" (10.5%) compared to "2-5 times" (3.4%) [OR = 2.69, 95% CI: 0.33-21.75; p = 0.353].

3.4 Association of risk factors and HIV infection among men and women

Table 3.4 presents the relationship between various levels of risk factors and HIV infection among young men and young women. Multiple logistic regression models were developed, based on three hierarchical conceptual frameworks as presented in Chapter 2: Methods and in Table 3.4. Factors presented in the first model that significantly improved the logistic regression models were retained in the model when factors in the subsequent hierarchy were examined. Model 1 in Table 3.4 presents the results that were significantly associated with HIV infection upon running socio-demographic and life style risk factors. In fact this model improved the strength of associations which were found to be weak without any statistical significance in the initial analysis as depicted in tables 3.3.1a and 3.3.1b. Students and those attending primary education showed a reduced risk of HIV infection among men whereas unemployment showed significantly increased risk of HIV infection in women.

For all sexually experienced study respondents (Model 2), upon inclusion of the above risk factors (students, primary education and unemployment), sexual debut ≤ 16 years remained to be associated with HIV infection with raised OR, while reporting sexual intercourse in the last 12 months was also associated with a much reduced effect on HIV infection among men. Similarly, among women, age of sexual debut ≤ 16 and > 4 lifetime sexual partners showed a strong association with a minimal drop in the OR. For non-spousal partners' characteristics (Model 3), age of sexual debut ≤ 16, more than four lifetime sexual partners, and having a non-spousal partner aged 22 to 26 years were significantly associated with an increased risk of HIV infection in young women but the effect of age difference ceased to be significant. Age of sexual debut ≤ 16 was positively associated with an increased risk of HIV infection in men. Providing financial

Table 3.4: Association of risk factors and HIV infection among respondents aged 14 to 25 by sex in Limpopo Province, RSA

Risk factors*	Men			Women		
	Total N	Adjusted OR 95% CI	P-value	Total N	Adjusted OR 95% CI	P-value
Model 1†						
Primary education	796	0.19 (0.04-0.84)	0.028	-	- -	-
Student	796	0.19 (0.10-0.36)	< 0.001	-	- -	-
Unemployed	-	- -	-	984	1.68 (1.04-2.71)	0.033
Model 2‡						
Age of sexual debut ≤ 16	463	5.11 (2.07-12.63)	< 0.001	704	1.78 (1.13-2.82)	0.014
Had sexual intercourseΨ	463	0.25 (0.10-0.68)	0.006	-	- -	-
> 4 Lifetime sexual partners	-	- -	-	704	3.63 (2.13-6.27)	< 0.001
Model 3§						
Age of sexual debut ≤ 16	417	3.90 (1.45-10.47)	0.007	535	1.74 (1.02-2.98)	0.043
> 4 Lifetime sexual partners	-	- -	-	535	3.46 (1.85-6.51)	< 0.001
Non-spousal partners' age 22-26	-	- -	-	535	2.28 (1.36-3.82)	0.002
Provide financial support	-	- -	-	535	0.41 (0.18-0.95)	0.039
Sexual intercourse 6-20 timesΨ	417	2.29 (1.01-5.19)	0.047	-	- -	-

* Risk factors which significantly improved the model included in the table ($p < 0.05$).
† Adjusted for age, socio-demographic profile, and life style.
‡ Adjusted for age, socio-demographic profile, and sexual behaviour.
§ Adjusted for age, socio-demographic profile, sexual behaviour, and non-spousal partners' sexual characteristics.
Ψ Respondents reporting sex in the last 12 months.

support and sexual intercourse "6-20 times" in the last 12 months were associated without any statistical significance in the previous tables 3.3.3b and 3.3.3a respectively. However, for Model 3 in Table 3.4, providing financial support by women showed a reduced risk of HIV infection while reporting sexual intercourse "6-20 times" by men was a marker of increased risk of HIV infection compared to reporting one sexual intercourse experience in the last 12 months.

CHAPTER 4

4.0 DISCUSSION

The finding of the overall prevalence of HIV infection of 9.44% in Limpopo Province was comparable to the finding of the South African National HIV Prevalence Survey of 10.3% among 15 to 24-year-old youth. A number of studies in South Africa[40, 45, 50, 52] and other Sub-Saharan African countries[17, 24, 25, 30] have shown the prevalence of HIV infection to be substantially higher among young women than their young male counterparts. Similarly, South African 2006 HIV/AIDS statistics reported an increased HIV prevalence in women (12.0%) than in men (2.4%) among youth aged 15 to 24 in Limpopo Province[40]. This study also revealed a similar pattern of increased risk of HIV prevalence among young women (12.4%) than young men (5.8%) aged 14 to 25, although the age range of this study population was slightly wider than the above mentioned studies (15 to 24 years). The 2005 National HIV Incidence Survey indicated that South African young black women were eight times more likely to be infected than young men; however, this study used the incidence rate, which is a better tool for understanding the current magnitude of HIV infection unlike the above mentioned studies. This alarming rate of HIV infection among young black African women indicates that there is a need for designing and implementing an urgent effective intervention that targets young women. This report explored a number of possible risk factors that might have resulted in the observed differences of HIV infection between young women and young men, while acknowledging the biological factors that are discussed in the literature review presented in Chapter 1 of this report.

Socio-demographic profile might influence the risk of developing HIV infection directly or indirectly; this study explored education, employment and marriage as possible risk factors for the observed increased prevalence of HIV infection among young women than young men. Generally, the prevalence of HIV infection was higher among young women than young men without any apparent association across the level of education in the bivariate analysis. However, the multivariate analysis showed a relatively reduced risk of HIV prevalence among men attending primary education and those reporting as students. Among developing nations, Uganda was one of the first nations that achieved a reduced risk of infection among young educated individuals, particularly among women, as early as 1997, while recently other studies have shown a shift in the risk of HIV infection from educated to uneducated individuals[25, 37, 42, 51, 54]. Nevertheless, other studies have shown relatively increased prevalence of HIV infection among the more educated than among the less educated[41, 47]. The observed reduced risk of HIV prevalence among students and those attending primary education in Limpopo Province could be explained by the fact that most of these students (84.97%) and those with primary education (84.59%) were young men aged 14 to 19 years (data not shown). Furthermore, this study indicated that young men were more likely to develop a sexual relationship with someone from a similar age group or younger; these younger people were found to be at a lower risk of developing HIV infection than women in the age group studied in the current research.

Model 1 showed that unemployed women were more likely to develop increased HIV infection compared to self-employed women. This finding might be further explained as more unemployed women seek relationships with older non-spousal men (42.9% and 48.4% of women had relationships with men in the 22 to 26 & 27 to 67 year age groups respectively, compared to 90.7% of unemployed men who had relationships with 11 to 21-year-old women) perhaps for financial

security, gifts and/or as a future spouse. Unemployed women more commonly denied provisions of financial support and more readily admitted reception of financial support than men, as indicated in Table 3.3.2. Although unemployment was not directly measured by the other studies mentioned above, the fact remains that socio-economic inequality increases women's vulnerability to HIV infection[33, 54]. Furthermore, low SES was associated with increased HIV infection among women aged 15 to 24 years, as described by Hargreaves et al.[18]. Hence, unemployment was strongly associated with increased HIV prevalence, particularly among young women.

Very low rate of marriage was reported in this study more among men (1.1%) than among women (7.2%), as pointed out by the 2003 survey conducted at the national level among young South Africans aged 15 to 24[45]. Generally, the finding of a higher proportion of marriage in young women than in young men is in line with other African studies[4, 13, 15, 16]. Although the increased prevalence of HIV infection among married young men compared to single young men in Limpopo Province was in line with the findings of research carried out in Kisumu, Kenya and Ndola, Zambia[16], statistically this was not significant, as shown in Table 3.3.1a. It is important to note that the above Kenyan and Zambian research used proportion, and that the numbers of HIV-positive married men in the current study were too small to be statistically significant.

Several studies have pointed out that the risks related to first sexual encounter at a young age are disproportionately higher among women. Similarly, in Limpopo Province, more women described their first sexual encounter as unwanted "but happened" and "forced to have sex" than men, particularly for sexual debut at the age of ≤ 16 years. Starting sexual intercourse at an early age is associated with increased risk of HIV infection mainly due to biological features of the immature

genital tract and cervical ectopy[9, 16, 42, 46]. However, some of the studies did not find a relationship between early sexual debut and increased HIV infection[16, 17, 30] while others did find a significant relationship[9, 42, 46]. The median age of sexual debut (17 years) recorded in both the 2003 national survey of HIV and sexual behaviour among young South Africans[45] and the 2005 South African National HIV Survey among those aged 15 to 24 was slightly different from the median age of Limpopo Province (16 years) and perhaps this could be the result of the wide age range (14 to 25). The finding of increased prevalence of HIV infection for those who reported their sexual debut at the age of ≤ 16 years among women aged 23 to 25 is in line with data from a cohort study in Zimbabwe[46] and other studies[9, 42]. However, the study population of the Zimbabwe study was different from this study as the age range of the study population of that research was 18 to 35 years and the research was carried out only among women. Finally, age of sexual debut ≤ 16 remained to be significantly associated for both Model 2 and Model 3, after adjusting for sexual behaviour and non-spousal characteristics respectively.

As indicated in a number of other studies[7, 17, 24, 30, 37, 42, 47, 52], there was increased HIV prevalence among those reporting a higher number of lifetime sexual partners. The estimated odds ratio for the effect of more than four lifetime sexual partners, controlling for age, was 3.86 (95% CI: 2.27-6.57, $p<0.001$) among women compared to one to four lifetime sexual partners, while among men it was 0.82 (95% CI: 0.39-1.70, $p=0.588$). Furthermore, more than four lifetime sexual partners was significantly associated with higher HIV prevalence after adjusting for age, socio-demographic profile and sexual behaviours (Model 2) and upon inclusion of non-spousal partners' age characteristics in Model 3. Although reporting more than four lifetime partners indicated a prominent risk factor for increased HIV prevalence among women in Limpopo Province, women (10.64%) were

less likely to report more than four lifetime partners (compared to one to four lifetime partners) than men (36.23%), particularly in the younger age groups. This may suggest that young women under-report and/or that young men over report the number of their partners. A similar pattern of under reporting of sexual partners among young women and/or over reporting of sexual partners among young men was observed in the 2003 national survey of HIV and sexual behaviour among young South Africans[45]. This apparent paradox may be explained by the probability that HIV transmission from men to women is significantly higher than from women to men (OR=2.3, 95% CI: 1.14-4.8), as pointed out by Nicolosi et al.[39]. Additionally, the higher the number of sexual partners among young women, the greater the risk of HIV infection. This could partly be due to women's biological vulnerability, which further indicates the dose response relationship of HIV transmission.

Young women are at a higher risk of developing HIV infection than their young male counterparts as they are more likely to be involved with older sexual partners. The older the male sexual partner the higher the prevalence of HIV infection, as indicated in this study and elsewhere[17, 24, 30, 42, 47, 52]. For instance, women aged 14 to 19 years old who had sexual relations with men aged 22 to 26 years were six times more likely to develop HIV infection compared to those who had sexual relations with men of 11 to 21 years old. This is because young men are more likely to have sexual relationships either with their similar-aged sexual partner or with younger sexual partners who have less risk of HIV infection, as clearly indicated in this study and elsewhere[17, 24, 30, 42, 47, 52]. The finding of the Limpopo Province pattern of negatively skewed IQR (-4.59 to -1.61 years) for the age difference between partners for men and positively skewed IQR (1.72 to 6.02 years) for women is in line with the findings in the 2003 national survey of HIV and sexual behaviour among young South Africans as mentioned in Chapter 1[45] Although in this study population, among women the age differences of 1.8

to 2.99 and three to 9.9 years were significantly associated with HIV infection, this effect ceases upon inclusion of non-spousal partners' characteristics in Model 3.

Most of the studies mentioned above indicated that young women develop sexual relationships with an older partner who has accumulated assets and is able to provide money, entertainment and gifts, or has potential as a future husband[17, 30]. Similarly, this study indicated that provision of financial support is more common among men, while women more commonly acknowledge reception of financial support from their partners. Furthermore, young women reporting "no regular provision of financial support" to their non-spousal partners was strongly associated with an increased risk of HIV sero-prevalence in rural Limpopo Province, after controlling for age, sexual behaviour, and non-spousal partners' characteristics. Additionally, frequency of "6-20 times" sexual intercourse indicated an increased HIV prevalence among men, after adjusting for age, socio-demographic profile, sexual behaviour, and non-spousal partners' characteristics.

Condom use in the last 12 months was found by this study (data collected 2001) to be considerably lower among both men (31.3%) and women (28.4%) compared to the 2003 national survey of HIV and sexual behaviour among young South African men (57%) and women (48%)[45] and the 2005 National South African Survey, which reported condom use of 72.8% for men and 55.1% for women among youth aged 15 to 24[52]. The three above mentioned studies show that the trend of condom use is still much higher among young men than young women and further indicate that the HIV/AIDS prevention strategies are showing a certain degree of momentum. Although condom use is an important risk factor and useful indicator in the prevention of HIV infection, this Limpopo Province study did not show any significant relationship between condom use and increased HIV infection.

However, men with a 22 to 26-year-old non-spousal female partner tended to have a higher rate of condom usage (43.7%) and were likely to have relatively low HIV prevalence (13.0 %) compared to women with a 22 to 26-year-old non-spousal male partner, who had a lower rate of condom use (26.4%) and a higher percentage of HIV prevalence (20.3%). Furthermore, as the age difference increases between young women respondents and their non-spousal male partners, the likelihood of condom use decreases (data not shown in Chapter 3: Results) from 40.2% to 16.3%. This is in line with South African and Botswana study findings that men are more likely to refuse to use a condom when the age difference between them and their female partners is greater than ten years[20, 28].

Finally, the hierarchical conceptual framework and automated step wise logistic regression models indicated important risk factors that affect increased HIV sero-prevalence in Limpopo Province. Such risk factors include unemployment, being students, primary education, age of sexual debut ≤ 16 years, more than four lifetime sexual partners, age difference of 1.8 to 2.99 and three to 9.9 years, denying regular provision of financial support to their partner, women's sexual relationship with a non-spousal partner aged 22 to 26 and 27 to 67, and men's sexual intercourse of six to 20 times.

The limitations of this study are discussed as follows:

1. It is important to note that the possibility of false positive rapid OraSure test results might be a limitation of this study in Limpopo Province. The OraSure test was chosen for this study as it was considered as a convenient test and one with the potential to reduce the chance of refusal from the study respondents. A false positive rapid HIV test is defined as a reactive OMT OraSure (OraQuick) test result followed by a negative FDA-approved serum or OMT Western blot[22]. The Minnesota study reported that during a two-year rapid HIV test performance study, a cluster of 16 false positive

OraQuick tests was observed from April 15, 2004 to 31 August 2004 and that the specificity of the test fell below the FDA required minimum 98%. Further, the investigation reported that the field investigation did not suggest a specific cause for the observed cluster, and that the subsequent incidence investigation detected no false positive testes. The investigation suggested that without guidance from the manufacturer other clusters of false positive results might occur as a result of differential interpretation. Finally, the study recommended that the manufacturer should revise the package insert to specify how to interpret the partial lines and visible lines in the test zone that do not appear reddish-purple[22]. Although the use of the OraSure test might exaggerate the prevalence of HIV, particularly in a community where the prevalence is low, the possibility of a false positive rapid OraSure test in this study might be less worrisome as the expected prevalence of HIV in Limpopo Province is high.

2. Sensitive issue biases could be introduced by the study respondents. For instance, under reporting of sexual intercourse was likely as 5.49% of women and 3.07% of men who denied sexual intercourse were HIV positive, and most of them (79.17%) were aged 14 to 16 years. Women also reported few multiple sexual partners unlike men, despite a significantly increased risk of HIV prevalence among women who reported multiple sexual relationships. Under reporting among young age groups is a recognised problem in this and other similar studies[16, 19].

3. In this study, the refusal of an HIV test was made by people who tended to be older men and women (aged 23 to 25 years) who are at increased risk of HIV infection; more likely to have more than four lifetime sexual partners; and more likely to report tertiary education as the prevalence of HIV is relatively much higher among educated young people as indicated in this and other earlier

studies[41, 47]. A lower percentage of students, especially young men, tend to decline an HIV test and this group of the population is at lower risk of HIV infection. Similarly, a South African study indicated that those who decline HIV tests tend to be older men, more likely to have more than one partner, to be among urban formal households rather than rural, and more likely to be white and Indian than African[52]. The refusal of an HIV test, in this study tends to be from groups with increased risk of HIV prevalence that may underestimate the HIV prevalence in Limpopo Province. Nevertheless, as the proportion of those who tested is above satisfactory level i. e. 85.6 %; the effect of underestimation of HIV prevalence is minimal.

4. There is no data to provide a complete picture of other possible factors of gender differentials, especially STIs, other biological markers, level of poverty, and alcohol consumption.

5. This study lacks temporality like any cross-sectional study, which makes it difficult to know whether the assessed risk factors were the same or different at the time of actual HIV infection compared to the time of data collection. The use of stepwise logistic regression has limitations as discussed in Chapter 2 as this approach is based entirely on statistical associations rather than on any conceptual basis for inter-relationships between various risk factors[26, 59]. The use of a hierarchical conceptual framework approach may have limitations in its ability to assess among the cross-sectional data. The differences seen in the OR in the bivariate analysis and models 1, 2 and 3 could be due to the mediation of the risk factors involved at each level of the models or simply because of the difference in the denominator among the models.

CHAPTER 5

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

There is consistent evidence both from this study and a number of other studies[17, 24, 25, 30, 40, 50, 52] that the rates of HIV infection among young women are higher than among young men. This research has explored socio-demographic and behavioural explanations in order to account for the observed differences of the rapid rise of HIV-1 infection in young women than in young men. Among socio-demographic characteristics, student young men had relatively reduced risk of HIV infection while unemployed women indicated increased risk of HIV prevalence. Educated men have relatively increased risk of HIV infection than less educated men in the rural Limpopo Province, although more recent studies have indicated a shift of increased HIV infection from educated to uneducated individuals. This increased risk of HIV infection among the educated is an important indicator that there have been little or insufficient prevention activities in Limpopo Province.

Data from rural Limpopo Province indicated that factors such as “trip to large city”, “sleeping home” or “sleeping away”, “frequency of months staying at the residential area”, “frequency of condom use” and “shortage of food” were not sufficiently significant to explain the differential rate of HIV infection. However, age of sexual debut ≤ 16 years, particularly among 23 to 25-year-old women; more than four lifetime sexual partners among women; non-spousal partners’ age at 22 to 26 among 14 to 19-year-old women; age difference of three to 9.9 years in women from their male partners; and frequency of sex six to 20 times in men were important factors that resulted in the differential rate of HIV infection between young women and young men.

This study concentrated rather more on socio-demographic characteristics and sexual behaviour that resulted in higher HIV prevalence among young women than biological factors, which is beyond the scope of this study. However, women's greater biological vulnerability to HIV infection when compared to men, as already discussed in great detail in Chapter 1, could play an important role in facilitating increased HIV infection. This report lacks important data on circumcision, sexual violence against women, rape, clinical stage of HIV/AIDS, STIs, and alcohol consumption. Data on these factors could explain more of the complex interaction between biological, social factors and sexual behaviour.

5.2 Recommendations

There is a need to address the alarming spread of HIV infections, particularly among young black South African women. This study revealed that the rural population of Limpopo Province still lags behind the populations of those African countries that have achieved significant reductions in the incidence of HIV infection. These reductions have been particularly noticeable among young educated women, with a number of studies showing that education is an important indicator of successful HIV/AIDS prevention programme. This study further indicated that unemployed women particularly were at increased risk of HIV infection. Thus, there is a need to expand programmes on information, education and communication (IEC), and economic empowerment through micro-finance. A need also exists for the creation of job opportunities and the promotion of free education. Furthermore, the finding of sexual debut ≤ 16 years and > four lifetime sexual partners as risks to increased HIV infection might implicate women's biological vulnerability. Thus, there is a need for special education targeting young women to avoid multiple sexual partners, to delay sexual debut, to practise safe sex, and to obtain protection against sexual violence. A successful health intervention

will need relevant and effective preventive strategies in order to reach young women who are most affected, although prevention should encompass both gender and various age groups. Nevertheless, it is difficult to alter the underlying socio-economic situations of young women, which could prevent their exposure to HIV infection from an older partner.

There is a need for further study that includes the complex socio-economic characteristics, sexual behaviours and biological factors that affect the increased HIV infection among young women than young men. Data for this study was collected from a baseline RADAR study, which is an ongoing three-year prospective, randomised, controlled, and community-matched intervention trial. Although the above study was not aimed at addressing risk factors that might explain gender differences of HIV prevalence among younger age groups, it provides an opportunity for study in that a prospective randomised intervention study will provide a complete picture of other possible factors of gender differentials, especially STIs, other biological markers, level of poverty, and alcohol consumption.

APPENDICES

APPENDIX A

HOUSEHOLD QUESTIONNAIRE

HI00A. Sleeps here. (1 = Usually sleeping at the house in last month, 2 = Usually sleeping away from the house in last month)

H100F. Maximum level or schooling (1 = No formal schooling illiterate, 2 = No formal schooling literate, 3 = Some primary, 4 = Completed primary, 5 = Some secondary, 6 = Completed secondary, 7 = Attended vocational/training colleges, 8 = Attended University)

H100G. Income from work (1 = Self employed in agriculture, 2 = Self employed in non-farm enterprise registered business, 3 = Self employed in non-farm enterprise unregistered business, 4 = Student, 5 = Salaried worker, 6 = Domestic worker, 7 = Unemployed, looking for a job, often does causal, seasonal or contract work, 8 = Unemployed looking for a job, occasionally gets any seasonal or contract work, 9 = Unemployed, looking for a job, rarely or never had any work during the last year, 10 = Unwilling to work, retired or too young to be working, 11 = Unable to work)

H602. While living in his house and during the past month have you or any of your own children gone without food or had a reduced amount to eat for a single day because of shortage of food? (1 = Never, 2 = Once only, 3 = A few times, 4 = Often, 99 = no response)

YOUNG PERSON QUESTIONNAIRE

Y101. Sex (1 = Male, 2 = Female)

Y102. Date of birth (dd/mm/yy)

Y103. Have you ever been married or lived as being married?

(1 = Never married, 2 = Currently married, 3 = Separated/ Divorced, 4 = Widowed)

Y108. Have you made an overnight trip to a large city during the last year?

(1 = Yes, 2 = No, 99 = no response)

Y109. For how many months of the last year were you staying here? Give no of months___

Y110. **If less than 7 months**. How was the pattern of your visits home in the last year?

(1= Mainly weekends, 2 = Mainly month ends, 3 = Occasional extended trips, 4 = Migrated in this year, 5 = Other)

Y400: Males Only

Y401. Have you been circumcised? (1 = Yes, 2 = No, 9 = No response given)

Y403. In the last 12 months, have you ever purchased or picked up condoms with the intention of using them for protection during sex? 1 = Yes 2 = No 9 = No response given

Y500: Sexual Behaviour

Y501. Have you ever had sexual intercourse? (1 = Yes, 2 = No, 9 = No response given)

Y502. At what age did you first have sexual intercourse?

(Age in years__, 88 = Don't know, 99 = No response)

Y503. How would you describe the first time that you had sex? Would you say that you wanted to have sex, you did not want to have sex but it happened anyway, or were you forced to have sex?

(1 = Wanted to have sex, 2 = Did not want but happened, 3 = Forced to have sex, 4 = 99 no response)

Y504. How many people would you say you have had sexual intercourse with in total up to now in your life? (Give total number__, 88 = don't know (too many), 99 = No response)

Y505. Have you had sexual intercourse in the last 12 months? (1 = Yes, 2 = No, 9 = No response)

For Women: Think about all the male sexual partners you've had in the last 12 months.

For Men: Think about all the female sexual partners you've had in the last 12 months.

Y506. How many of your partners in the last 12 months were your spouse/ live in partner(s)

(Total number__, 88 = Don't know, 99 = No response)

Y507. How many of your partners in the last 12 months were Sexual partners that you are not married to and have never lived with

(Total number__, 88 = don't know, 99 = No response)

Y600: Spousal Partners

Y603. How old are they? (__, 99 = Don't know)

Y606. How often would you say you have used a condom when having sex with this person in the last 12 months? (1 = Never, 2 = Less than half the times, 3 = Half or > half the times, 4 = Always or nearly always)

Y607. Did you use a condom the last time you had sex with this person? (1 = Yes, 2 = No)

Y700: Non-Spousal Partners

Y703. How old is that person? (__, 99 = don't know)

Y704. Do you regularly provide financial support from this person? (1 = Yes, 2 = No)

Y705. Do you regularly receive financial support from this person? (1 = Yes, 2 = No)

Y706. During the last 12 months how often would you say you have had sexual intercourse with this person? (1 = once only, 2 = 2 – 5 times, 3 = 6 – 20 times, 4 = >20 times)

Y707. How often would you say you have used a condom when having sex with this person in the last 12 months? (1 = Never, 2 = Less than half the times, 3 = Half or > half the times, 4 = always or nearly always)

Y708. Did you use a condom the last time you had sex with this person? (1 = Yes, 2 = No)

APPENDIX B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ali

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M050435**
PROJECT	Gender and HIV in Limpopo Provence
INVESTIGATORS	Dr MA Ali
DEPARTMENT	School of Public Health
DATE CONSIDERED	05.04.29
DECISION OF THE COMMITTEE*	

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE **CHAIRPERSON** ..... pp
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : J Hargreaves

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

REFERENCES

1. Ahmed HA, Mbwana J, Gunnarsson E, Ahlaman K, Guerino C, Svensson LA, Mhalu F, and Lagerard T. Etiology of Genital Ulcer Disease and Association with Human Immunodeficiency Virus Infection in Two Tanzanian Cities. Sexually Transmitted Diseases ● February 2003; Vol. 30 ● No. 2

2. Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A. Randomized, Controlled Intervention Trial of Male Circumcision for Reduction of HIV Infection Risk: The ANRS 1265 Trial. November 2005 | Volume 2 | Issue 11 | e298

3. Bailey RC, Moses S, Parker CB, Agot K, Maclean I, Krieger JN, Williams CFM, Campbell RT, Ndinya-Achola JO. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. Vol 369 February 24, 2007

4. Carpenter LM, Kamali A, Ruberantwari A, Malamba SS, Whitworth JAG. Rates of HIV-1 transmission within marriage in rural Uganda in relation to the HIV sero-status of the partners. AIDS: Volume 13(9) 18 June 1999 pp 1083-1089

5. Chaililwattana P, Chuachoowong R, Siriwasin W, Bhadrakom C, Mangclaviraj Y, Young NL, Cheaskul S. Chlamydial and Gonococcal Cervicitis in HIV-Seropositive and HIV-Seronegative Pregnant Women in Bangkok: Prevalence, Risk Factors, and Relation to Perinatal HIV Transmission. Sexually Transmitted Diseases: Volume 24(9) October 1997 pp 495-502

6. Chakraborty H, Sen PK, Helms RW, Vernazza, PL, Fiscus SA, Eron JJ, Patterson BK, Coombs RW, Krieger JN and Cohen MS. Viral burden in genital secretions determines male-to-female sexual transmission of HIV-1: a probabilistic empiric model. AIDS: Volume 15(5) 30 March 2001 pp 621-627

7. Chen L, Jha P, Stirling B, Sgaier SK, Daid T, Kaul R, Nagelkerke N. Sexual Risk Factors for HIV Infection in Early and Advanced HIV Epidemics in Sub-Saharan Africa: Systematic Overview of 68 Epidemiological Studies. October 2007 | Issue 10 | e1001

8. Clark JL, Konda KA, Munayco CV, Pún M, Lescano AG, Leon SR, Pajuelo J, Suarez-Ognio L, Klausner JD, Coates TJ and Cáceres CF. Prevalence of HIV, Herpes Simplex Virus-2, and Syphilis in male sex partners of pregnant women in Peru. BMC Public Health 2008, 8:65 doi:10.1186/1471-2458-8-65

9. Coombsa RW, Reichelderferb PS and Landayc AL. Recent observations on HIV type-1 infection in the genital tract of men and women. AIDS 2003, 17:455-480

10. Cowan FF, Pascoe SJ, Barlow KL, et al. Association of genital shedding of herpes simplex virus type 2 and HIV-1 among sex workers in rural Zimbabwe. AIDS 2006; 20:261-7.

11. Cunningham AL, Taylor R, Taylor J, Marks C, Shaw J, Mindel A. Prevalence of infection with herpes simplex virus types 1 and 2 in Australia: a nationwide population based survey. *Sexually Transmitted Infections* 2006;82:164-168; doi:10.1136/sti.2005.016899

12. Department of Health: Guidelines for Good Clinical Practice in the Conduct of Clinical Trials in Human Participants in South Africa Pretoria: DOH; 2000.

13. Ferry B, Caraël M, Buvé A, et al. Comparison of key parameters of sexual behaviour in four African urban populations with different levels of HIV infection. AIDS 2001, 15 (suppl4):S41-S50.

14. Freeman EE, Weiss, HA, Glynn, JR, Cross PL, Whitworth JA, Hayes RJ. Herpes simplex virus type 2 infection increases HIV acquisition in men and women: systematic review and meta-analysis of longitudinal studies. AIDS 2006, 20: 73-83

15. Glynn JR., Caraël M, Buvé A, Musonda RM, Kahindo M, Study Group on the Heterogeneity of HIV Epidemics in African Cities. HIV Risk in Relation to Marriage in Areas With High Prevalence

of HIV Infection. JAIDS Journal of Acquired Immune Deficiency Syndromes: Volume 33(4) 1 August 2003 pp 526-535

16. Glynn JR, Garael M, Avurt B, Kahindo M, Chege J, Musanda R, Kaona F, Buve A. Why do young women have a much higher prevalence of HIV than young men? A study in Kisumu, Kenya and Ndola, Zambia. AIDS 2001 AUG; 15 Suppl 4:551-60

17. Gregson S, Nyamukapa CA, Garnett GP, Zhuwav T, Carael M et al. Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in rural Zimbabwe. Lancet 2002; 359:1896-1903.

18. Hargreaves JR, Morison LA, Chege J, et al. Socioeconomic status and risk of HIV infection in an urban population in Kenya. Tropical Medicine and International Health: Volume 7 No 9 PP 793-802 SEPTEMBER 2002

19. Hawken MP, Melis RDJ, Ngombo DT., Mandaliya KN, Ng'ang'a LW, Price J, Dallabetta G, Temmerman M. Opportunity for Prevention of HIV and Sexually Transmitted Infections in Kenyan Youth: Results of a Population-Based Survey. JAIDS Journal of Acquired Immune Deficiency Syndromes: Volume 31(5) 15 December 2002 pp 529-535

20. Hayes RJ, Schulz KF, Plummer FA. The Cofactor Effect of Genital Ulcer, on Per-exposure Risk of HIV Transmission in Sub-Saharan Africa. J. Trop Med Hyg. 98(1): 1-8, 1995, Feb.

21. Helen Weiss. Epidemiology of Herpes Simplex Virus Type 2 Infection in the Developing World. HERPES *11 Supplement 1* 2004

22. Jafa K, Patel P, MacKellar DA, Sullivan PS, Delaney KP, et al (2007) Investigation of False Positive Results with an Oral Fluid Rapid HIV-1/2 Antibody Test. PLoS ONE 2(1): e185.doi:10.1371/journal.pone.0000185

23. Kamali A, Nunn AJ, Mulder DW, Dyck EV, Dobbins JG, Whitworth JAG. Seroprevalence and incidence of genital ulcer infections in a rural Ugandan population. Sex Transm Inf 1999;75:98–102

24. Kelly RJ, Gray RH, Sewankambo NK, Serwadda D, Wabwire-Mangen F, Lutalo T, Wawer MJ. [S]. Age Differences in Sexual Partners and Risk of HIV-1 Infection in Rural Uganda. JAIDS Journal of Acquired Immune Deficiency Syndromes. 32(4): 446-451, April 1, 2003.

25. Kilian AHD, Gregson S, Ndyanabangi B, Walusaga K, Kipp W, Sahlmüller G, Garnett GP, Asiimwe-Okiror G, Kabagambe G, Weis P, von Sonnenburg F. Reductions in risk behaviour provide the most consistent explanation for declining HIV-1 prevalence in Uganda. AIDS: Volume 13(3) 25 February 1999 pp 391-398

26. Kirkwood BR, and Sterne JAC: Essential Medical Statistics, 2nd edition, Oxford, UK: Blackwell Science Ltd; 2003.

27. Lai W, Chen CY, Morse SA, Htun Ye, Fehler HG, Liu H, Ballard RC. Increasing relative prevalence of HSV-2 infection among men with genital ulcers from a mining community in South Africa. Sex Transm Infect 2003;79:202–207

28. Lawrence Corey. Herpes Simplex Virus Type 2 and HIV-1: The Dialogue between the 2 Organisms Continues. The Journal of Infectious Diseases 2007;195:1242–4

29. Legoff J, Bouhlal H, Gresenguet G, Weiss H, Khonde N, Hocini H, Desire N, Si-Mohamed A, de Dieu Longo J, Chemin C, Frost E, Pepin J, Malkin JE, Mayaud P, Belec L: Real-time PCR quantification of genital shedding of herpes simplex virus (HSV) and human immunodeficiency virus (HIV) in women coinfected with HSV and HIV. *J Clin Microbiol* 2006, 44(2):423-432.

30. MacPhail G, Williams BG: Camphel C. Relative risk of HIV infection among young men and women in South Africa township. Int. J. STD. AIDS 2002; 13:331-342

31. Malkin JE. Epidemiology of genital herpes simplex virus infection in developed countries. Herpes 2004;11:Suppl 1:2A-23A. 21.

32. Marie-Marcelle Deschamps, Jean William Pape, Alice Hafner, and Warren D. Jr.Johnson. Heterosexual Transmission of HIV in Haiti. 15 August 1996 | Volume 125 Issue 4 | Pages 324-330

33. Mbirimtengerenji ND. Is HIV/AIDS Epidemic Outcome of Poverty in Sub-Saharan Africa?. Croat Med J 2007;48:605-617

34. Mbopi Keou FX, Legoff J, Gresenguet G, Si-Mohammed A, Matta M, Mayaud P, et al. Genital shedding of herpes simplex virus type 2 DNA and HIV-1 RNA and proviral DNA in HIV-1 Herpessimplex virus type 2 co-infected women. J Acquir Immune Defic Syndr 2003; 33:121–124.

35. Mbulaiteye SM, Ruberantawri A, Nakiyingi JS, Carpenter LM, Kamali A, Whitworth JAG. Alcohol and HIV: a study among sexually active adults in rural southwest Uganda. International Journal of Epidemiology 2000, 29:911-915

36. McClelland RS, Wang CC, Overbaugh J, et al. Association between cervical shedding of herpes simplex virus and HIV-1. AIDS 2002;16:2425-30.

37. Mmbaga EJ, Hussain A, Leyna GH, Mnyika KS, Sam NE and Klepp KI. Prevalence and risk factors for HIV-1 infection in rural Kilimanjaro region of Tanzania: Implications for prevention and treatment. BMC Public Health 2007, 7:58

38. Nagot N, Ouédraogo A, Foulongne V, Konaté I, Weiss HA, Vergne L, Defer MC, Djagbaré D, Sanon A, Andonaba JB, Becquart P, Segondy M, Vallo R, Sawadogo A, Van de Perre P, and Mayaud P. Reduction of HIV-1 RNA Levels with Therapy to Suppress Herpes Simplex Virus. N Engl J Med 2007;356:790-799.

39. Nicolosi A, Correa Leite ML, Musicco M, Arici C, Gavazzeni G, Lazzarin A. The efficiency of male-to-female and female-to-male sexual transmission of the human immunodeficiency virus: a study of 730 stable couples. Epidemiology 1994, 5:570-575.

40. Noble R. South Africa HIV & AIDS Statistics. AIDS & HIV Information from AVERT.org

41. Nyambi P, Zekeng L, Kenfack H, Tongo M, Nanfack A, Nkombe I, Ndonko F, Shang J, Burda S, Mbah H, Agyingi L, Zhong P, Nadas A, Zolla-Pazner S, Marmor M. HIV Infection in Rural Villages of Cameroon. JAIDS Journal of Acquired Immune Deficiency Syndromes: Volume 31(5): 506-513, December 15, 2002.

42. Orroth K.K, White RG, Korenromp EL, Bakker R, Changalucha O, Habbema JDF, and Hayes RJ. Empirical Observations Underestimate the Proportion of Human Immunodeficiency Virus Infections Attributable to Sexually Transmitted Diseases in the Mwanza and Rakai Sexually Transmitted Disease Treatment Trials: Simulation Results. Sexually Transmitted Diseases, September 2006, Vol. 33, No. 9, p.536–544

43. Patterson BK, Landay A, Siegel JN, Flener Z, Pessis D, Chaviano A, and Bailey RC. Susceptibility to Human Immunodeficiency Virus-1 Infection of Human Foreskin and Cervical Tissue Grown in Explant Culture. American Journal of Pathology, Vol. 161, No. 3, September 2002

44. Paz-Bailey G, Kilmarx, PH, Supawitkul S, Chaowanachan T, Jeeyapant S, Sternberg M, Markowitz L, Mastro TD, Van Griensven F. Risk Factors for Sexually Transmitted Diseases in Northern Thai Adolescents: An Audio-Computer-Assisted Self-Interview With Noninvasive Specimen Collection. Sexually Transmitted Diseases: Volume 30(4) April 2003 pp 320-326

45. Pettifora AE, Rees HV, Steffenson A, et al. HIV and sexual behaviour among young South Africans: a national survey of 15-24 year olds. Johannesburg: Reproductive Health Research Unit, University of the Witwatersrand, 2004.

46. Pettifora AE, Stratena AV, Dunbara MS, Shiboskia SC and Padiana NS. Early age of first sex: a risk factor for HIV infection among women in Zimbabwe. AIDS 2004, 18:1435–1442

47. Quigley M, Munguti K, Grosskurth H, Todd J, Mosha F, Senkoro K, Newell J, Mayaud P, ka-Gina G, Klokke A, Mabey D, Gavyole A, Hayes R. Sexual behaviour patterns and other risk factors for HIV infection in rural Tanzania: a case-control study. AIDS: Volume 11(2) 11 February 1997 p 237-248

48. Quinn TC, Wawer MA, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, Meehan MO, Lutalo T, and Gray RH. Viral Load and Heterosexual Transmission of Human Immunodeficiency Virus type 1.2000, Massachusetts Medical Society: Volume 342 Number 13

49. Rakwar J, Lavreys L, Thompson ML, Jackson D, Bwayo J, Hassanali S, Mandaliya K, Ndinya-Achola J, Kreiss J. Cofactors for the acquisition of HIV-1 among heterosexual men: prospective cohort study of trucking company workers in Kenya. AIDS: Volume 13(5) 1 April 1999 pp 607-614

50. Rice BD, Bätzing-Feigenbaum J, Hosegood V, Tanser F, Hill C, Barnighausen T, Herbst K, Welz T, and Newell ML. Population and antenatal-based HIV prevalence estimates in a high contracepting female population in rural South Africa. BMC Public Health 2007, 7:160 doi:10.1186/1471-2458-7-160

51. Sandøy IF, Michelo C, Siziya S and Fylkesnes K. Associations between sexual behaviour change in young people and decline in HIV prevalence in Zambia. BMC Public Health 2007, 7:60

52. Shisana O, Rehle T, Simbayi LC, Parker W, Zuma K, Bhana A, Connolly C, Jooste S, Pillay V et al. **(**2005). South African National HIV Prevalence, HIV Incidence, Behaviour. and Communication Survey, 2005. Cape Town: HSRC Press**...**

www.health-e.org.za/resources/HIV%20Prevalence%20Report

53. Tachet A, Dulioust E, Salmon D, De Almeida M, Rivalland S, Finkielsztejn D, Heard I, Jouannet P, Sicard D and Rouzioux C. Detection and quantification of HIV-1 in semen: identification of a subpopulation of men at high potential risk of viral sexual transmission. *AIDS* 1999, 13:823–831

54. TÜrmen T. Gender and HIV/AIDS. International Journal of Gynaecology and Obstetrics 82 (2003) 411–418

55. Tyebkhan G. Declaration of Helsinki: The ethical cornerstone of human clinical research . Indian J Dermatol Venereol Leprol 2003;69:245-7

56. UNAIDS. Global summary of the AIDS epidemic update: December 2007. "UNAIDS/07.27E / JC1322E". 1. HIV infections – epidemiology. 2. HIV infections – prevention and control. 3.... data.unaids.org/pub/EPISlides/2007/2007_epiupdate_en.pdf

57. Vernazza PL, Troiani L, Flepp MJ, Cone RW, Schock J, Roth F, Boggian K, Cohen MS, Fiscus SA, and Eron JJ. The Swiss HIV Cohort Study. Potent antiretroviral treatment of HIV-infection results in suppression of the seminal shedding of HIV/AIDS: Volume 14(2) 28 January 2000 pp 117-121

58. Vernazza PL, Eron JJ, Fiscus SA and Cohen MS. Sexual transmission of HIV: infectiousness and prevention. AIDS 1999, 13:155-166.

59. Victora CG, Huttly SR, Fuchs SC and Olinto MTA. The Role of Conceptual Frameworks in Epidemiolgical Analysis: A Hierarchical Approach. International Journal of Epidemiology: 1997; 26: 224-227.

60. Wald A, and Link K. Risk of human immunodeficiency virus infection in herpes simplex virus type 2-seropositive persons: a meta-analysis. J Infect Dis 2002;185: 45-52.

61. Wang BO, Xiaoming LI, Stanton B, Fang X, Liang G, Liu H, Lin D, and Yang H. Gender Differences in HIV-Related Perceptions, Sexual Risk Behaviors, and History of Sexually Transmitted Diseases Among Chinese Migrants Visiting Public Sexually Transmitted Disease Clinics. AIDS Patient Care STDS. 2007 January; 21(1): 57–68.

62. Weiser SD, Leiter K, Heisler M, McFarland W, Korte FP, DeMonner SM, Tlou S, Phaladze N, Iacopino V, and Bangsberg DR. A Population-Based Study on Alcohol and High-Risk Sexual Behaviors in Botswana. PLoS Medicine | www.plosmedicine.org. October 2006 | Volume 3 | Issue 10 | e392

63. Weiss H. Epidemiology of herpes simplex virus type 2 infection in the developing world. Herpes 2004;11:Suppl 1:24A-35A

64. Wong T, Singh A, Mann J, Hansen L and McMahon S. Gender Differences in Bacterial STIs in Canada. BMC Women's Health 2004, 4(Suppl 1):S26