

**PREDICTORS OF HIV POSITIVE STATUS AMONG 15-24 YEARS OLD PREGNANT
WOMEN ATTENDING ANTENATAL CARE IN SOUTH AFRICA**



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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Epidemiology in the field of Field Epidemiology

Johannesburg, November 2020

DECLARATION

I, Mojalefa Makae declare that this research report is my own, unaided work. It is being submitted in partial fulfilment for the degree of Master of Science in Epidemiology in the field of Field Epidemiology, Faculty of Health Sciences at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Signature of candidate

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke extending to the right, positioned above a horizontal line.

20th day of November 2020 in Johannesburg

DEDICATION

This research report is dedicated to:

My son Areatetse-Mahlohonolo Lefa, for giving me the strength and hope that encouraged me to put extra efforts even when I felt like quitting the course. For understanding when I had to leave him and went to stay at university. For spending sleepless night without him, when I had to be away to attend outbreaks and being at library studying, writing assignments and reports. This accomplishment is for him, and a symbol that the only “LEFA” I can give him is education.

And to my late grandmother, Lydia Madibapane Makae, gone too soon. The lessons I learnt from you are still valuable and in every challenge that I encountered in my journey you were dearly missed. Rest in eternal peace ‘Mangwane, Kunene, umuntu wa se b’khosini, dabula mdaka, dabula ka lizwe’.

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ABSTRACT

Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) continues to be a significant public health problem. Women are disproportionately affected by the HIV epidemic. Adolescent Girls and Young Women (AGYW) (15-24 years) are at high risk of new HIV infections in South Africa. The burden of HIV among AGYW significantly varies by province, but the factors contributing to this difference are inadequately understood

The aim of this study was to investigate the geographic distribution of HIV and socio-demographics characteristics associated with HIV among pregnant women aged 15-24 years old attending antenatal care (ANC) in public health facilities in South Africa in 2017.

This was a secondary data analysis of data collected during the national antenatal survey in 2017. The antenatal survey is a cross-sectional survey conducted every 1-2 years among pregnant women aged 15-49 years in 1,595 sentinel sites selected from across all districts of South Africa. The survey was conducted between 1 October and mid-November, 2017. In the main (primary) study, consenting women eligible to participate in the study were consecutively enrolled and completed a nurse administered questionnaire. Following this, blood specimens were collected from the same women and sent to regional laboratories for HIV testing. The target population for the secondary analysis (i.e. for this study) was pregnant women aged 15-24 years who had an HIV test result (from the laboratory test done) and a complete survey questionnaire. Prevalence was estimated for each province and at district level. All estimates accounted for survey design and was weighted for midyear population size of reproductive age women at province level using the 2019 Statistics South Africa (STATSA) data. Multivariable logistic regression analysis was conducted to examine the association between socio-demographic characteristics and HIV positive status of pregnant women in the age 15-24 years. An age disparate relationship was defined as engagement in sexual partnership between AGYW and a man (father of the child) who is 5 or more years older.

The survey enrolled 36 128 pregnant women aged 15-49 years old. Of this, 12 967 (35.9%) met the inclusion criteria for the current study. Of the total (12 967,35.9%) who met the inclusion criteria, about 87.3% (11 127) of participants were black African, 85.1% (10 821) were single and 79.3% (9 968) had completed secondary education. The median age of participants was 21 years

(interquartile range (IQR): 19-23 years). About 35.6% (4 363) of the participants (i.e. AGYW) were engaged in age disparate relationship. HIV prevalence among AGYW was 18.5% (95% confidence interval (CI): 17.9–19.1%) nationally. HIV prevalence was 11.3% (95% CI: 10.5-12.1) among adolescents (15-19 years) and 21.9 (95% CI: 21.1-22.7) among young women aged 20-24 years. KwaZulu-Natal had the highest HIV prevalence (24%), followed by Mpumalanga (23.6%) and Eastern Cape (22.4%) respectively. Western Cape and Northern Cape had the lowest HIV prevalence at 8.4% and 8.9% respectively. In KwaZulu-Natal and Mpumalanga provinces, HIV prevalence ranged from 18.7% to 30.6% and 20.6% to 25.5% at district level respectively.

In a multivariable analysis, young women in age disparate relationship had higher odds of being HIV positive [adjusted odds ratio, AOR 1.8 (95% CI:1.7 – 2.0)] compared with women not engaged in age-disparate relationship. Women in the age group 18-20 years and 21 – 24 years had higher odds of being HIV positive [AOR 1.7 (95% CI: 1.5 – 2.1) and 3.0 (95% CI: 2.6 – 3.6) respectively] compared to women aged 15–17 years. Single and cohabiting women were more likely to be HIV positive [AOR = 1.9 (95% CI: 1.6 – 2.2) and 1.8 (95% CI: 1.5 – 2.3) respectively] compared to married women. Women with no or primary education [AOR - 1.7 (95% CI 1.5 - 2.0)] and women with secondary education [AOR = 1.9 (95% CI: 1.5 – 2.4)] had higher odds of being HIV positive compared to women with tertiary education.

Despite efforts made to curb HIV in South Africa among AGYW, prevalence remains high in this age group. We found age disparate relationship, low education, older age, gravidity, marital status and geographic location to be strong predictors of HIV positive status. Interventions for curbing and reducing HIV infection should include targeting high burden provinces/districts and channeling more resources to such areas. Increasing ART coverage among older men, rapid expansion of pre-exposure prophylaxis (PrEP) among young women, and offering support, protection and empowerment strategies for vulnerable AGYW could reduce the risk of HIV infection in this age group. It is recommend prioritizing tertiary education among AGYW in order for them to be able to make informed decisions about their sexual life and be able to protect themselves against HIV infection.

Keywords: HIV, Adolescent girls and young women, pregnant, antenatal care, South Africa

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ABBREVIATIONS AND ACRONYMS

AGYW	Adolescent Girls and Young Women
ANC	Antenatal Care
ART	Antiretroviral Treatment
CDC	Center for Disease Control and prevention
CGH	Center for Global Health
CHIVSTI	Center for HIV & Sexually Transmitted Infection
DHIS	District Health Information System
DHS	District Health Survey
ECHO	Evidence for Contraceptive Options and HIV Outcomes
ELISA	Enzyme-Linked Immunosorbent Assay
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immuno Deficiency Syndrome
IQR	Interquartile Range
MTCT	Mother-to- Child Transmission
NDoH	National Department of Health
NICD	National Institute for Communicable Diseases
PMTCT	Prevention of Mother to Child Transmission
PPS	Probability Proportional to Size
PrEP	Pre-exposure prophylaxis
SAFETP	South African Field Epidemiology Training Programme
Stats-SA	Statistics South Africa
STI	Sexually Transmitted Infection
UNAIDS	Joint United Nations Program on HIV & AIDS

US

United States

WHO

World Health Organisation

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CHAPTER 1

1.1 Introduction

Since the discovery of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) in the early 1980's, HIV/AIDS globally has continued to be a significant public health problem. A lot has been discovered on how it is transmitted and how one's immune system is attacked by the virus (1,2) The World Health Organisation (WHO) estimated that there were 37.9 million people living with HIV and 770 000 people died of AIDS-related illness in 2018 globally (3). By 2018, Sub-Saharan Africa, mainly Eastern and Southern African countries had the largest proportion (54%) of people living with HIV in the world (3).

Women, particularly adolescent girls and young women (AGYW) (15-24 years) are disproportionately affected by the HIV epidemic. The Joint United Nations Programme on HIV/AIDS (UNAIDS) reported that globally, 18.8 million reproductive age women (15-49 years) were living with HIV with nearly 870 000 new HIV infections among women in 2017 (4).

AGYW are twice as likely to acquire HIV infection compared to their male counterparts of the same age (4). In Eastern and Southern African countries, about 2.4 million girls were living with HIV in 2017 (5). The high prevalence of HIV among women and young girls is attributed to the disproportionately unequal cultural, social and economic status of women in society (6). According to the 2014 GAP report, many adolescent pregnant women living in rural sub-Saharan African countries are poor, mostly deprived, achieve low levels of education and are more likely to lack access to services than other women (7).

South Africa, in 2018, had 7.7 million people living with HIV, 240 000 new HIV infections and 71 000 AIDS-related illness (8). The prevalence of HIV infection in South Africa in 2018 was reported to be 20.4% among women aged 15-49 years (8). While among AGYW, HIV prevalence in South Africa was reported to be three times higher (11.3%) as opposed to their male peers (3.7%).

Since 1990, South Africa conducts nationally representative antenatal care (ANC) sentinel surveys annually to determine the distribution of HIV and syphilis infection among pregnant women aged 15-49 years attending public health antenatal clinics. According to the 2017 antenatal survey, HIV prevalence was 30.7% among pregnant women in South Africa (9).

The antenatal survey form part of the national surveillance program for HIV in the country and recently (in 2017) additional HIV indicators - HIV incidence among pregnant women, progress towards the 90-90-90 UNAIDS targets, syphilis service uptake and accuracy of routine HIV rapid testing have been added in the study to provide insight on the incidence of HIV infection, effectiveness of prevention of mother-to-child transmission (PMTCT) services and progress towards the UNAIDS 90-90-90 targets among pregnant women.

This study examined the geographic distribution of HIV and socio-demographics characteristics associated with being HIV positive among 15-24 years old pregnant women using data from the 2017 national antenatal survey.

The paper is organized in 4 sections. The first chapter reviews existing literature, gives a general introduction to the problem, context and rationale of the study and presents the research questions, aims and objectives of the study. The second chapter describes the methods and materials used. Chapter three presents the results of the study. Chapter four discusses the findings of the study and contextualizes the findings with previous research and theory and presents the conclusion and recommendations of the study. The fourth chapter also presents the limitations and the strengths of the study.

1.2. Background literature review and critique

1.2.1. General overview of the antenatal HIV sentinel surveillance system

HIV sentinel surveillance data gives information on a country's progress in combating the spread of HIV (10). In 1989, WHO recommended, HIV sentinel surveillance systems to be established using, pregnant women as a target population (11). Pregnant women were chosen as a target population for this surveillance system as most pregnant women attend antenatal clinic at least once during their pregnancy and were recognized as a good proxy to provide HIV estimates that can be extrapolated to the general population (11). HIV surveillance systems in most countries use annual HIV surveillance data in pregnant women together with population based surveys to generate HIV prevalence estimates for the general population (12). Antenatal surveillance has been used as a primary source of information for monitoring the epidemic trend and for planning resources for HIV services targeting pregnant women (10).

Globally more than 115 countries have been carrying out HIV surveillance among women attending ANC (13). Studies done using ANC sentinel surveys data report risk behaviours of pregnant women to be comparable to women in the general population, showing that antenatal surveys can be a good data source to study the risk factors associated with HIV infection among women in the general population (14).

1.2.2 Risk factors of HIV

Risk factors for HIV can be categorized in eight categories. Figure 1.1 illustrates the link between these risk factors and HIV infection. The complex interplay between underlying, intermediate and immediate factors is described in detail elsewhere (15)

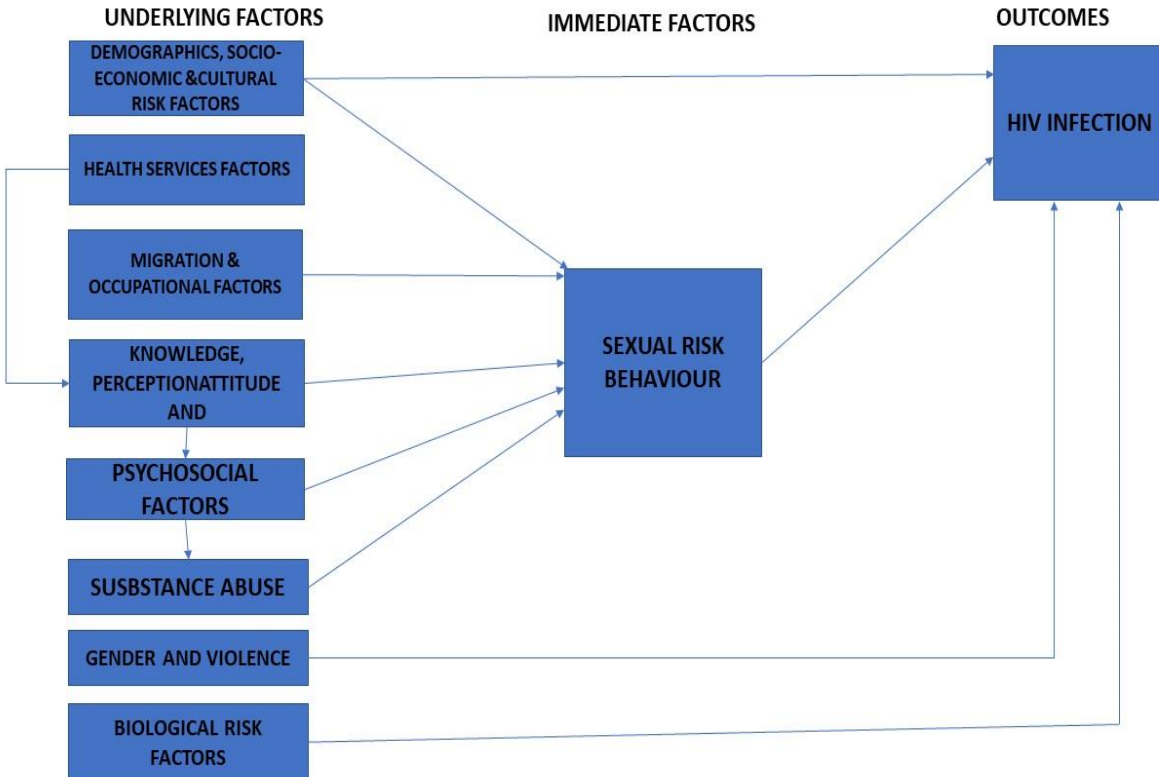


Figure 1. 1: The link between risk factors of HIV and HIV infection

a) Demographic, socio-economic and cultural risk factors

Globally the spread of HIV is unequal. Socio-economic factors such as education, income, unemployment, age, marital status, geographical location and poverty play a big role in influencing the risk of HIV infection (16).

Marital status

Marriage is a legal contract between two people whereby their relationship is recognized by the law. Married people are expected to have less risk of HIV due to the fact that they are expected to have fewer sexual partners. However, since some people become HIV infected before they get married marriage may not always be a protective factor. In certain cultures men practice polygamy (17,18). The risks that expose women and men in a polygamy relationship to HIV include extramarital relationship and not determining the HIV status of the partner at the time of marriage (19).

Racial group

HIV prevalence among the black African community in South Africa, is high. According to the fifth South African national HIV prevalence, incidence, behavior and community survey done in 2017, the prevalence of HIV among Black Africans was 16.6%, Coloureds was 5.3%, Whites was 1.1% and Indians was <1% (20).

Geographical location

According to the national household survey conducted in 2017, HIV prevalence varied by province: for example the Western Cape showed the lowest (13%) and KwaZulu-Natal showed the highest (27%) HIV prevalence (20). Few studies could be found that assess factors that account for inter-provincial differences in HIV prevalence in South Africa (17,21). These studies indicate geographical variation in HIV prevalence may be explained by the differences in male circumcision, marriage, migration and other sexually transmitted infections. Other studies have suggested that the prevalence of HIV may be high in informal urban areas compared to formal urban and rural areas (22). The prevalence of HIV was reported to be 25.8% in KwaZulu-Natal informal urban areas compared to 13.9% in both formal rural and urban areas in KwaZulu-Natal (22). Rural areas as compared to urban areas mostly have fewer facilities for HIV testing services. Facilities in rural areas have insufficient capacity for HIV surveillance, leading to lesser-detailed information on the spread of HIV. These health facilities also have a generally destitute health infrastructure and more confined entry to health care facilities (22) In rural areas, the prevalence of HIV may be underestimated due to the possibility that those who test in urban areas may decide to move back to rural areas to seek support from their families after testing positive for HIV, while others (rural residents), due to fear of stigma or people finding out of their HIV status, may provide wrong residential addresses to testing facilities during testing (23). Among pregnant women, the 2015 and 2017 ANC survey showed KwaZulu-Natal and Mpumalanga to be the highest prevalence provinces similar to findings in the South African household survey (9,24).

Education

Education plays an important role in reducing the risk of HIV infection. Various mechanisms of sexual behavior are changed through schooling. HIV education and health promotion programmes in schools, if implemented well, can improve the knowledge, attitude and sexual behavior of students. (25). Higher (tertiary level) education could also influence the type of sexual network one is likely to have as the person is likely to associate him/herself with the people who are also educated. Higher education could lead to better opportunities for employment, which helps halt the spread of HIV especially among school leavers and youth who may engage in transactional sex due to lack of hope and income-earning opportunity. A study done in 187 countries found that poor education was a major determinant of HIV infection and that having access to education was a protective factor from early marriage because education empowers women to make good choices including, who they want to have sex with and when, they can negotiate use of condoms, they are able to request their partners to be faithful, they earn adequate incomes to support their families which helps in protecting themselves from HIV (2).

An important element to promote healthy behavior is health education (2). According to Mondal & Shitan, health education is a strong mechanism to reduce the burden of HIV disease (2). It provides information about the disease to individuals, how the disease is transmitted, precautionary measures to be taken in order to help prevent the HIV transmission, and steps in place if suspecting having the disease. Education emphasizes the idea of self-empowerment and also provides information on the importance of healthy sexual behaviors for prevention of HIV transmission (2).

Intergenerational sex

In the South African setting, inter-generational sex can result in, HIV positive adult men infecting young women and as these young women grow older, infecting their opposite sex peer group with HIV, was reported to be a major contributing factor for the spread of HIV (26–28). According to Pettifor et.al., the prevalence of HIV in South Africa was 15.5% (95% CI: 13.7-17.6) among young women aged 15-24 years old compare to young men [4.8% (95% CI 3.9-5.9)] of same age group (29).

Employment

Unemployment was one of the contributory factor for HIV infection. Culturally especially in sub-Saharan Africa, women depended on men for support. Women who have no income engage in transactional sex in order to put food on the table for their families (30). This makes them vulnerable as they are unable to negotiate safe sex (30). South Africa faces high unemployment rate. The level of unemployment reached 27.6% in the first quarter of 2019 among the general population due to slowed economic growth and slow creation of jobs (31). The most affected group was youth aged 15–24 years, with unemployment rate of 55.2% in the 1st quarter of 2019 among this age group (31).

b) Sexual risk behaviors

Sexual behavior was a major risk factor for HIV. Various studies showed that people who engage in unprotected sexual practice (such as having multiple sexual partner, unprotected sex, early sexual debut and inconsistent condom use) put their lives and of their sexual partners at risk (32).

Condom use

Unprotected sex increases the risk of unwanted pregnancy, HIV infection, and other sexually transmitted infections (STIs)(33). The South African HIV prevention programme promotes condom as the main HIV prevention method.

Reports indicate condom use is low among women with multiple sexual partners. According to the 2016 South African Demographic and Health Survey (DHS) report, 42% of reproductive age (15-49years) women and 37.7% of AGYW (15-24 years) with multiple partners did not use condoms in their last sexual encounter (33). But among sex workers, use of condom has been reported to be relatively high – in a report by UNAIDS in 2016, it is reported that more than 90% of sex workers around the world used condom with their client (34).

Among women in stable relationship, condom use is reported to be low. Studies indicate that women in stable relationship fear to introduce condoms as it may bring doubts of infidelity. Women fear losing their partners if they ask to use condoms (30).

Studies showed that use of condoms among youth aged 15-24 years was greater than among older people aged above 24 and below 49 years' (32). The use of condoms is reported to be low among pregnant women and among women living in rural areas (17). During pregnancy women often have fewer sexual partners' and tend to not use condom compared to women who are not pregnant (35). In addition, during pregnancy and the postpartum period, women's sexual activities decrease, this leads male spouses engaging in riskier behavior which put themselves and their partners at risk of HIV (36).

Multiple sexual partners

Being in multiple or having multiple sexual relationships put one at a higher risk of acquiring sexual infections including HIV as the likelihood of having a partner with HIV is higher when you are in multiple-relationships (37). The South African DHS reported that 4.6% and 20.7% of women and men aged 15-24 years had two or more partners in 2016 respectively (33). It further state that in the same year 42.1% of urban and 49.7% of non-urban women had sexual relationship with a person who was neither their spouse nor lived with them.

Early sexual debut

Age at first sex marks the start of infection exposure and is the main indicator for monitoring response to the HIV epidemic among youths (38). Early sexual debut is associated with high number of life time sexual partners and increased HIV risk (39). A study conducted in 2010 among youth in SA reported that, of 2 874 (55%) participants reported having had sexual intercourse, 39% of them experienced sexual intercourse at least at the age of 16 years and below. Majority of participants (59%) who reported having had early sexual debut were females (40).

In the current era of rapid expansion of ART, mother-to-mother transmission of HIV could also

be one cause of HIV transmission for adolescent girls and young women as children infected with HIV through mother-to-child transmission could grow to adulthood. According to the UNAIDS report in 2019, 710 000 adolescent women (10-19 years) in Eastern and Southern African countries live with HIV, >95% of whom acquired HIV through mother-to-child transmission (41) .

c) Knowledge, attitude and perception

Knowledge, attitude and perception about HIV/AIDS influences HIV risk. Knowing HIV status helps one to reduce risk of HIV infection and making safer decisions that make HIV negative individuals to remain free from HIV infection, while those who have knowledge of their HIV positive status are able to take action including accessing treatment and safeguarding their sexual partners (33).

In South Africa, despite some misconceptions about the transmission and the treatment for HIV/AIDS which were mostly centered in rural areas, most people had knowledge about HIV/AIDS and how one contracted the virus (17).

Cultural and traditional beliefs /misconceptions about HIV include: beliefs about HIV that HIV was caused by witchcraft, spirits and supernatural forces and in some cases, it was seen as a form of religious punishment for a guilty person, a curse from God or a sinner's disease (42). Other studies have revealed that people kept putting themselves and their partners at risk of HIV infection by engaging in unsafe sexual practices despite having information and counselling on HIV infection. Most people at risk of HIV don't consider themselves to be at risk (32).

d) Psychosocial factors

Stigma (against HIV positive people) is one of the psychosocial factor that contribute to the spread of HIV. Since the emergence of HIV, stigma has been a major public health concern (43). Stigma was defined as basic emotional reaction to hazard that assist people feel secured by predicting controllable hazard, and consequently blame it to others (43). UNAIDS reported, of 35% countries

with available data (on stigma) globally, more than 50% of people reported having discriminatory attitudes towards HIV positive people (44).

Stigma associated to HIV was a stumbling block towards preventing and getting the required treatment (43). Stigma related to HIV stopped people from finding out if they are HIV positive or not; admitting their risk to HIV infection and caused the ones who are HIV positive to lose confidence of talking about their HIV status with any person or even their sexual partners (43). It was also reported that high levels of stigma were associated with low level of access to care and that contributes in broadening the HIV epidemic (44).

e) Biological factors

Women have greater physiological risk compared to men for contracting HIV. Physiologically the female genital tract is more susceptible to injuries during sex more than the male genital tract (45). Infection with sexually transmitted diseases could also cause further breakdown in the vagina's natural defense system and can facilitate transmission of HIV (45).

Some studies suggest hormonal contraceptive use can increase a woman's biological susceptibility to HIV infection. This is due to the fact that vaginal, cervical and immune system are affected by contraceptives (17). However, the findings in this regard are not conclusive as the Evidence for Contraceptive Options and HIV Outcomes (ECHO) study found no substantial difference in risk between those who use hormonal contraceptive and those who don't (46). In addition, women are less likely to have protected sex when using contraceptives, which makes them to be at high risk for HIV (17). During pregnancy the level of progesterone and estrogen increases which affects immunological response and the defense mechanism in the female genital tract – this increases the risk of horizontal HIV transmission during pregnancy (47).

f) Migration and Occupational factors

Migration is movement of people from one place to another sometimes in search of better opportunities. Migration causes HIV/AIDS to unroll rapidly through multiple sexual networking (17). South Africa is experiencing high volume of migration (political and economic migration).

Generally, most of the South African mine workers were migrants from Zimbabwe, Lesotho, Mozambique, Botswana, Swaziland, Zambia and Malawi. Some people for example came to South Africa due to ailing economy in their respective countries. Some came to the country without knowing where they will sleep, or what to eat so these people have no food, and clothes, and end up engaging in commercial sex work for their survival (19). Lengthy separations of mine workers from their regular partners and easy access to commercial sex workers put them at high risk of HIV infection and when they go back home they pass it on to their regular partners (17).

Movement among people from one place to another being either internal or external movement, could increase the risk of HIV infection. Historically men will move from their places of residence to go and look for jobs in big cities leaving their partners back home. Some work as truck drivers for long distances while others work in the agricultural sector and different occupations. The long distance truck drivers also contribute towards the spread of HIV as a result of activities relating to unprotected casual sexual relationships which they become involved in while they are travelling (48). Rural poverty, unemployment, and rising cost of life contributes to labour migration (48).

South African agricultural sector is remarkably hit by HIV/AIDS. Farm workers are mostly affected due to poor access to health care and health related information, which are attributed to remote location of work therefore most are less likely to have knowledge on how to protect themselves against HIV(49).

g) Gender inequality, violence, substance abuse

According to WHO, violence is "the intentional use of physical force or power, threatened or actual, against oneself or another person"(50). Women in South Africa are vulnerable to sexual abuse, where rape cases are high despite being under reported (17). In 2016, marital rape was among the crimes that were under reported in South Africa (17). According to a survey done in Johannesburg about 3.9% and 7.8% of rape cases reported to police were committed by partners and strangers respectively (51).

Most women were unable to persuade their partners to test for HIV and their partners depend on their (women) HIV results to determine theirs (52). Majority of women got blamed for their partners' HIV positive status even when their HIV status was negative (52). In a study conducted in South Africa, women reported that their partners engaged in sexual activity without protection even when they knew that they had an STI and that these mostly occurred when one was under the influence of drugs or exchanging sex for drugs or money (17).

Drinking excessive alcohol (more than 14 drinks per week for men and more than 7 drinks per week for women) increases the risk of acquiring sexually transmitted diseases (53). Furthermore, a study done in KwaZulu-Natal reported that illicit substance abuse adversely affected higher order cognitive processes usually classified as "executive control functions" of which some of these take part in major roles in sexual decision-making when served with alcohol (49).

h) Health service factors

HIV programmes in the antenatal care tend to focus on HIV positive pregnant women (7). Same attention is also needed to prevent HIV infection for those HIV negative pregnant women who are already receiving care within the health care system (7). Efforts to strengthen services for HIV negative women during pregnancy and breastfeeding has been very slow. More effort in improving ANC services is needed, which can be of importance especially for adolescent girls who may have limited information about HIV (7).

Lack of training and skills to deliver youth-friendly services by healthcare providers led to slow uptake of HIV testing services by AGYW (7). A study conducted in Soweto reported that communication challenges with parents and community members due to common experiences of health providers' unsupportive attitude, dynamics of power relationships prevented participants (AGYW) from utilizing the services and seeking information they needed (7,54)(55)

In summary, studies conducted globally, in sub-Saharan Africa and in South Africa indicate the following are main risk factors for HIV infection: partner's HIV status, age disparate relationship,

biological and socio-economic reasons, occupation, marital status, race, age, socio-economic factors such as income, education and employment, migration, culture, knowledge and belief about HIV/AIDS, sexual behavior, STI, and power imbalances. In this study we determine which characteristics measured during the 2017 antenatal survey are associated with HIV positive status and predict HIV infection.

1.3. Problem statement

While much research has been done on factors associated with HIV in the general population, few researchers have investigated predictors of HIV among pregnant women. In South Africa, despite conducting antenatal survey for more than two decades, no analysis has been done to describe the association between demographic variables collected in the antenatal survey and HIV prevalence among young pregnant women (15-24 years). In addition, in the literature, while there are studies that describe the theoretical link between demographic factors and HIV, for some of the demographic factors (e.g. marital status, education, and gravidity) there is limited empirical data on the association between these factors and HIV.

1.4. Justification

There is a strong interest at National Department of Health (NDoH) to know the predictors of HIV infection among young women aged 15-24 years as women in this age group have the highest HIV incidence, and are primary targets for HIV interventions. HIV prevalence in the older age group (25-49years) is more likely to represent both survival of people living with HIV on antiretroviral treatment and new HIV infections which makes determining the risk factors of HIV in this age group complex. While young women in the age group 15-24 years, especially the youngest age group (15-19 years) are more likely to have become sexually active recently and the factors associated with HIV infection are more likely to be associated with risk of new HIV infection. The study will help to identify factors that predict HIV infection, which will inform government to target its scarce resources on factors that have huge influence on HIV prevalence.

1.5. Research questions

- a) Are there differences in the geographic distribution of HIV infection among pregnant AGYW attending ANC in public health facilities in South Africa in 2017?
- b) Which socio-demographic characteristics predict HIV infection among pregnant AGYW attending ANC in public health facilities in South Africa in 2017?

1.6. Aim

The overall aim was to determine the geographic distribution of HIV and socio-demographics characteristics associated with HIV among pregnant AGYW attending ANC in public health facilities in South Africa in 2017.

1.7. Objectives

- To describe the geographic distribution of HIV among pregnant AGYW attending ANC in public health facilities in South Africa at national, provincial and district level
- To compare socio-demographic characteristics of HIV positive and HIV negative pregnant AGYW attending ANC in public health facilities in South Africa.
- To determine socio-demographic characteristics associated with HIV among pregnant AGYW attending ANC in public health facilities in South Africa.

CHAPTER 2

2.0. METHODOLOGY

2.1. Study design

This is a secondary analysis of the antenatal survey data

2.2. Primary study

The antenatal survey was a cross-sectional, linked-anonymous survey. The main aim of the survey was to measure the prevalence of HIV among pregnant women aged 15-49 years attending public health facilities for any ANC service during their current pregnancy.

The study was conducted in South Africa, situated in the South of the African continent and shares land borders with six countries: Botswana, Lesotho, Mozambique, Namibia, Swaziland and Zimbabwe. South Africa has a population of about 57 million people according to Statistics South Africa (Stats-SA) 2018 mid-year population estimates. The country has a surface area of about 1 213 090 square kilometers and is the ninth largest country in Africa. Figure 2.1 and annexure 1 shows the 52 districts of South Africa.

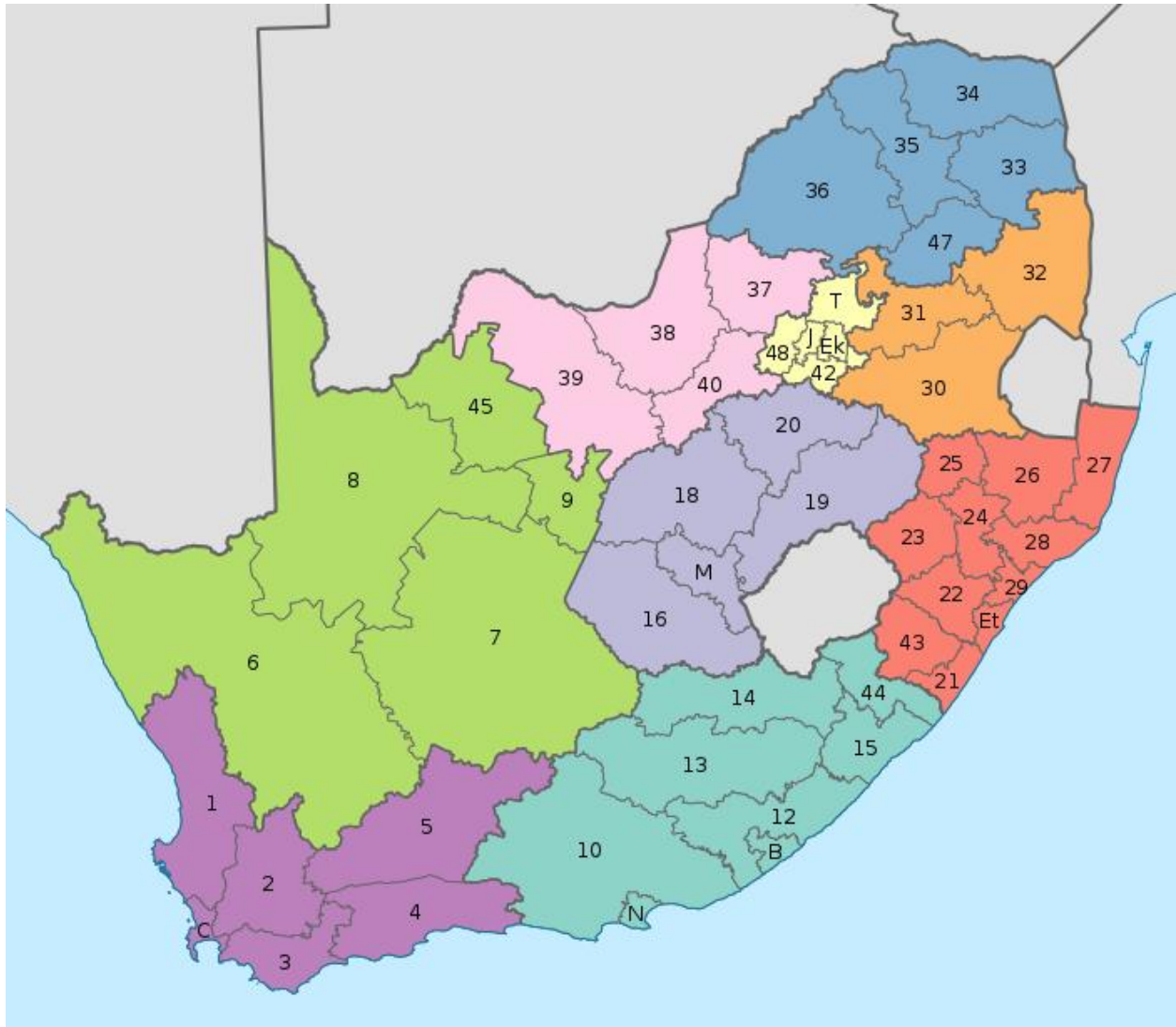


Figure 2.1: South African map with 52 districts (source Google Maps: 2019)

2.2.1. Sample size and sampling

One thousand five hundred ninety-five (1 595) public health facilities representative of all public health facilities in South Africa were included in the primary study. The selection of health facilities was based on the geographical distribution taking into account all the nine provinces and 52 districts of the country. Facilities were stratified by type of geographical location (as urban, semi-urban and rural clinics) and size (as small, medium and large facilities). Facility geo-coordinate and the Stats-SA census 2011 information on ward level geographical type

classification was used to stratify facilities into rural, urban and semi-urban categories. Facilities were classified as small, medium, and large facilities using quantile values of the district ANC visit volume data (2016) as proxy measure for size. Sample size calculated at district level was allocated for each stratum proportionally. The selection of eligible sentinel sites within each stratum was based on the Probability Proportional to Size (PPS) sampling method. Since the sampling period in each facility was the same, this produced a self-weighting sample for each district. A fixed (equal) sample size was allocated per stratum.

Sites had to provide pregnancy testing and ANC services in order to be included in the survey. Sites had to have a minimum of 20 ANC attendees per month¹; had to routinely draw blood from ANC attendees with facilities to store sera at 4 degrees Celsius; and arrangements in place to transport biological specimens to the nearest reference laboratory within 24 hours. Only public facilities were included in the survey (private facilities were not included). In each sentinel site, consenting pregnant women aged 15-49 years, attending ANC either for the first time or for follow-up visits during their current pregnancy during the-survey period were included. Women were sampled consecutively until sample size was reached.

Pregnant women who had already participated in the survey in previous visits during the survey period were excluded to avoid duplicate sampling. Pregnant women aged ≥ 14 years or ≤ 50 years were excluded. The planned sample size of the survey was 36,015 pregnant women from 1,595 public facilities selected from across all districts of South Africa. Further description of the sample size and sampling method is provided in the main report for the survey (9).

¹ Note that this criteria was applied when sites were first selected for the antenatal survey in 1990, and 2006, since then the ANC volume of these sites may have changed, but the sites continue to be sentinel sites regardless of the change.

2.2.2. Data collection

The survey was conducted between 1 October 2017 and 15 November 2017. Data collection included obtaining of written informed consent, a brief interview, medical record review and blood specimen collection which was performed by nurses providing antenatal services in the antenatal clinics at the sampled facilities. The antenatal nurse assessed eligibility of participants. Following this, eligible women were requested to give informed consent to participate in the survey. The information sheet in annexure 2 was given to each participant to read. Nurses also explained the information sheet to the participants in the language used for communication during consultation/routine services. After this, women who gave written informed consent were interviewed and blood sample was collected.

Information on: education, partner age, marital status and race of the woman was collected through interviews. Data on: gravidity, parity, participant age, gestational age and visit type of participants were abstracted from medical record. Blood specimens (whole blood) were collected and tested for HIV at regional laboratories using two serial 4th generation Enzyme-linked immunosorbent assay (ELISA) tests. HIV testing was done in line with the strategies as outlined in the 2016 South African HIV testing guideline (56). The algorithm for testing is presented under figure 2.2.

When the initial ELISA test results are non-reactive, the results were reported as negative. If ELISA results were reactive, a second ELISA test was done. If both ELISA test results were reactive, then results were reported as reactive. However, if the test for the second ELISA test was non-reactive, the results were reported as discrepant and the participant is requested to repeat the HIV rapid testing after six weeks. Participants with discrepant ELISA one and two results were reported as ‘discrepant’ for this study (i.e. the additional test conducted after 6 weeks was not considered in determining their HIV status for the study).

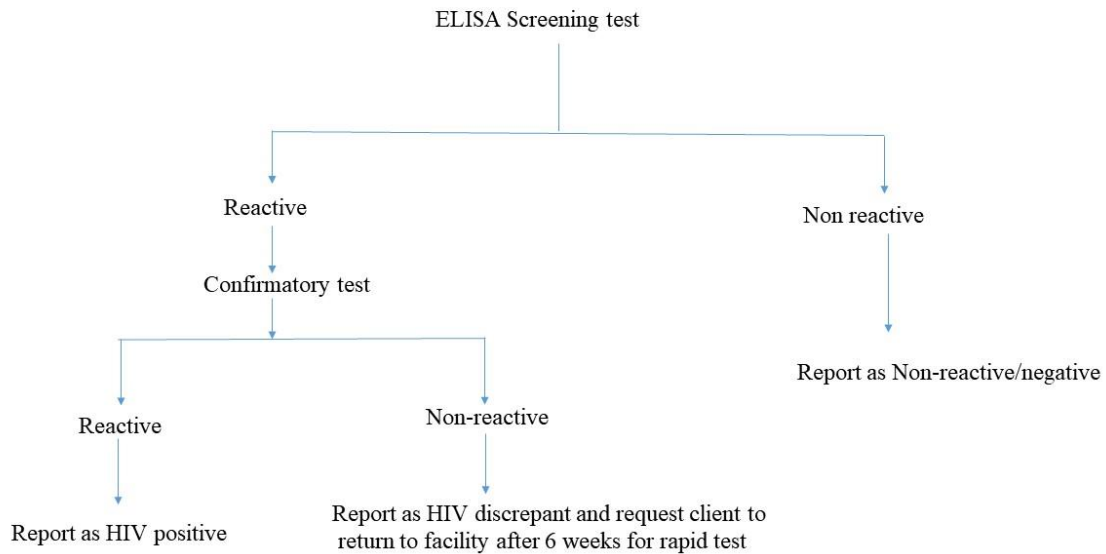


Figure 2.2: The ELISA algorithm as outlined in the 2016 South African HIV testing guideline

Participation in the study was voluntary. Participants were free to leave the study at any time and there were no negative consequences for leaving the study and were still getting the same care even if they did not participate in the survey. Ethical approval for the primary study was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (annexure 3), the nine provincial health research ethics committees and the Center for Global Health (CGH) Associate Director of Science of the United States (US) Center for Disease Control and Prevention (CDC).

Interview and medical record data were collected on paper. The information collected on paper was captured by data clerks on District Health Information System (DHIS). HIV test results were exported from the lab information system (TrakCare) into excel. The data captured on DHIS and the lab data from TrakCare was merged on STATA 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) for analysis.

2.3. The current study (secondary data analysis)

The target population for the secondary data analysis was pregnant women aged 15-24 years' who were attending ANC at public health facilities in South Africa during the 2017 national antenatal survey.

2.3.1. Inclusion Criteria

All pregnant women aged 15-24 years who attended ANC during the period of the survey were eligible.

2.3.2. Exclusion criteria

Women aged 14 years or less and women aged 25 years or older were excluded from the study. Enrolled women who had missing age data, missing HIV test results, missing data forms and discrepant HIV results were also excluded from the analysis.

2.3.3. Sample size and sampling

The sample size in the primary study was calculated to measure HIV prevalence among pregnant women aged 15-49 years at national level as one of the objectives. The risk factor analysis was exploratory; therefore, sample size was not calculated. All 15-24 years old pregnant women participated in the survey were included. No sampling was done.

2.3.4. Study outcomes and definition of terms

The outcome of the study was "HIV positive status" as measured by an HIV ELISA test in the laboratory. Participants with two (screening and confirmatory) reactive ELISA test results were considered HIV positive. HIV prevalence was defined as the percentage of eligible (15-24 years) pregnant AGYW who were HIV positive

Rural, peri-urban and urban areas were defined according to the parent survey using facility geo-coordinate and the Stats-SA census 2011 information on ward level geographical type classification. This definition was retained in the secondary study.

2.3.5. Data management and analysis

Data cleaning included verifying and removing duplicate records, checking for consistency, completeness and outliers, applying the inclusion and exclusion criteria, as well as coding/recoding of variables in preparation for analysis. Final verification was done comparing with the original dataset to verify if new errors were not introduced.

Data was analysed using STATA Version 15 Statistical software (StataCorp LP, College Station, Texas, United States of America). The analysis took into account the survey design (i.e. the clustering and stratification within province), and was weighted for the number of women residing in each province. Sub-domain analysis was used to restrict the survey analysis to the subpopulation of women in the age 15-24 years. Descriptive analysis was performed using summary statistics to describe different characteristics of participants. The distribution of key variables were presented in percentages (for categorical variables), mean, median and interquartile ranges (IQR) (for continuous variables). HIV prevalence was presented in stratified groups of participant age (using 2 years age band, 3 years age band and 5 years age band) to look into the various risk factors that may predict HIV in AGYW: for example the 2 and 3 years age band would enable to assess HIV prevalence among the youngest age group (15-16years) and amongst school leavers (18-20 years) age group - HIV in the youngest age group (15-16years) may be attributable to mother-to-child-transmission (MTCT) and rape; school leavers may be at high risk of HIV infection as parents in the poorest socioeconomic quintile may not have adequate income to send their children to tertiary institutions/schools, resulting in children engaging in age disparate relationship or transactional sex as a means of survival/ income to support their livelihood. The 5 years' age band could enable to assess HIV prevalence among adolescent girls (15-19 years) most of whom are likely to be attending school at the time of their pregnancy, versus young women (20-24 years)

who have completed school. HIV prevalence was also reported by parity, province, district, gravidity, education, marital status and partner's age.

GIS mapping was used to explore geographical variations by HIV prevalence using QGIS software version 3.2.1. (QGIS Geographic Information System. Open Source Geospatial Foundation), 2018 (57). GIS mapping included district and provincial level analysis of HIV prevalence.

Logistic regression was used to analyse factors associated with HIV positive status. Covariates that were included in this analysis included: geographic location (the 9 provinces, rural-urban-peri-urban geographical types), age, age difference with partner, race, marital status, education, parity, and gravidity. An age disparate relationship was defined as engagement in a sexual relationship between AGYW and a man 5 or more years older – the 5years cutoff point for age disparate relationship was informed by previous literature (58–60) In addition, age disparate relationships with partners 7years or older were assessed to investigate whether HIV risk increases as the age gap increases.

Bi-variable analysis was performed between demographic factors [i.e. province, district, geographical location (rural vs. urban vs. semi-urban), education, age, race, gravidity, parity, partner age, marital status, and gestational age] and HIV status. Variables significant (from bi-variable models) at P value cut-off point of < 0.2 were included in a multivariable model. Variables significant at the P value cut-off point of < 0.05 and variables that altered the estimate of other significant variables in the logistic regression model by $\geq 10\%$ were kept in the final multivariable model. An interaction term was added between geographical type (rural, urban, peri-urban) and province as the effect of geographical type was not the same across provinces. The wald test was used to determine the significance of the interaction term. In a final logistic regression model, variables were regarded statistically significant at the P value cut-off point of < 0.05 . To avoid multi-collinearity, two models were fitted one with partner age difference of 5 years or more and a second model with age difference of 7 years or more.

Missing data was handled through pairwise deletion method (i.e. observations with missing data were excluded only when missing data was involved in the analysis). The following data quality measures were put in place to reduce the occurrence of missing data in the primary study: (i) All data forms with missing age data were returned to facilities for corrections. (ii) Data base used for capturing data was designed to exclude out of range data such as barcode not assigned to province.

Model checking was done using linktest in STATA to check correct model specification. The Hosmer and Lemeshow's goodness-of-fit test was used to check the overall model fit.

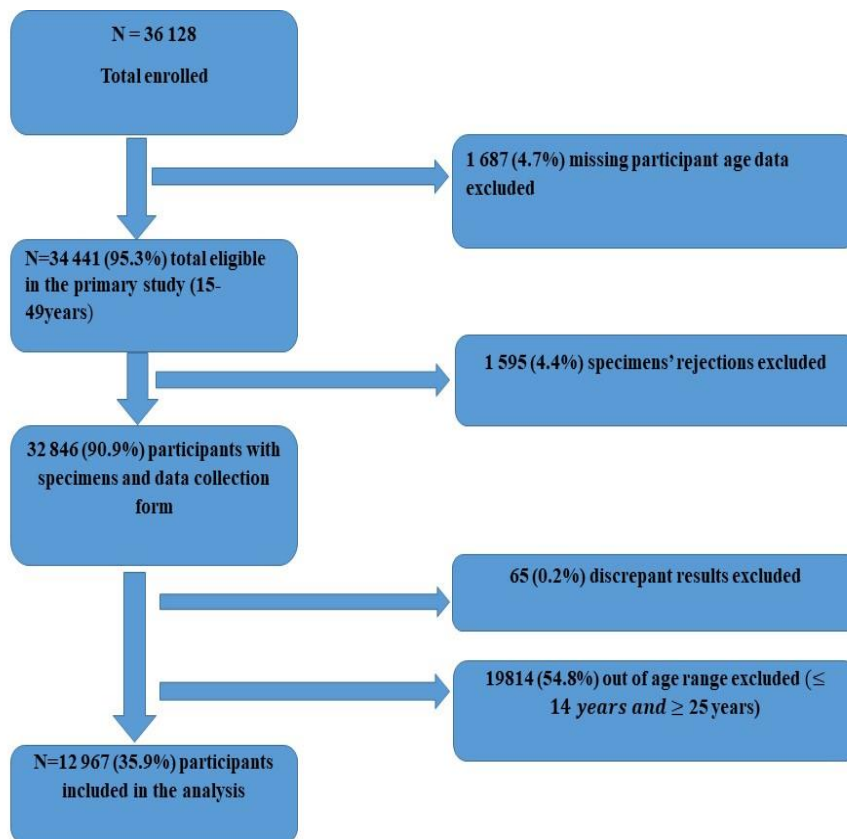
2.6. Ethical consideration

For secondary study, approval to use data was obtained from National Department of Health (NDoH) through the National Institute for Communicable Diseases (NICD) Centre for HIV and STI (CHIVSTI) (annexure 4). Ethical approval was also obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (M181150) (annexure 5).

CHAPTER 3

3.1. Results

A total of 36 128 participants were enrolled in the 2017 national antenatal survey. Of these, data for participant age was missing for 4.7% (1 687) of participants and these were excluded. Specimens for 4.4% (1 595) of participants were rejected due to haemolysis. About 0.2% (65) of participants had discrepant and were excluded. A further 54.8% (19 814) of participants fell outside the target age group for this study (≤ 14 & ≥ 25 years) and were also excluded from the analysis. A total of 35.9% (12 967) observations were included in the final analysis (figure: 3.1).



unweighted data

Figure 3.1: Flow chart showing observations excluded from analysis, antenatal survey, South Africa in 2017.

3.2. Demographic characteristics of participants

The median age of participants was 21 years (IQR: 19-23 years). Approximately 87.3% (11 127) of participants were black African, 85.1% (10 821) were single and 79.3% (9 968) had secondary education. Majority (62.2%, 7 980) of participants were attending clinic for follow-up visits with 37.8% (4 842) attending first visits. Majority (61.4%, 7 834) of participants reported that their current pregnancy was their first pregnancy and 38.6% (4 882) reported the current pregnancy was their 2nd, or above. While 66% (8 385) of participants had no children, 27.4% (3 482) had 1 child and 6.6% (841) had 2 or more children. Majority of participants (57.9%) were from the urban areas and 33.9% and 8.2% were from rural and peri-urban areas respectively. The median gestational age of participants was 21 weeks (IQR: 19-23weeks). More than a third of participants (35%, 4 363) reported their partners were older than them at least by 5 years (table 3.1).

Table 3.1: Socio-demographic characteristics of 15-24 years old pregnant women, in the ANC survey 2017.

Description	Number of participants N=12,967 (n)	Percentage (%)
Age (median, IQR)	Median: 21	IQR: 19 – 23
Age category		
15-16 years	746	5.8
17-18 years	2 157	16.6
19-20 years	2 980	23.0
21-22 years	3 461	26.7
23-24 years	3 623	27.9
Geographical type		
Peri-Urban	1 068	8.2
Rural	4 394	33.9
Urban	7 505	57.9
Population group		
Black African	11 127	87.3
Other (Coloured, Whites, Indians)	1 619	12.7
Marital status		

Single	10 821	85.1
Married	1 032	8.1
Cohabiting	850	6.7
Separated	3	0.0
Divorced and widowed	7	0.1
Antenatal visit type		
First visit	4 842	37.8
Follow-up visit	7 980	62.2
Number of live born children*		
No child	8 385	66.0
One child	3 482	27.4
2 to 4 children	841	6.6
Gravidity		
Primi- gravida	7 834	61.4
Multi-gravida *	4 882	38.6
Education		
None	170	1.3
Primary	1 031	8.2
Secondary	9 968	79.3
Tertiary	1 409	11.2
Gestational age (median, IQR)	Median: 26	IQR: 18 – 33
Partner age		
<5	8 090	65.0
5	4 363	35.0
Partner age		
<7	9 845	79.0
7	2 608	21.0

*unweighted data; missing data excluded. *The difference in multigravida and number of live births could be due to abortions and history of still birth participants may have.*

About a fifth (21.3%,856) of adolescents aged 20 years and below already had one child, while 5.1 % (159) had 2 to 4 children (table 3.2).

Table 3.2: Demographic characteristics of participants by parity and age group among pregnant women aged 15-24 years, antenatal survey, 2017.

Age	Number of children alive n(%)		
	0	1	2 – 4
15 – 17 years	1, 523 (93.2)	178 (4.8)	32 (2)
18 – 20 years	3, 308 (80.4)	678 (16.5)	127 (3.1)
21 – 24 years	3, 554 (51.0)	2, 276 (39.2)	682 (9.8)

unweighted data

3.3. Type of visit

The Gauteng province had the least proportion of follow up visit attendees (53.9%, 805), followed by Eastern Cape (55.9%,948) and Limpopo (58.2%,545) provinces. While KwaZulu-Natal had the highest proportion (68.7%, 2 592) of follow-up visit attendees, followed by Northern Cape (62%, 388) and Western Cape (60.7%, 900) (table 3.3).

KwaZulu-Natal had the most number (30.6%, 1 154) of first visit attendees, followed by Eastern Cape (43.5%, 738), Gauteng (45.7%, 684), Western Cape (39%, 579) and Mpumalanga (40.9%, 459) Provinces respectively. North West had the highest proportion (7.6%, 61) of not documented participants followed by Limpopo (2.4%, 22) (table 3.3).

Table 3.3: Type of visit by province, pregnant women aged 15-24 years, antenatal survey, 2017.

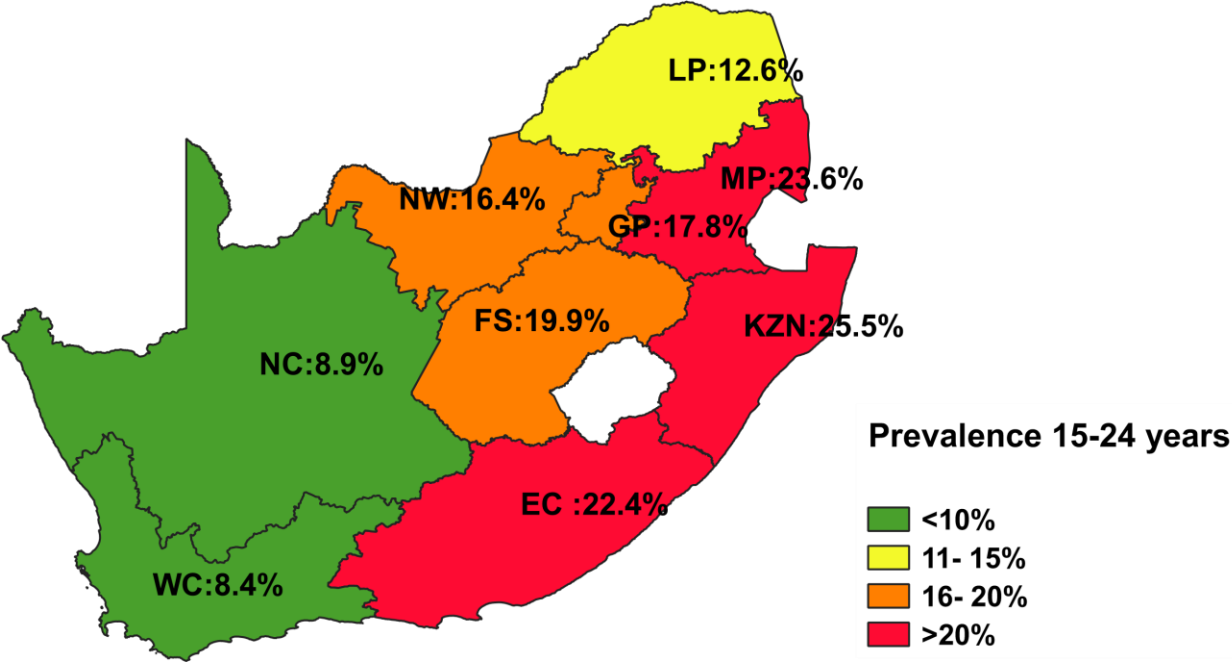
Province	1 st Antenatal Visit n(%)	Follow-up Visit n(%)	Not Documented n(%)	Total
Eastern Cape	738 (43.5)	948 (55.9)	9 (0.5)	1 695 (100)
Free State	363 (35.1)	664 (64.3)	6 (0.6)	1 033 (100)
Gauteng	684 (45.7)	805 (53.9)	6 (0.4)	1 495 (100)
KwaZulu-Natal	1, 153 (30.6)	2 592 (68.7)	28 (0.7)	3 773 (100)
Limpopo	369 (39.4)	545 (58.2)	22 (2.4)	936 (100)

Mpumalanga	459 (40.9)	659 (58.7)	4 (0.4)	1 122 (100)
Northern Cape	234 (37.4)	388 (62.0)	4 (0.6)	626 (100)
North West	263 (32.8)	479 (59.6)	61 (7.6)	803 (100)
Western Cape	579 (39.0)	900 (60.7)	5 (0.3)	1 484 (100)
South Africa	4 842 (37.4)	7 980 (61.5)	145 (1.1)	12 969 (100)

unweighted data

3.4. HIV Prevalence at national level

The overall prevalence of HIV among pregnant women aged 15-24 years was 18.5% (95% confidence interval (CI): 17.9 – 19.1%). The highest HIV prevalence was in KwaZulu-Natal (25.5%), Mpumalanga (23.6%) and Eastern Cape (22.4%) provinces, while Western Cape (8.4%) and Northern Cape (8.9%) had the lowest HIV prevalence respectively (figure 3.2).



weighted data; EC: Eastern Cape; FS: Free State; GP: Gauteng; KZN: KwaZulu-Natal; LP: Limpopo; MP: Mpumalanga; NW: North West; NC: Northern Cape; WC: Western Cape

Figure 3.2: HIV Prevalence at Provincial level among 15-24 years old pregnant women in South Africa, 2017.

3.5. HIV Prevalence by age

HIV prevalence was 11.3% (95% CI: 10.5-12.1%) among adolescents (15-19 years) and 21.9% (95% CI: 21.1-22.7%) among young women aged 20-24 years. The highest prevalence was seen among women between the age group 23-24 years at 27.0% (95% CI: 25.8-28.3%). The lowest prevalence was in the age groups 15-16 and 17-18 years, with prevalence of 5.8% (95% CI: 4.6-7.2%) and 10.9% (95% CI: 9.8-12.1%) respectively (Figure 3.3).

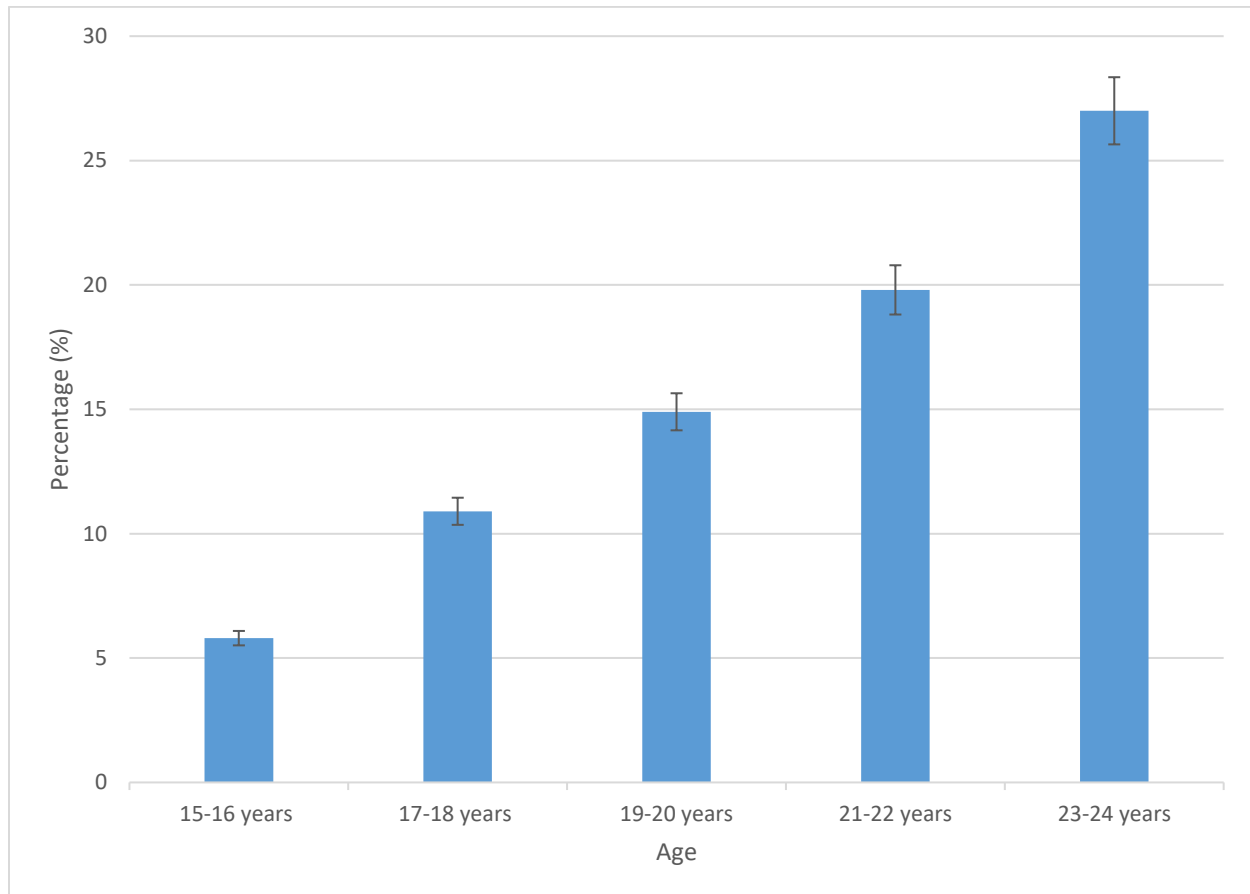


Figure 3.3: HIV prevalence by age group among pregnant women aged 15-24 years in South Africa, 2017

HIV prevalence among participants in the age group 18-20 years (potential school leavers age group) was 14.0%, (95% CI:13.1–15.0%) (table 3.4).

Table 3.4: HIV prevalence by age category among pregnant women aged 15-24 years in South Africa, 2017

HIV prevalence by age category		
Age category	n (%)	95% CI
15 – 17 years	145 (7.8)	6.8 – 8.8)
18 – 20 years	619 (14.0)	13.1 – 15.0
21 – 24 years	1 749 (23.4)	22.5 – 24.3

Weighted data

3.6. HIV Prevalence by parity and gravidity

Women who had no child (nulliparous women) and primi-gravida women had lower HIV prevalence [13.3% (95% CI: 12.7-14.0%) and 12.5%, (95% CI: 11.9 - 13.1%) respectively] compared with multipara (28.4%, 95%CI: 27.2 - 29.6%) and multigravida (27.7%, 95% CI: 26.7 - 28.8%) women (table 3.5).

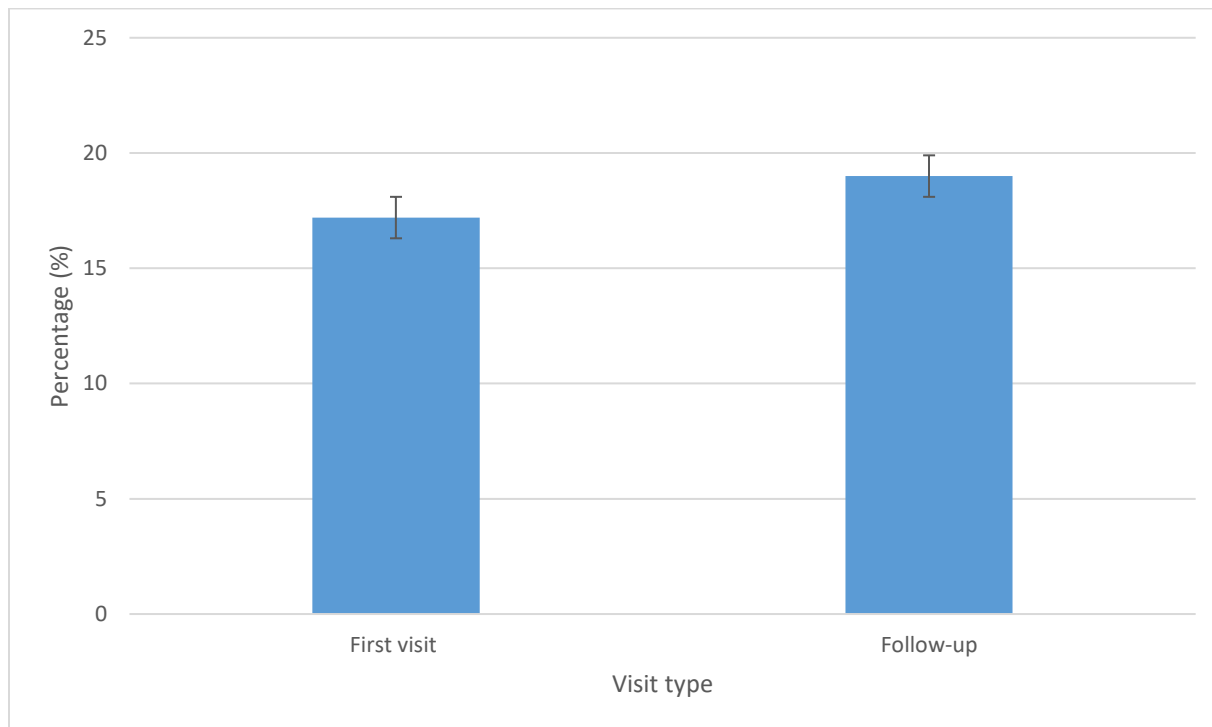
Table 3.5: HIV prevalence by parity and gravidity among pregnant women aged 15-24 years in South Africa, 2017.

HIV prevalence by parity and gravidity		
	n (%)	95% CI
Number of children		
No child	1 160 (13.3)	12.7 – 14.0
1-4 children	1 296 (28.4)	27.2 – 29.6
Number of pregnancies		
Primi-gravida	1 018 (12.5)	11.9 – 13.1
Multi-gravida	1 445 (27.7)	26.7 – 28.8

weighted data; missing data excluded

3.7. HIV prevalence by visit-type

HIV was slightly higher (19.0%, 95% CI: 18.2 – 19.8%) among follow-up visit attendees as compared to women attending ANC for the first time in the current pregnancy (17.2%, 95% CI: 16.3 – 18.2%) (figure 3.4).

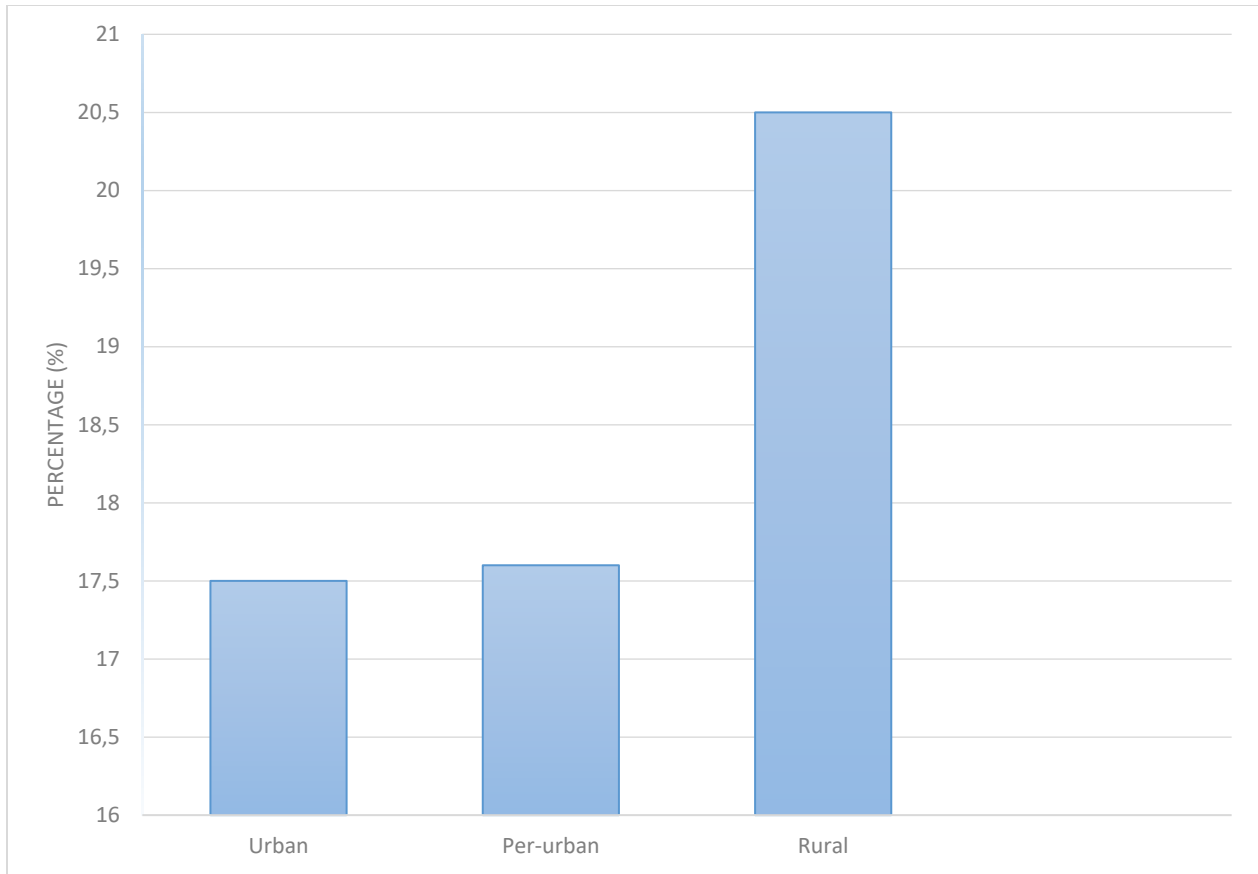


weighted data

Figure 3.4: HIV prevalence by visit-type among pregnant women aged 15-24 years in South Africa, 2017.

3.9. HIV Prevalence by geographical type

A higher HIV prevalence was observed among pregnant women who were attending ANC in rural health facilities (20.5%, 95% CI: 19.4 - 21.8%) compared to women who were pregnant and attending ANC at peri-urban (17.6%, 95% CI: 15.4 - 20.1%) and urban (17.5%, 95% CI: 16.7 – 18.3%) health facilities (figure 3.5).



weighted data

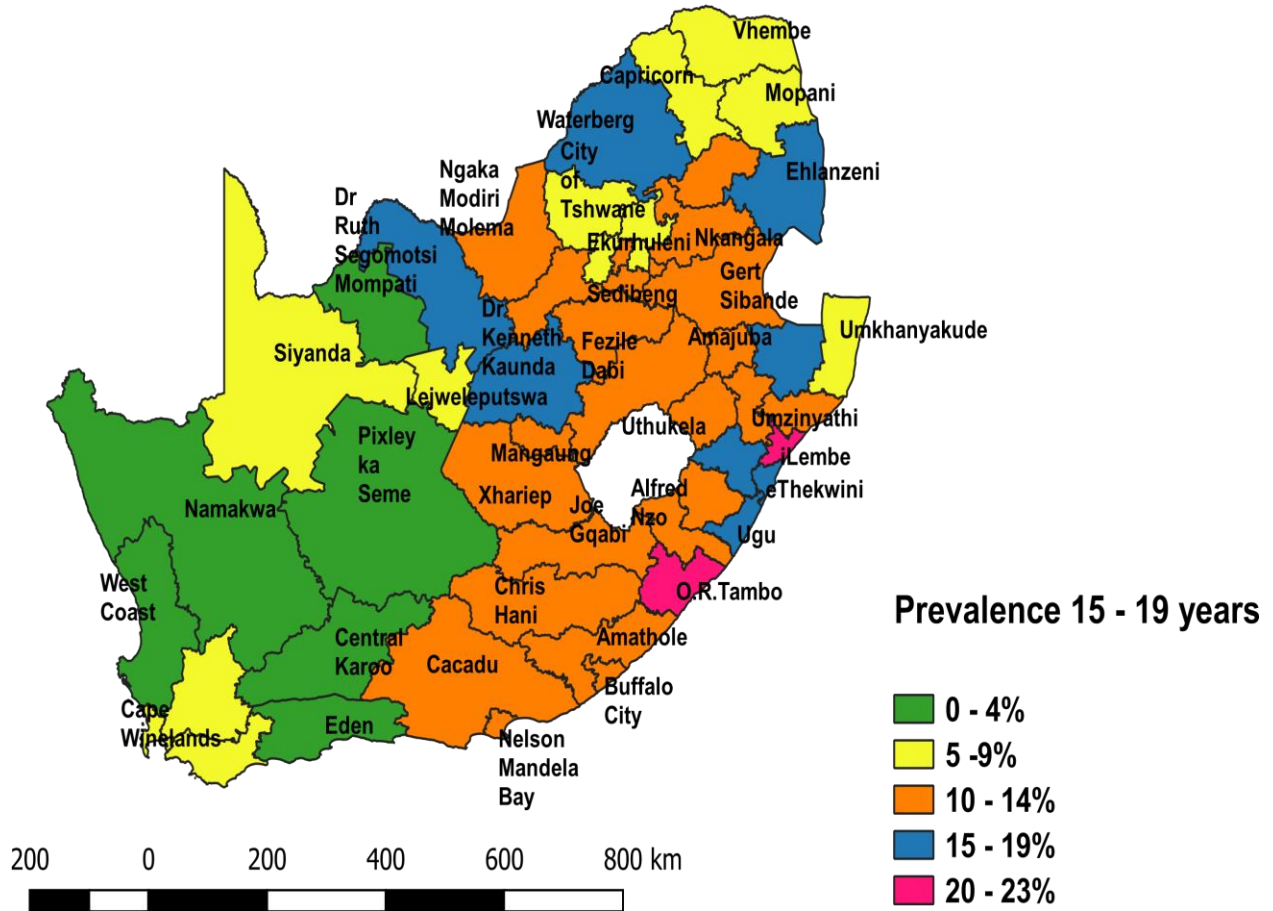
Figure 3.5: HIV prevalence by geographical type among pregnant women aged 15-24 years in South Africa, 2017.

3.10. Prevalence at district level by age group

Figure 3.6, 3.7 and 3.8 shows prevalence at district level among age groups 15-19, 20-24 and 15-24 years. At district level, across all age groups, the 6 highest prevalence districts were in KwaZulu-Natal (uMgungundlovu 30.6%, eThekweni 29.0%, iLembe 28.8% and Ugu 28.0%), Eastern Cape (Chris Hani 26.5%) and Mpumalanga (Ehlanzeni 25.5%)². In Northern Cape, Namakwa had the lowest (0%) HIV prevalence across all age groups, but this could be due to the low sample size realization in this district (n=33). In KwaZulu-Natal, Umkhanyakude had the lowest prevalence across all age groups and this prevalence was comparable to prevalence in some

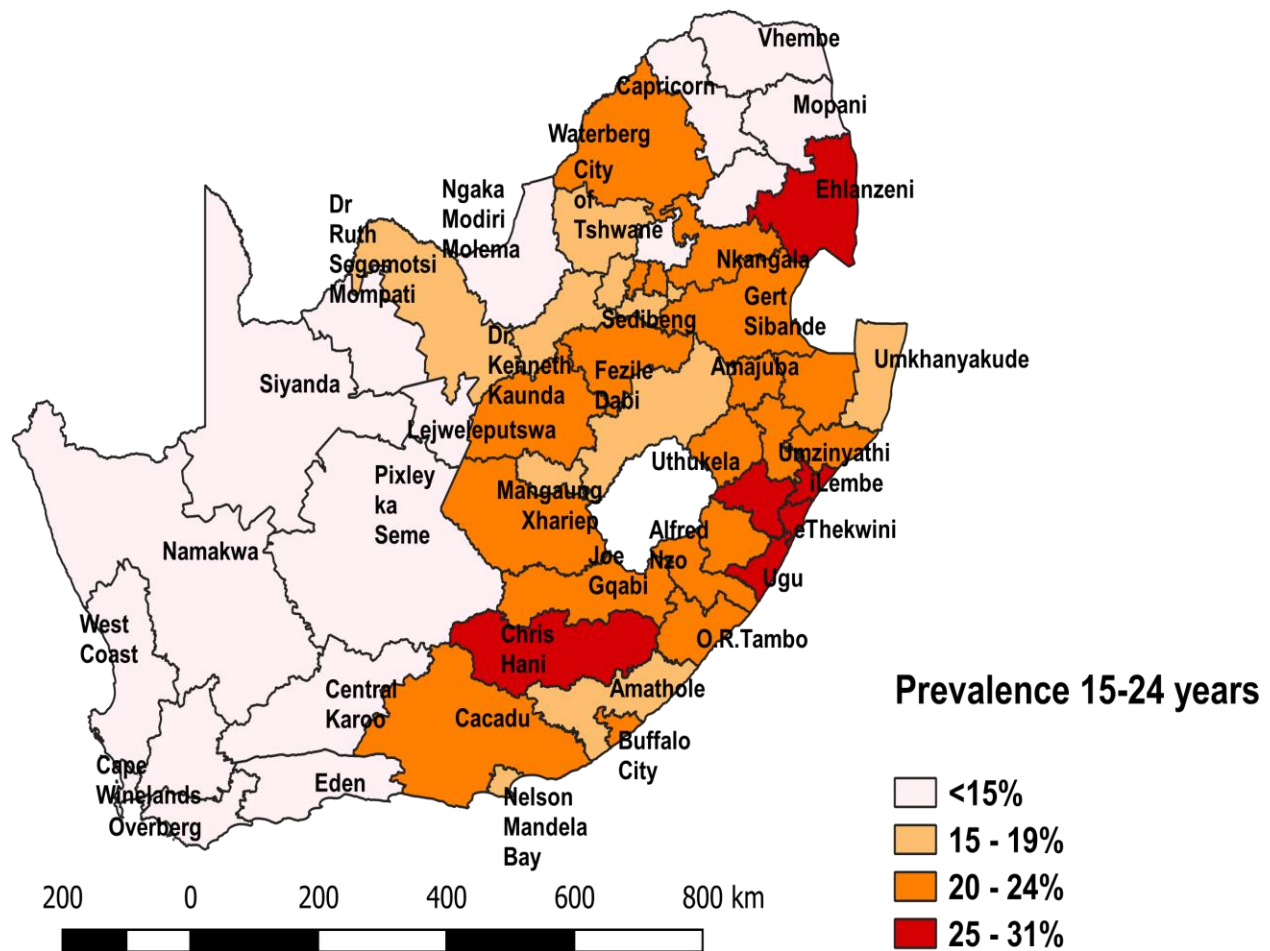
² Note that the percentages displayed in brackets are for the age group 20-24 years old.

of the Gauteng and North West districts. Vhembe, Mopani, Sekhukhuni and Capricorn in Limpopo province and Ngaka Modiri Molema in North West also showed low prevalence within the age group of 15-24 and 20-24 years.



weighted data

Figure 3.6: Prevalence at district level among pregnant women aged 15-19 years, antenatal survey, South Africa, 2017



Weighted data

Figure 3.8: Prevalence at district level among pregnant women aged 15-24 years, antenatal survey, South Africa, 2017

3.11. Comparison of HIV positive and HIV negative participants

In a bivariable analysis when comparing the socio-demographic characteristics of HIV positive and HIV negative pregnant women aged 15-24 years attending ANC in public health facilities in South Africa, we found that age, partner age, geographic location, parity, gravidity, race, education, visit type and marital status were significantly associated with HIV infection ($p < 0.05$) (table 3.6).

Table 3.6: Comparison of socio-demographics characteristics between HIV positive and HIV negative adolescent girls and young women, in South Africa, 2017.

Variables	Total number of participants (N=12 967)	HIV non-infected n (%)	HIV infected n (%)	P-value
Age groups (years)	(n)			
15-16	746	697 (6.4)	49 (1.7)	< 0.001
17-18	2 157	1 903 (17.5)	254 (9.5)	
19-20	2 980	2 519 (23.8)	461 (18.2)	
21-22	3 461	2 746 (26.7)	715 (28.7)	
23-24	3 623	2 589 (25.6)	1 034 (41.9)	
Age groups (years)				
15-19	4 301	3 785 (35.1)	516 (19.7)	< 0.001
20-24	8 666	6 669 (64.9)	1 997 (80.3)	
Age groups (years)				
15-17	1 665	1 520 (14.1)	145 (5.2)	< 0.001
18-20	4 218	3 599 (33.6)	619 (24.2)	
21-24	7 084	5 335 (52.3)	1 749 (70.6)	
Geographic location				
Urban	7 505	6 112 (62.2)	1 393 (58.4)	< 0.001
Peri-urban	1 068	874 (7.8)	194 (7.4)	
Rural	4 394	3 468 (30.0)	926 (34.2)	
Gravidity				
Primigravida	7 834	6 816 (65.8)	1 018 (41.7)	< 0.001
Multigravida	4 916	3 471 (34.2)	1 445 (58.3)	
Marital Status				
Single	10 832	8 733 (84.3)	2 098 (84.6)	< 0.001
Married	1 032	849 (8.9)	183 (7.3)	
Cohabiting	850	665 (6.7)	185 (8.1)	
Education				

None & Primary	1 201	959 (10.0)	242 (9.9)	< 0.001
Secondary	9 968	7 972 (77.8)	1 996 (81.7)	
Tertiary	1 409	1 217 (12.2)	192 (8.4)	
Partner age (years)				
<5	8 090	6 858 (67.4)	1 232 (51.3)	< 0.001
>=5	4 363	3 208 (32.6)	1 155 (48.7)	
Partner age (years)				
<7	9 845	8 232 (81.4)	1 613 (67.7)	< 0.001
>=7	2 608	1 834 (18.6)	774 (32.3)	
Parity				
0	8 385	7 225 (70.3)	1 160 (47.8)	<0.001
1-2	2 608	2 943 (29.0)	1 225 (49.6)	
3-4	155	84 (0.7)	71 (2.6)	
Visit type				
First visit	4 842	3 967 (39.7)	875 (36.8)	0.005
Follow-up	7 980	6 388 (60.3)	1 592 (63.2)	
Race				
Black African	11 129	8 749 (82.9)	2 378 (96.2)	< 0.001
Other	1 619	1 538 (17.1)	81 (3.8)	

weighted data

3.12. Multivariable analysis of factors associated with HIV infection among pregnant adolescent girls and young women

Table 3.7 shows the association between HIV positive status and demographic factors among pregnant women aged 15-24 years old attending ANC in public health facilities in South Africa using multivariable logistic regression model. In a bivariable analysis, age, education, gravidity, parity, partner age, geographic location, province and visit type were found to be significant and were included into the multivariable analysis. Race was significant but was not included in the analysis, as the majority of participants were Black African (85.3%) where as the number of

participants from other races were very small. Parity was not included in the model with gravidity to avoid multi-collinearity. In a separate multivariable model run for parity, parity of one or more (i.e. being multipara) was significantly associated with higher odds of being HIV-positive compared to parity of 0 (*data not presented in table*).

Table 3.7: Multivariable analysis of factors associated with HIV infection among pregnant adolescent girls and young women in South Africa, 2017.

Predictors	Proportion n (%) N=12 967	Prevalence (95% CI)	OR (95% CI) bivariable model	AOR (95% CI) multivariable model
Age difference with partner (model 1)				
≤5	8 090 (64.4)	14.5 (13.9 – 15.2)	1.0	1.0
>5	4 363 (35.6)	25.0 (23.9 – 26.1)	2.0 (1.8 -2.1)	1.8 (1.7 – 2.0)
Age difference with partner (model 2)				
≤7	9 845 (78.9)	15.7 (15.0 – 16.3)	1.0	1.0
>7	2 608 (21.1)	28.0 (26.5 – 29.5)	2.1 (1.9 – 2.3)	1.8 (1.7 – 2.0)
Age group				
15 – 17	1 665 (12.5)	7.8 (6.8 – 8.8)	1.0	1.0
18 – 20	4 218 (31.8)	14.0 (13.1 – 15.0)	1.9 (1.7 – 2.3)	1.7 (1.5 – 2.1)
21 – 24	7 084 (55.7)	23.4 (22.5 – 24.3)	3.6 (3.1 - 4.2)	3.0 (2.6 – 3.6)
Gravidity				
Prim-gravida	7 834 (61.3)	12.5 (11.9 – 13.1)	1.0	1.0
Multigravida	4 916 (38.7)	27.7 (26.7 – 28.8)	2.7 (2.5 – 2.9)	2.0 (1.8 – 2.2)
Education				
Tertiary	1 201 (9.9)	13.4 (12.0 – 15.0)	1.0	1.0

Secondary	9 968 (78.5)	19.2 (18.5 – 19.9)	1.5 (1.3 – 1.8)	1.7 (1.5 – 2.0)
Primary or none	1 409 (11.6)	18.3 (16.6 – 20.2)	1.4 (1.2 – 1.7)	1.9 (1.5 – 2.4)
Marital status				
Married	1 032 (8.6)	15.6 (13.8 – 17.6)	1.0	1.0
Single	1083100	18.5 (19.3 – 23.8)	1.2 (1.1 – 1.4)	1.9 (1.6 -2.2)
Cohabiting	(84.4)	21.5 (19.3 – 23.8)	1.5 (1.2 – 1.8)	1.8 (1.5 – 2.3)
	850 (7.0)			
Geographical type				
Eastern Cape				
Urban	784 (46.3)	20.3(17.8– 23.0)	1.0	1.0
Peri-urban	161 (9.5)	19.3 (12.7 – 28.2)	0.9 (0.6 – 1.6)	1.0 (0.6 – 1.7)
Rural	750 (44.2)	25..3 (22.5 – 28.4)	1.3 (1.1 – 1.6)	1.5 (1.1 – 1.8)
Limpopo				
Urban	196 (21.0)	11.2 (7.6 – 16.4)	1.0	1.0
Peri-urban	93 (9.9)	21.5 (14.4 – 31.0)	2.2 (1.1 – 4.2)	1.6 (0.9 – 3.1)
Rural	647 (69.1)	11.8 (9.7 – 14.1)	1.1 (0.6 – 1.7)	0.8 (0.5 – 1.3)
Northern Cape				
Urban	459 (73.3)	8.1 (6.4 – 10.2)	1.0	1.0
Peri-urban	43 (6.9)	14.0 (8.6 - 21.8)	1.8 (1.0 – 3.1)	1.7 (0.8 – 3.6)
Rural	124 (19.8)	10.5 (6.6 – 16.3)	1.3 (0.8 – 2.2)	1.1 (0.6 – 2.0)
North West				
Urban	393 (49.0)	18.6 (15.3 – 22.3)	1.0	1.0
Peri-urban	78 (9.7)	11.5 (4.9 – 24.7)	0.6 (0.2 – 1.4)	0.7 (0.3 – 1.8)
Rural	332 (41.3)	15.1 (11.8 – 19.1)	0.8 (0.5 – 1.1)	0.7 (0.5 – 1.2)

Western Cape				
Urban	1 218 (82.1)	8.3 (7.2 – 9.5)	1.0	1.0
Peri-urban	179 (12.0)	6.7 (4.5 – 9.8)	0.8 (0.5 – 1.2)	0.7 (0.4 – 1.2)
Rural	87 (5.9)	13.8 (4.7 – 34.0))	1.8 (0.5 – 5.8)	1.4 (0.4 – 4.4)
Gauteng				
Urban	1418 (94.9)	18.2 (16.8 – 19.7)	1.0	1.0
Per-urban	44 (2.9)	13.6 (8.3 – 21.6)	0.7 (0.4 – 1.2)	0.8 (0.4 – 1.4)
Rural	33 (2.2)	21.2 (10.3 – 38.6)	1.2 (0.5 – 2.8)	1.0 (0.4 – 2.8)
Mpumalanga				
Urban	454 (40.5)	22.5 (19.6 – 25.6)	1.0	1.0
Peri-urban	64 (5.7)	28.1 (26.1 – 30.2)	1.4 (1.1 – 1.6)	1.5 (0.8 – 2.0)
Rural	604 (53.8)	24.0 (20.7 – 27.6)	1.1 (0.8 – 1.4)	1.1 (0.9 – 1.5)
KwaZulu-Natal				
Urban	1692 (44.8)	27,3 (25.5 – 29.1)	1.0	1.0
Peri-urban	334 (8.9)	23.1 (18.7 – 28. 1)	0.8 (0.6 – 1.1)	0.8 (0.6 – 1.1)
Rural	1747 (46.3)	24.2 (22.4 – 26.0)	0.9 (0.7 – 1.0)	0.9 (0.7 – 1.1)
Free State				
Urban	891 (86.2)	20.2 (18.1 – 22.5)	1.0	1.0
Peri-urban	72 (7.0)	20.8 (13.3 – 31.2)	1.0 (0.6 – 1.8)	1.1 (0.6 – 1.9)
Rural	70 (6.8)	15.7 (8.4 -24.6)	0.7 (0.3 – 1.5)	0.7 (0.3 – 1.4)

Linktest p value = 0.9239 from ftest for goodness of fit. Adjusted for antenatal care visit type. Wald test for interaction term:p value= 0.001. weighted data. Adjusted odds ratios are presented from model 1 for all variables except for 'partner age >7 years' for which the AOR was taken from model 2. Both models were adjusted for the same variables. OR: Odds ratio; AOR: adjusted odds ratio.

The study showed education, geographic location, gravidity, marital status and partner age as significant predictors of HIV positive status among pregnant women attending ANC at public health facilities in South Africa in 2017.

In Eastern Cape, living in rural areas was a risk factor for HIV positivity compared with living in urban area. AGYW living in rural areas in the Eastern Cape Province were 1.5 times more likely than women living in the urban areas in the Eastern Cape Province to be HIV infected [AOR = 1.5 (95% CI: 1.1–1.8)].

Age was a predicting factor for HIV positive status. Women in the age 18–20 years and 21–24 years were 1.7 times (AOR 1.7, 95% CI: 1.5–2.1) and 3.0 times (AOR 3.0, 95% CI: 2.6–3.6) more likely than women aged 15–17 years old to be HIV positive.

The results also showed that partner age was a significant predictor of HIV positive status among pregnant AGYW. AGYW who were in a relationship with a partner older than them by more than 5 years were 1.8 times more likely to be HIV infected than young women of same age in a relationship with a partner older than them by less than 5 years [AOR = 1.8 (95% CI: 1.7-2.0)] and: the odds of HIV infection stayed the same with increasing partner age difference of 7 years and more [AOR = 1.8 (95% CI: 1.7-2.0)].

The number of pregnancy (gravidity) a woman had was a predicting factor for HIV positive status. Women who were pregnant twice or more were 2.0 times more likely to be HIV infected than women who were pregnant for the first time [AOR = 2.0 (95% CI: 1.8–2.2)].

Marriage was a protective factor. AGYW who were single or cohabiting were more likely than married women to be HIV infected [AOR = 1.9 (95% CI: 1.6–2.2) and 1.8 (95% CI: 1.5–2.3)] respectively.

The results also showed that education was a predicting factor for HIV positive status among pregnant women aged 15-24 years. Women with no or primary education and women with secondary education respectively were 1.7 times and 1.9 times more likely than women with tertiary education to be HIV infected [AOR - 1.7 (95 % CI 1.5 - 2.0) and = 1.9 (95% CI: 1.5 – 2.4) respectively].

We used the Hosmer and Lemeshow's goodness-of-fit test to check the overall model fit. The test showed that the model had adequate fit ($p = 0.9239$).

CHAPTER 4

4.1. DISCUSSION

The prevalence of HIV among young women in South Africa is high. There is a need to understand predictors of HIV that increases the risk of HIV among this age group (15-24 years). The aim of this study was to describe the geographic distribution of HIV and socio-demographic characteristics associated with HIV among pregnant women aged 15-24 years old attending ANC in public health facilities in South Africa. HIV has been found as one of the public health problem among AGYW. It is important to determine predictors associated with HIV positive status and the geographical distribution thereof at a provincial and district level in order to locate areas where the prevalence is high and where further interventions are needed. The findings of this study showed that HIV is associated with geographic location, partner age, age, education, gravidity and marital status.

4.1.1. Geographic location

The study found substantial geographical variation in the burden of HIV. According to this study three of the nine provinces, namely, KwaZulu-Natal (25.4%), Mpumalanga (23.6%) and Eastern Cape (22.4%) carried the highest HIV burden nationally. Similar geographic variations in HIV prevalence have been observed in other studies in South Africa (21,61) and other sub-Saharan African and Asian countries (62–64). Among the three high burden provinces identified in this study, Eastern Cape and KwaZulu-Natal are provinces with the highest levels of poverty, underdeveloped infrastructure and unemployment (63)(67). Therefore, socio-economic inequalities, difficulties of traveling to health care facilities due to the landscape of these provinces and cultural beliefs may have been the main factors that contributed to the high HIV prevalence in these provinces.

KwaZulu-Natal is a province dominated by isiZulu speaking people who still practice their culture of polygamy. Women in polygamous relationship are exposed to large sexual network which may

put them at risk of HIV infection (68). It is widely known that male circumcision reduces the risk of HIV infection significantly. However, in the Zulu culture historically circumcision is not part of their traditional practices (69,70), as a result circumcision prevalence rate in the KwaZulu-Natal province is low (71). On the other hand, in the Eastern Cape province a contributing factor could be that circumcision is practiced at late stage when males are already in adulthood stage (18 years and above); some would have already involved in unprotected sexual intercourse prior to circumcision, which reduces the HIV prevention benefit of circumcision (72).

4.1.2. Rural-Urban difference

This study showed substantial rural-urban difference in HIV prevalence in the Eastern Cape province. In the Eastern Cape Province, the burden of HIV was found to be high in rural areas. In the literature factors such as unemployment, movement, and poor socio-economic status, have been identified as major risk factors for the spread of HIV in rural areas. Women in rural areas may seek help in urban areas due to a number of reasons, including lack of services, lack of resources and lack of transportation (the distance one has to travel from home to the health facility). Health facilities in urban areas are believed to have more resources compared to health facilities in rural areas. Zuma et al., argued that the main driver for the spread of HIV infection in rural areas is the movement of people from rural to urban areas, in seeking for better services, and jobs which exposes them to risk behaviours including having multiple partners (73,74). Lack or no HIV testing facilities, poorer overall health infrastructure and more restricted access to health care facilities in rural areas have also been reported as contributory factors towards increased HIV prevalence (25,75). In some rural areas, misconceptions such as the belief that traditionally initiated and circumcised men are immune from getting HIV increases the spread of HIV (76). Most rural areas are entrenched in cultural practices where women don't partake in sexual decision making and it is also a taboo for a woman to express her sexuality and to negotiate safer sex (76). In some cultures women are considered properties of their husband after lobola (or bride price) has been paid, and men are given full right to refuse safe sex practice once lobola has been paid (77). Therefore, all of these factors put women at a higher risk of contracting HIV infection.

4.1.3. Partner age

In this study, engaging with older (>5 years older) partners among AGYW was associated with increased odds of being HIV infected. Similar findings were reported in studies done in Southern African countries (78,79). The sexual relationships between younger women (aged 15-24 years) and older men has been understood to be the major driver of the spread of HIV infection in South Africa (80). AGYW tend to associate older men with emotional stability, safety and maturity compared to age-similar partners. AGYW are attracted by material things that they gain from such relationships (78,79) Power and economic imbalances and poverty are some of the underlying factors that lead young women to age disparate relationships according to research (63,81).

Given that age disparate relationship is a main contributor of teenage pregnancy and HIV, at country level there are various interventions (e.g. DREAMS) undertaken to prevent HIV transmission caused by age-disparate relationship. Studies indicate that providing young girls with cash transfer can reduce the chance of young girls getting involved in age disparate relationships and also reduces the risk of getting HIV infection among young girls (82,83) Many people in South Africa live with earning of below \$1 a day. Higher education is not easily accessible to most young people, as they cannot afford the cost of education (school fees, uniform, books and transportation). The introduction of government social welfare grants to children in South African households improved school attendance (84).

4.1.4. Age

Our study showed age as an important predictor of HIV. Age in general is an important risk factor, and often used as a proxy for monitoring trend in recent infection. The highest HIV prevalence was in the age group 23-24 years and the lowest was in the age group 15-16 years. The HIV prevalence in the age group 15-16 years could be due to peri-natal infection, as well as horizontal transmission. Most AGYW entering into sexual relationships early have limited knowledge on how to protect themselves from HIV infection. Studies indicate that most sexual encounters at younger age (15-18) are forced sexual encounters (85). The results showed that as age increased the risk of being HIV positive increased. The observed association between age and increased HIV

prevalence is likely to be due to both an indirect effect of survival of women receiving ART to older age and the high prevalence of risk behaviors among young women. This result is also in agreement with a study done in Cameroon (86).

4.1.5. Marriage

The results showed marital status as a significant predictor of HIV positive status. In the study single young women and young cohabiting women were more likely to be HIV infected compared to young women who were married. This could be because married people mostly are stable and have one sexual partner as compared to unmarried women. Similar findings were found in a study done in KwaZulu-Natal, South Africa (87). This can also mean that most single or cohabiting people are more likely to be in multiple sexual relationships before they are married compared to married people. However, other studies have found that being married could also increase the risk of HIV infection as often women have limited power in marriage to negotiate safe sex practice (81,88,89).

4.1.6. Education

In this study young women with tertiary education had less risk of HIV infection compared with women with less than tertiary education. In the literature similar findings have been reported (90). In a studies by Zuma et al & Mabaso et al, women with lower than tertiary level education had twice higher odds of acquiring HIV compared with women with tertiary education (40,87). Available studies argue women with tertiary education have better opportunities of empowering themselves to assert their sexual and reproductive rights and they are more likely to know how HIV is transmitted and different methods of preventing HIV infection (91). Other studies suggest that keeping girls in schools reduces HIV risk (92–94). The more time AGYW spent in school, the more AGYW get exposed to reproductive health and sexual education. Keeping AGYW in school keeps them away from meeting partners who may expose them to acquiring HIV infection, because most of their time is spent in school, with fellow age mates, rather than outside of school environment. Obtaining tertiary education and associated qualifications helps improve AGYW socio-economic status, empower them more to be able to negotiate for safer sex and makes them

to be independent from sexual partners (95). Furthermore, having tertiary education creates better socio-cognitive abilities and in return one develops better understanding of HIV infection (87,96).

4.1.7. Gravidity

The study showed the risk of HIV infection increases with gravidity. An increase in gravidity shows the person was sexually active for longer and may also have longer unprotected sexual encounter. A similar finding was also reported in a study done in Cameroon(86).

4.2. Study Limitations

Several limitations were identified in this study. Pregnant women who use private facilities for ANC were not included in the survey (this include people from high income groups, Whites, and Indians). Therefore, the study findings mainly represent black African women who use public facilities. This study was a secondary analysis, therefore was limited to variables collected in the main survey. Due to the cross-sectional nature of the study, the study measured prevalence, as a result, this study could not show causal relationships. The prevalence may increase with increasing age due to cumulative HIV positive cases over time, since some of the participants may have been perinatally infected. There is possibility of reverse causality with HIV acquisition preceding the occurrence of identified predictor factors. This could occur, for example, if there were perinatally infected AGYW in the study population. A small percentage (10%) of participants were excluded from the study due to missing data, rejections, and discrepant results but this is unlikely to change the estimates reported in the current study as the missingness of data or rejections are unlikely to be associated with the outcome of the study or covariates used in the analysis (rather the missingness was due to random data quality gaps including lack of adequate training and clerical errors). Due to socio-cultural perceptions, generally women like to understate their sexual behavior, due to this we may have underestimated the prevalence of certain risk behavior (such as age-disparate relationship). Furthermore, the recall of partner age especially for AGYW in sexual relationship with men older than them by 5 or more years may contribute to some reporting bias. The analysis mainly targeted association between demographic factors and HIV. Other factors such as behavioral, psycho-social and economic factors were not included in the analysis. Some

of the districts had low sample size realization and as such there was limitation in precisely measuring the prevalence in districts with small sample size achievement.

4.3. Strength of the Study

The strength of this study as an antenatal care clinics based surveillance is that it provided us with access to a national data that is readily available for analysis to describe geographic patterns using data from a cross-section of sexually active adolescent girls and young (15-24 years) pregnant women in the general population.

4.4. Conclusion

Despite numerous efforts being made towards curbing HIV in the country (South Africa), the HIV prevalence among AGYW remains high. The findings in this study indicated that geographical type, marital status, age, partner age, education and gravidity were important predictors of HIV infection among women aged 15–24 years in South Africa. These predictors have contributed immensely to the odds of HIV infection among pregnant women attending ANC in public health facilities in South Africa. The study has shown that HIV infection was not uniformly distributed among geographical locations in South African districts and the prevalence was high in three provinces namely; KwaZulu-Natal, Eastern Cape and Mpumalanga province.

4.5. Recommendations

Maximizing the use of available resources in the highly affected districts will be beneficial. Targeting the high burden districts and channelling more resources to high burden districts will help reduce the burden of HIV. There should be support, protection and empowerment strategies for vulnerable adolescent girls and young women with a view of comprehensively caring and increasing their safety. There is also a need to increase ART coverage for older men as the coverage of ART among men is low. Increasing ART coverage and promoting viral suppression among men is essential as this can reduce the risk of HIV transmission to AGYW in age-disparate relationship. It would be beneficial to rapidly expand pre-exposure prophylaxis (PrEP) among young people.

The efficacy and the benefits that PrEP comes with and its existence should be broadened and be easily available so that the uptake of PrEP can increase. It will be good for adolescent girls and young women including young men to have access to PrEP in order to prevent the transmission of HIV infection, therefore rapid expansion of PrEP among young people will be ideal and beneficial to the South African society since it will reduce the incidence rate.

Increasing the coverage of VMMC among men can reduce HIV infection among men and in turn helps reduce HIV transmission to young women engaged with men older than them. Many men who are HIV negative are still uncircumcised and could benefit from the HIV prevention effect of medical male circumcision. Targeting older men for medical male circumcision by expanding the services and allowing working individuals (men) day offs at work with full payment will attract older men to participate in voluntary medical circumcision as a prevention strategy to address the high rate of HIV infection.

Prioritizing tertiary education among AGYW will empower adolescent girls and young women with knowledge that they can use to make better-informed decisions about their sexual life and be able to protect themselves against HIV infection.

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Annexures

Annexure 1: South African Districts

The 52 South African Districts in all 9 provinces

Provincial Districts	Prevalence at 15-24 years		Prevalence at 20-24 years		Prevalence at 15-19 years	
	%	95% CI	%	95% CI	%	95% CI
Western Cape Provincial Districts						
West Coast	6.8.	4.5-10.1	8.5	5.6-12.9	2.5	1.0-5.9
Cape Wine Lands	7.0	5.4-9.0	7.7	5.7-10.3	5.7	3.9-8.4
Overberg	14.2	7.7-24.7	16.7	9.3-28.1	9.4	3.7-21.9
Central Karoo	6.3	3.5-10.9	9.4	5.6-15.5	0.0	0.0
Eden	5.5	3.7-8.3	6.2	4.0-9.5	3.9	1.8-8.3
City of Cape Town	11.4	9.4-13.8	13.4	10.9-16.3	5.7	3.7-8.6
Northern Cape Provincial Districts						
Frances Baard	10.8	7.0-16.2	12.4	8.3-18.1	7.1	3.1-15.6
John Taola Gaetsewe	9.5	6.3-14.0	12.5	9.3-16.6	3.5	1.0-11.3
Namakwa	0.0	0.0	0.0	0.0	0.0	0.0
Pixley ka Seme	6.0	3.6-9.8	7.1	3.3-14.6	4.6	2.1-9.7
Siyanda	11.9	8.7-15.9	13.8	10.0-18.7	8.3	4.0-16.7
Eastern Cape Provincial Districts						
Alfred Nzo	23.0	19.0-27.5	31.8	25.0-39.4	11.5	6.7-19.0
Buffalo City	21.0	15.9-27.1	24.4	18.4-31.6	13.2	7.4-22.3
Sarah Baartman	22.2	15.0-31.5	28.4	19.6-39.3	11.1	5.8-20.2
Amathole	19.7	15.1-25.4	22.9	16.9-30.2	15.0	9.0-24.0
Chris Hani	26.5	20.9-33.0	38.5	30.0-47.7	11.3	6.7-18.5
Joe Gqabi	21.4	16.0-28.0	27.1	20.1-35.5	11.6	6.2-20.7

Nelson Mandela Bay	19.7	14.7-25.7	23.3	17.8-29.9	12.0	7.1-19.6
OR Tambo	24.3	20.2-29.0	26.6	21.6-32.2	20.4	15.0-27.1
North West Provincial Districts						
Bojanala	17.2	12.7-22.8	19.7	14.2-26.6	9.6	5.3-16.8
Dr Kenneth Kaunda	16.4	11.6-22.7	17.1	12.4-23.2	14.3	5.3-33.0
Dr Ruth Segomotsi Mompati	16.9	12.8-22.1	16.8	11.6-23.8	17.2	10.0-27.9
Ngaka Modiri Molema	14.0	9.7-19.7	15.2	10.0-22.5	13.0	7.1-20.3
Mpumalanga Provincial Districts						
Ehlanzeni	25.5	21.9-29.4	30.5	25.7-35.6	16.8	12.1-22.8
Gert Sibande	24.9	20.2-30.3	32.4	25.5-40.2	12.5	7.4-20.3
Nkangala	20.6	17.6-24.0	23.9	20.4-27.9	13.1	8.6-19.4
Limpopo Provincial Districts						
Capricorn	11.9	8.8-16.0	13.5	9.5-18.8	6.9	3.2-14.6
Mopani	11.5	7.0-18.4	13.5	7.9-22.3	8.3	4.4-15.4
Greater Sekhukhune	14.8	9.9-21.5	16.4	9.8-26.1	12.1	6.9-20.3
Vhembe	6.8	4.7-9.7	7.5	4.6-11.9	5.6	2.8-10.9
Waterberg	23.6	18.6-29.5	25.7	20.3-31.9	19.4	10.4-33.5
KwaZulu Natal Provincial Districts						
Amajuba	23.7	19.3-28.9	30.0	24.3-36.5	10.2	7.3-14.0
Harry Gwala	22.0	18.6-25.8	29.8	25.1-35.0	10.8	7.1-16.2
King Cetshwayo	23.6	18.7-29.3	29.3	22.4-37.3	14.6	10.1-20.8
Ugu	28.0	24.5-31.8	33.2	28.2-38.6	16.8	12.0-23.1
Umkhanyakude	18.7	14.3-24.1	28.5	21.1-37.17	6.9	3.9-11.8
Umzinyathi	23.7	20.4-27.3	29.5	24.6-34.9	14.2	10.4-19.1
Uthukela	23.1	20.0-26.6	29.7	26.2-33.4	12.2	7.8-18.6

Zululand	24.3	20.6-28.4	30.0	23.8-37.0	15.3	10.7-21.4
eThekwini	29.0	26.1-32.0	33.8	30.1-37.7	16.7	12.2-22.4
iLembe	28.8	25.1-32.8	32.0	26.9-37.6	22.7	16.6-30.3
uMgungundlovu	30.6	27.1-34.4	38.7	32.6-45.1	15.1	10.6-21.1
Free State Provincial Districts						
Fezile Dabi	20.7	16.4-25.9	25.5	19.0-33.4	11.8	7.4-18.4
Lejweleputswa	21.6	17.9-25.8	23.7	20.1-27.9	17.6	11.2-26.6
Mangaung	19.8	15.7-24.8	22.1	16.9-28.4	14.1	8.3-22.8
Thabo Mofutsanyane	17.3	13.0-22.7	21.3	16.0-27.7	10.1	5.9-16.9
Xhariep	20.6	15.5-26.8	24.4	17.4-33.2	12.2	7.2-19.9
Gauteng Provincial Districts						
Ekurhuleni	20.2	16.9-23.9	14.9	12.1-18.3	9.1	5.4-15.0
City of Johannesburg	20.7	16.9-25.1	23.2	19.4-27.6	11.5	7.9-16.7
City of Tshwane	13.6	10.9-16.8	24.1	19.2-29.8	9.5	5.5-15.7
Sedibeng	18.5	15.7-21.6	20.5	17.1-24.4	12.5	7.4-20.4
West Rand	17.7	15.4-20.2	20.8	17.6-24.5	9.3	6.4-13.3

Annexure 2: Information sheet



NATIONAL 2017 ANTENATAL SENTINEL HIV SURVEY, SOUTH AFRICA

0000001

PROVINCE INFORMATION									
<input type="checkbox"/> Gauteng	<input type="checkbox"/> Free State	<input type="checkbox"/> Eastern Cape	<input type="checkbox"/> KwaZulu-Natal	<input type="checkbox"/> Western Cape	<input type="checkbox"/> Limpopo	<input type="checkbox"/> Mpumalanga	<input type="checkbox"/> Northern Cape	<input type="checkbox"/> North West	
DISTRICT INFORMATION									
NATIONAL HIV SURVEILLANCE FOCAL PERSON CONTACT NUMBER: 011 386 6328									
Name of District:									
Name of Sub District:									
Name of Sentinel Clinic:									
DHIS Clinic Code:									
SPECIMEN INFORMATION									
Collection Date:		<input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="M"/> <input type="text" value="M"/> 2017	Client Folder Number:						
Test Requested		HIV ELISA							<div style="text-align: center;"> <p>GA1700002</p> </div>
ELIGIBILITY ASSESSMENT AND CONSENT									
Is this the client's first ANC visit in this pregnancy?		1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No, second visit	3. <input type="checkbox"/> No, third visit	4. <input type="checkbox"/> No, >=fourth visit				
Age of pregnant survey client (years)=									
Race		1. <input type="checkbox"/> African	2. <input type="checkbox"/> Asian	3. <input type="checkbox"/> Coloured	4. <input type="checkbox"/> White				
Marital Status		1. <input type="checkbox"/> Single	2. <input type="checkbox"/> Married	3. <input type="checkbox"/> Widowed	4. <input type="checkbox"/> Divorced	5. <input type="checkbox"/> Separated	6. <input type="checkbox"/> Living with Partner	7. <input type="checkbox"/> Refused to answer	
<input type="checkbox"/> 1. Client agrees to participate in the interview and blood specimen	<input type="checkbox"/> 2. Client refuses to participate (give reason for refusal by selecting option 2a-2e)		<input type="checkbox"/> 2a. Have already been tested at ANC and know I am HIV positive	<input type="checkbox"/> 2c. Tested before pregnancy and know I am HIV positive.	<input type="checkbox"/> 2e. Other reasons (specify):				
<input type="checkbox"/> 1b. Client agrees to use of blood sample for future studies			<input type="checkbox"/> 2b. Tested at ANC and already know I am HIV negative.	<input type="checkbox"/> 2d. In a hurry					
DEMOGRAPHIC AND CLINICAL INFORMATION									
1 <input type="checkbox"/> Education: None		2 <input type="checkbox"/> Education: Primary		3 <input type="checkbox"/> Education: Secondary			4 <input type="checkbox"/> Education: Tertiary		
Gravidity: Number (No.) of pregnancies (include this one)				Did the client receive routine HIV test either today or in previous ANC visits during this pregnancy (review ANC register / client file)?					
Parity: No. of live born children				1 <input type="checkbox"/> Yes					
Gestational age: this pregnancy (In weeks)				2 <input type="checkbox"/> No, although HIV test was offered					
How old is your partner (the father of the child)- in years				3 <input type="checkbox"/> No, because HIV test was not offered					
				4 <input type="checkbox"/> No, because already positive before ANC					
What is the client's latest routine rapid HIV test result from previous or current ANC tests (review register/client file)?				If reported HIV positive ask these two questions					
1 <input type="checkbox"/> Negative from test done today				Have you ever taken ARV? If yes when did you start:			Have you taken ARV's in the last 3 days		
2 <input type="checkbox"/> Negative (from test done in previous ANC visit during this pregnancy)				1 <input type="checkbox"/> Yes, before pregnancy			1 <input type="checkbox"/> Yes		
3 <input type="checkbox"/> Positive at ANC				2 <input type="checkbox"/> Yes, at 1st trimester			2 <input type="checkbox"/> No		
4 <input type="checkbox"/> Positive before ANC				3 <input type="checkbox"/> Yes, at 2nd trimester					
5 <input type="checkbox"/> Discrepant				4 <input type="checkbox"/> Yes, at 3rd trimester					
6 <input type="checkbox"/> Not offered				5 <input type="checkbox"/> No					
7 <input type="checkbox"/> Not accepted									
Did the client receive routine Syphilis test during current pregnancy (review client file/ANC register) <input type="checkbox"/> Yes <input type="checkbox"/> No									

Vincennes F. Y3

Annexure 3: Approval letter from National Department of Health (NDoH)



health

Department:
Health
REPUBLIC OF SOUTH AFRICA

Private Bag X828, PRETORIA, 0001. 27th Floor, Room 2710, Civitas, Cnr Thabo Sehume & Struben Street, PRETORIA, 0001
Tel: +27 (0) 12 395 8000, Fax: +27 (0) 12 395 8422

The Chairperson
Research Committee
Provincial Department of Health

Dear Sir

**RE: APPROVAL FOR NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES (NICD)
TO CONDUCT THE 2017 NATIONAL ANTENATAL SENTINEL HIV PREVALENCE
SURVEY IN SOUTH AFRICA**

The Annual National Antenatal Sentinel HIV Prevalence Survey has been conducted in the nine provinces of South Africa amongst women attending public antenatal clinics since 1990. The 2017 survey will be conducted from the 1st of October -15th of November 2017 and it forms the 25th survey in the series of antenatal surveys conducted in South Africa. The survey will target 36,015 pregnant women from 1,595 public facilities nationally. The implementation of the 2017 National Antenatal Sentinel HIV Prevalence Survey forms is part of the Department of Health's Annual Performance Plan for 2015/16 – 2017/18 and it is aligned to the Department's Strategic Objective of Preventing Disease and Reducing its Burden and Promoting Health.

The 2017 National Antenatal Sentinel survey will be conducted by the National Institute for Communicable Diseases (NICD) with technical oversight, strategic leadership and operational support from the National Department of Health and the nine HIV Survey Provincial Coordinators. The survey will be embedded in routinely conducted activities and data collection will be performed by routine staff.

Yours sincerely

DR YOGAN PILLAY
DEPUTY DIRECTOR-GENERAL: HIV/AIDS, TB AND MWCH.

DATE: 8/9/12

Annexure 4: Ethics approval letter for primary study



R14/49 Prof Adrian Puren et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170556

NAME: Prof Adrian Puren et al
(Principal Investigator)
DEPARTMENT: School of Pathology
National survey at 52 Districts in South Africa

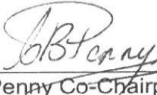
PROJECT TITLE: Protocol for Implementing the Annual Antenatal HIV Seroprevalence Survey in South Africa

DATE CONSIDERED: 26/05/2017

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR:

APPROVED BY: 
Professor C. Penny Co-Chairperson, HREC (Medical)

DATE OF APPROVAL: 28/08/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004, 10th floor, Senate House/3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in May and will therefore be due in the month of May each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).


Principal Investigator Signature

Date

30th August 2014

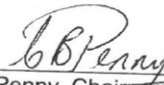
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Annexure 5: Ethics approval letter for secondary study



R14/49 Mr Mojalefa Makae

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M181150**

NAME: Mr Mojalefa Makae
(Principal Investigator)
DEPARTMENT: School of Public Health
Centre for HIV and STI
PROJECT TITLE: Predictors of HIV positive status among 15-24 years
old pregnant women attending antenatal care
in South Africa
DATE CONSIDERED: 30/11/2018
DECISION: Approved unconditionally
CONDITIONS:
SUPERVISOR: Dr S. Woldesenbet, Dr T. Kufa-Chakezha & Dr L. Kuonza
APPROVED BY: 
Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL: 15/02/2019

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **November** and will therefore be due in the month of **November** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).


Principal Investigator Signature

Date

20/02/2019

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Annexure 6: Plagiarism declaration form



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Mojalefa Makae (Student number: 1798965) am a student registered for the degree of MSc Epidemiology (Field Epidemiology) in the academic year 2020.

I hereby declare the following:

- ❖ I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- ❖ I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- ❖ I have followed the required conventions in referencing the thoughts and ideas of others.
- ❖ I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature:  Date: 20/11/2020

26/04/2015
1