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Behavioral, Demographic, and Clinical Determinants of HIV Serostatus in Zambian Women

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Abstract

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by

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MS, Alemaya University, 2003

BS, Awassa University, 1998

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The rate of human immunodeficiency virus (HIV) infection shows a diminishing trend at the global level while it shows increasing in intensity of mortality, morbidity, and burden in Sub-Saharan Africa. The intertwined behavioral, demographic, and clinical determinants fueled the incidence of infections in Zambian women. The purpose of this study was to determine the association between demographic, behavioral, and clinical determinants with HIV serostatus in Zambian women. With the conceptual framework of the World Health Organization's Commission for Social Determinants of Health (CSDH) and quantitative method of MANOVA, this study examined Zambian Demographic Health Survey data for Zambian women of two age groups (adolescent and adult). The findings showed statistically significant results in the association between HIV serostatus and self-perceived HIV risk for both groups and in the association between education and HIV serostatus among women in both groups (adolescents and adults). However, there was no statistically significant association between behavioral, demographic, and clinical determinants of HIV serostatus. These findings imply the need to conduct prospective studies to curb this deadly virus and improve community health for women in Africa.

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Dedications

This manuscript is dedicated to my late father, Masresha Gebreyohannes Babu and my late mother, Askale Woldetensay Tekle, who allowed me to commence my education and continuously encouraged me with the tremendous material, spiritual and emotional supports to obtaining the glorious landscape of these tremendous educational achievements. All heartfelt encouragements of friends, bypassers, and people from all walks of life are highly credited and do deserve my appreciation.

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First of all, I would like to praise the Almighty God, who guided me for accomplishing the highest caliber of education, Doctor of Philosophy (Ph.D.), in Public Health Specializing Community Health. I exceptionally would like to thank Dr. Ji Shen, my chairperson, who provided me full support, guidance, and expertise to go through the process of the dissertation and come to the end of the accomplishment of this academic journey. Special thanks to Dr. Kelly C. Sams, my committee member who supported me with timely feedback and excellent teamwork with the chair. Dr. Diribwa Debebe Mintesnot facilitated sending of my education documents from three universities and I was able to start my Ph.D. journey at Walden University because of this fantastic effort. I very much appreciate all my dear friends and priests, deacons, and parishioners of Ethiopian Orthodox Tewahido Church for their support, prayers, and encouragement to accomplish this prestigious academic milestone.

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Chapter 1: Introduction to the Study

Overview

Human immunodeficiency virus (HIV) is a virus that infects humans and leads to acquired immune deficiency syndrome (AIDS), a lethal disease that weakens the immune system (Centers for Disease Control and Prevention, 2015). Approximately 37 million people are living with human immunodeficiency virus (HIV); about 2 million new infections and almost 1 million AIDS-related deaths occur each year (Schwetz & Fauci, 2019).

Although infection rates of HIV/AIDS are decreasing globally, both infection rates and prevalence have increased in Zambia and other Sub-Saharan African countries (Ranganathan et al., 2017; Wakeham et al., 2017). Meager HIV prevention and insufficient access to clinical services are common issues in countries in this region. Ninety percent of HIV infections in this region is due to poor condom use and multiple sexual partners (Muzyamba, Broaddus, & Campbell, 2015). In Zambia, in particular, about 14% of people aged 18–49 years have HIV (Amoyaw, Kuuire, Boateng, Asare-Bediako, & Ung, 2015).

The purpose of this study is to assess the associations between the behavioral, demographic, and clinical determinants of HIV serostatus in Zambian women. Findings from this study may inform methods to reduce new infections, deter mortality and morbidity associated with AIDS, and improve the quality of life for Zambian women living with HIV/AIDS.

Background

Behavioral, demographic, and clinical factors affect HIV serostatus, as well as the risk acquisition levels, spread, and epidemic of HIV (Qiao, Zhang, Li, & Menon, 2018). Behavioral factors include the use of condoms and the number of sexual partners. Demographic determinants of HIV serostatus include age, sex, marital status, location, and education. Finally, clinical factors include HIV diagnosis, individuals' relationships with their health care providers, and access to counseling. Some factors serve as barriers to HIV testing and treatment, whereas others (such as access to counseling) facilitate the prevention of the disease.

Behavioral Factors

Behavioral factors, such as multiple sexual partners, unprotected sex, nondisclosure of HIV positive serostatus, increased HIV new infections, and spread of HIV for adolescent and adult women, contribute to the prevalence of HIV (Pinchoff, Boyer, Mutombo, Chowdhuri, & Ngo, 2017; Salam et al., 2016). Mathur et al. (2018) found that, for heterosexual couples, having multiple sexual partners alone contributed to 15% of female HIV-positive cases and increased HIV prevalence by 4% for 15- to 19-year-old Zambian women. Other researchers have found a positive correlation between the rate of HIV infection and sexual risk-taking in adolescent and adult women (Toska et al., 2017). For 15- to 49-year-olds, risky sexual behaviors led to greater increases in HIV prevalence for women than for men (Hegdahl, Fylkesnes, & Sandøy, 2016).

Demographic Factors

HIV serostatus correlates with demographic variables such as age, sex, and location. For example, Chanda-Kapata, Klinkenberg, Maddox, Ngosa, & Kapata (2016) and McCarraher et al. (2018) found that women have higher HIV infection rates than men. Furthermore, Okawa et al. (2018) found that female adolescents did not understand HIV transmission methods, even though they were concerned about it affecting their future marriages. Kharsany and Karim (2016) found consistent increases in HIV infection and transmission rates in Zambian women aged 18–49 years; these rates are six times higher than those of similarly aged Zambian men. Both HIV/AIDS infection rates and HIV-associated deaths are higher among women (Amoyaw et al., 2015). Research also suggests that the risk level is higher in urban areas than in rural areas (Chanda-Kapata et al., 2016; McCarraher et al., 2018).

People who are unaware of their HIV status are at an elevated risk of spreading the virus. In Zambia, HIV affects 2.9% of the population, and an estimated 1.2 million women aged 15–49 years have HIV (Qiao, Zhang, Li, & Menon, 2018).

Problem Statement

Zambia is a country in the Sub-Saharan African region that has people living with a high burden of human immunodeficiency virus (HIV) infections and sustained HIV transmission. Zambia is one of the ten countries that have one of the highest HIV prevalence in the world, accounting for 4% of the worldwide HIV infected people (Kharsany & Karim, 2016). The different types of HIV serostatus (HIV positive serostatus, HIV negative serostatus, unknown HIV serostatus) indicated an association

with risk of HIV infection and rate of mortality, and rate of morbidity with other sexually transmitted diseases (Moodley, 2017). Researchers in their literature review found age and education critical to awareness of HIV serostatus and the risk of HIV transmission due to risky behaviors (inconsistent condom use) for adolescent and adult women at personal, interpersonal, and community levels (Okawa et al., 2018; Omonaiye, Kusljic, Nicholson, & Manias, 2018; Pinchoff, Boyer, Mutombo, Chowdhuri, & Ngo, 2017). Toska et al. (2017) have shown that multiple sexual partners in HIV infected women (aged 18-49 years) correlated with an increase in HIV infection and a decrease in HIV status awareness and concluded the lack of conclusive evidence on the main HIV risky sexual behaviors succumbing individual to HIV infections. The HIV epidemics and prevalence due to risky sexual behaviors were higher for 15-49-years older women compared to men with the same age group (Hegdahl, Fylkesnes, & Sandøy, 2016). The nonawareness of HIV status has been a risk in contributing to the spread of new HIV infections at a scale of 2.9% and an estimated 1.2 million HIV infected Zambian women aged 15-49 years (Qiao, Zhang, Li, & Menon, 2018). Demographic factors such as age, gender, and location are also associated with HIV serostatus at a higher rate of infection for females than males and more prevalence in urban communities than rural communities (Chanda-Kapata et al., 2016); McCarraher et al., 2018).

In a cross-sectional study, Okawa e al. (2018) reported the association of knowledge deficiency to HIV transmission in female adolescents with unknown status and concerns of HIV infected female adults due to nondisclosure of HIV positive status. Their findings suggested a future study for in-depth understanding and more conclusive results on the

level of association of HIV serostatus and demographic factors (age, location, gender). Previous studies suggested having more data for drawing conclusive findings on behavioral determinants and demographic determinants to understand challenges and facilitators of HIV serostatus of Zambian women (Qiao, Zhang, Li, & Menon, 2018). Kharsany and Karim (2016) reported a continuous increase of HIV infection in Zambia women of 15-24 years at a scale of six times compared to men of similar age range and recommended future research focusing on risky sexual behaviors and knowledge gap in HIV serostatus awareness at a community level. Systematic and meta-analyses showed a limitation of research on behavioral factors associated to the HIV status of adolescents in Zambia and other Sub-Saharan Africa because of the studies focus on specific sexual behaviors (Ssewanyana et al., 2018). Moreover, systematic reviews recommended further studies on clinical factors such as linkage to treatment and commencement of antiretroviral medications to increase testing and treating and advance HIV treatment outcomes (Mark et al., 2017; Williams, Renju, Ghilardi, & Wringe, 2017). Therefore, this study assesses the association between the behavioral determinants (condom use, sexual partners, and HIV self-perceived risk), demographic determinants, and clinical determinants (use of HIV services GOV, use of HIV services clinic, and use of HIV services NGO) with HIV serostatus and infer findings for possible recommendations to specific populations of Zambia, such as adolescent women from age 18 to 24 years and adult women from age 25 to 49 years.

Purpose of the Study

The purpose of this study is to assess the association between behavioral and demographic determinants with HIV serostatus in Sub-Saharan Africa and propose preventive measures to reduce the burden of HIV, eliminate new infections, and promote community health of Zambian adolescent and adult women. I plan to understand the association of behavioral and demographic determinants with HIV serostatus and the impact of positive social change specifically on Zambian adolescent and adult women and possibly make a generalizable recommendation for women in similar settings who reside in Sub-Saharan African Countries.

Research Questions and Hypotheses

Research Question 1: What is the association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years?

H_o1: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a1: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

Research Question 2: What is the association between behavioral determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years?

H_o2: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a2: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

Research Question 3: What is the association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years?

H_o3: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a3: There is a statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

Research Question 4: What is the association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years?

H_o4: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a4: There is a statistically significant association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

Research question 5. What is the association between clinical determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24?

H_o5: There is no statistically significant association between clinical determinants and that of HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a5: There is a statistically significant association between clinical determinants and HIV serostatus in Zambian female adolescents from ages 18 to 24 years.

Research question 6. What is the association between clinical determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years?

H_o6: There is no statistically significant association between clinical determinants and that of HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a6: There is a statistically significant association between clinical determinants and HIV serostatus in Zambian female adults from ages 25 to 49 years.

Research Question 7: What is the synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian adolescents from ages 18 to 24 years?

H_o7: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a7: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus in Zambian female adolescents from ages 18 to 24 years.

Research Question 8: What is the synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian adults from age 25 to 49 years?

H_o8: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adults from age 25 to 49 years.

H_a8: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus in Zambian female adults from age 25 to 49 years.

Conceptual Framework of the Study

The World Health Organization's Commission for Social Determinants of Health (CSDH) is a conceptual framework used for this study. The CSDH reviewed extensive evidence on social determinants of health and addressed the behavioral and demographic factors that impact health equity and the community health (Östlin et al., 2011). This conceptual framework addresses population health and understands the community health inequalities at the global level in wealthy and developing countries (Venkatapuram, 2010). Moreover, WHO conceptual framework had been applied in low and middle-income countries and proved sufficient to measure health inequalities and involve policymakers for health promotion of the population health (Guerra, Borde, & de Snyder**,** 2016). Mtenga, Pfeiffer, Tanner, Geubbels, & Merten (2018) have shown that there is a connection between men's involvement in multiple sexual partners and HIV acquiring to the extent women have a higher risk of HIV infection at individual levels. In addition to men's several partners, factors such as women's economic dependence, alcohol drinking behaviors, and lack of financial certainty increased the risk of HIV to women (Mtenga, Pfeiffer, Tanner, Geubbels, & Merten, 2018). The authors created a literature review on the social determinants of HIV health in different social, economic, and demographic settings. The authors revealed that differences in gender, age, and race, sexual behaviors (multiple sexual partners, sex worker, noncondom use), low literacy level,

unemployment, low economic status were risk factors for increased rate of HIV infection and HIV transmission (Araújo, Duarte, & Pereira, 2018).

Nature of the Study

The nature of this study will be an inferential study. For this study, health data on "Survey of HIV Status and Fertility Preference in Sub-Saharan Africa 2009-2010 (ICPSR 36718)**"** will be used for secondary data analysis. The survey included female adolescents (18-24 years) and female adult Zambians (25-49 years). The behavioral, demographic, clinical determinants of HIV serostatus will be assessed. The outcome or the dependent variables will be HIV serostatus: HIV test result, ever tested HIV, ever tested AIDS). The quantitative approach will be used to quantify the behavioral and demographic determinants for testing statistically significant results. I will conduct a multivariate analysis of variance (MANOVA). The quantitative method will further produce quantitative descriptive statistics on HIV serostatus from this demographic health survey data.

Acronyms

Abstain, Be Faithful, Condomize (ABC) strategy: An HIV prevention strategy that combines abstaining from sexual intercourse, being faithful to a one sexual partner, and using a condom during sexual activities (Burman, Aphane, & Delobelle, 2015).

Acquired immune deficiency syndrome (AIDS): HIV with an advanced stage of a compromised immune system leading to the manifestation of opportunistic infections (Centers for Disease Control and Prevention, 2015).

Acquired drug resistance (ADR): the development of mutation due to the replication of the virus while on ART (Omooja et al., 2019).

Antiretroviral therapy (ART): HIV medication used to prevent and treat the virus.

Cluster of differentiation 4 (CD4): glycoprotein instituted on the surface of immune cells like T helper cells, monocytes, macrophages, and dendritic cells that has significant roles in T cell growth and host resistances at the time of the viral infections (Xueyan, Yanping, Jianfeng, & Jiying, 2018).

Deoxynucleic acid (DNA): double-stranded (helix) with sets of nucleotides containing genetic (hereditary) material in almost all living organisms.

Highly active antiretroviral therapy: A combination of antiretroviral treatments, aimed at both targeting various stages of the HIV replication cycle and maximizing suppression of the virus.

HIV incidence: The number of new HIV infections in a specific time and population (Friis & Sellers, 2004).

HIV prevalence: The number of individuals living with HIV in a specific population at a particular time (Friis & Sellers, 2004).

Human immunodeficiency virus (HIV): A virus that infects humans and leads to AIDS (Centers for Disease Control and Prevention, 2015).

Ribonucleic acid (RNA): a single-stranded (helix) nucleic acid present in all living organisms and acts as a messenger to carry instructions from DNA and to synthesize proteins

Serodiscordance: Mixed HIV serostatus in a sexual relationship; that is, one of the partners is HIV positive and the other is HIV negative (Persson, 2013).

Serostatus: The result of an HIV blood test, either positive (referred to as *seropositive*) or negative (*seronegative*). When a person has not taken an HIV blood test, they have *unknown serostatus*.

Sexually transmitted infections: Infectious diseases transmitted through sexual activity.

Sub-Saharan Africa: The region of Africa below the Sahara Desert composed of countries located in East Africa, Central Africa, South Africa, and West Africa (Merdad & Ali, 2018).

Test and treat: An approach to HIV management in populations with an HIV epidemic, in which health workers test people for HIV and immediately start them on ART (regardless of their CD4 cell count; Rozhnova, van, Heijne, & Kretzschmar, 2016).

Assumptions

In this study, I use secondary data from the 2009–2010 *Demographic Health Survey* conducted in Zambia and Nigeria. In selecting this data, I have made the following assumptions: (a) the data are accurate, (b) the survey designers selected the appropriate measures for the variables, (c) experienced personnel collected the data, (d) survey administrators used the participants' native language, and (e) participants provided accurate data. For the current study, I have further assumed that the sample size of 1,441 women is sufficiently large and that the data accurately represent the population of Zambian women (because the survey administrators collected data from both urban and rural groups).

Scope and Delimitations

In this study, I analyze demographic health survey data collected in 2009 and 2010 in Zambia and Nigeria. I explore the demographic, behavioral, and clinical determinants of HIV serostatus in two groups of Zambian women (1,441 women total): adolescents (ages 18–24 years) and adults (ages 25–49 years).

Limitations

There are several potential limitations to this study. First, due to cultural, normative, or religious pressures, participants may not have provided full or accurate data (particularly in the areas of HIV, family planning, current and past sexual practice, previous abortions, and attitudes toward and use of HIV services). Women may have also withheld information due to fear of stigma or sexual violence from a male partner.

Second, the generalizability of this study's findings may be limited because Zambia has a diverse population, and it may have been challenging for survey administrators to collect data from all ethnic groups, particularly those that are isolated. The sample may not include equal numbers of women from urban and rural locations. Therefore, sampling, selection, and recall biases might be introduced at the time of the data collection. Third, because the current study is a cross-sectional study, data are only available from one particular point in time, as opposed to over an extended period.

Significance

This study will contribute possible prevention strategies that target the women population who are at elevated HIV risk and is assumed to have potential relevance in impacting a positive social change specifically for Zambian women and possibly for the Sub-Saharan women with similar settings. The category of variables for this study includes independent variables and dependent variables from a secondary data set "*Survey of HIV Status and Fertility Preference in Sub-Saharan Africa 2009-2010 (ICPSR 36718*)." The independent variables are demographic determinants (age, location, marital status), clinical determinants (use of HIV services GOV, use of HIV services clinic, and use of HIV services NGO), and behavioral determinants (condom use, sexual partners, and HIV self-perceived risk). The dependent variables are HIV test result, ever tested HIV, and ever tested for HIV/AIDS. At the individual level, younger women in urban areas have male sexual partners of higher ages who practice risky sexual behavior (alcohol before sex, unprotected heterosexual interaction). The practice of perilous male sexual partners was disproportionately impacting women in Zambia and

women in other Sub-Saharan countries (Maughan-Brown, Evans, & George, 2016). There is a trend of increased risk of HIV and other sexually transmitted diseases (STDs) during pregnancy. The incidence and prevalence of sexually transmitted infections (HIV, chlamydia, gonorrhea, and syphilis) have increased in pregnant women in Sub-Saharan African and the rest of the world with the higher burden of STD infection for women below 30 years old (Teasdale et al., 2018). At the racial level, the rate of HIV mortality for Black women was eight times compared to White women (Nesbeth, Kandala, Najeeb, Nazneen, & Murthy, 2018). At a global level, the unknown HIV status was reported to cause eight times more deaths for women compared to men, and future research was recommended for identification of individuals with a high risk of HIV acquisition and detect their status and confirm this finding (Platt et al., 2016). I assume this study will provide additional insight in understanding the combination of behavioral, demographic, and clinical factors in determining HIV serostatus for Zambian female adolescent (18-24 years) and female adult (25-49 years) who are in an uncontrolled burden of HIV infection, continuous risk of HIV transmission, and a higher epidemic in era of diminishing trend of HIV in the rest of the world (Agbor, Etokidem, & Ugwa, 2017; Freeman et al., 2012; Goldberg & Short, 2016; Mojola, 2017).

Summary

This chapter provided an overview of the study and literature on HIV/AIDS in Zambian women. Chapter 2 includes a detailed review of the conceptual and empirical research on HIV/AIDS in Zambian women.

Chapter 2

Introduction

In this chapter, a review of the literature deals with behavioral, demographic, and clinical determinants of HIV serostatus in Zambian women. Two age groups participated in the demographic health survey; 18-24-year-old (adolescents) and 25-49-year-old (adult) Zambian women. The literature review was used to assess the association between behavioral, demographic, and clinical determinants of HIV serostatus. The literature review is sectioned into categories including the conceptual framework, HIV awareness of women, HIV in Sub-Saharan Africa, HIV epidemics in Zambia, HIV prevalence in Zambia, HIV prevalence in Zambian women, behavioral determinants of HIV serostatus, clinical determinants of HIV, demographic determinants of HIV, HIV serostatus, and types of HIV testing.

Literature Search Strategy

Secondary data for the previous dissertation topic, *The Immunomodulatory Role of Vitamin D in HIV Infected African American Women,* was researched. The efforts and requests, which lasted approximately four months, for the secondary data from database managing organizations, were not fruitful. During a dataset search in the Walden University databases, Center for Research Quality, under the search word "HIV," a demographic health survey called the *Survey of HIV Status and Fertility Preferences in Sub-Saharan Africa, 2009-2010 (ICPSR 36718)* updated/released by Bankole Akinrinou was located. This prompted the development of a new topic on April 10, 2017. The survey was conducted in Zambia and was posted in the Inter-University Consortium for

Political and Social Research (ICPSR). The dataset was used to address the research questions under the topic, *Behavioral, Demographic, and Clinical Determinants of HIV Status in Zambian Women*. The keyword used to search this secondary data in Walden University's "Center for Research Quality," specifically in ICPSR datasets, was HIV. The literature sources for the current study were searched solely within the Walden University EBSCO search engine. The search keywords were *HIV, HIV/AIDS, HIV Serostatus, HIV prevalence, HIV incidence, Global HIV prevalence, HIV prevalence, HIV incidence, and HIV epidemics, HIV in Sub-Saharan Africa, and HIV in Zambia, Women HIV awareness, and women HIV awareness in Sub-Saharan Africa.* The search modes and expanders (Boolean/phrase, find all my search items, and find any of my search items) under the search options of the EBSCO search engine were pertinent mechanisms that provided tremendous possibilities and opportunities to obtain specific literature and diverse literature types that could be used for the various contents of the literature review.

Conceptual Framework

The World Health Organization's Commission for Social Determinants of Health (CSDH) was the conceptual framework used in this study. The CSDH reviewed extensive evidence on the social determinants of health and addressed the behavioral and demographic factors that impact health equity and community health (Östlin et al., 2011). In the conceptual framework, population health was addressed, and an understanding of the community health inequalities at the global level, both in wealthy and developing countries, was provided (Venkatapuram, 2010). Moreover, the aforementioned

conceptual framework had been applied in low and middle-income countries and proved useful for measuring health inequalities and involving policymakers for health promotion of the population (Guerra, Borde, & De, 2016).

In a cross-sectional sequential explanatory mixed-method design guided by the World Health Organization Commission Social Determinants of Health, the connection between men's involvement with multiple sexual partners, and the extent to which women were at a higher risk of HIV infection were publicized at community and individual levels. In that study, in addition to men's multiple partners, factors such as economic dependence, alcohol-drinking behaviors, and lack of financial certainty increased women's risk of HIV (Mtenga, Pfeiffer, Tanner, Geubbels, & Merten, 2018). The authors conducted a literature review on the social determinants of HIV health in different social, economic, and demographic settings. The authors revealed that differences in gender, age, race, sexual behaviors (multiple sexual partners, sex worker, noncondom use), low literacy level, unemployment, and low economic status were risk factors for increased rates of HIV infection and HIV transmission (Saffier, Kawa, & Harling, 2017). Biomedical researchers dealt with this conceptual framework, which was used to find the causal agents of communicable diseases, control methods by biomedical researchers, identify the risks associated with chronic disease, and minimize the chances of chronic illnesses by epidemiologists (Masic, 2018). The World Health Organization's Commission for Social Determinants of Health influenced the dynamic HIV/AIDS for demographic determinants (gender, age, social network) and behavioral determinants

(sexual partners, condom use) on the rate of HIV infection to people living with HIV (Araújo & Duarte, 2018).

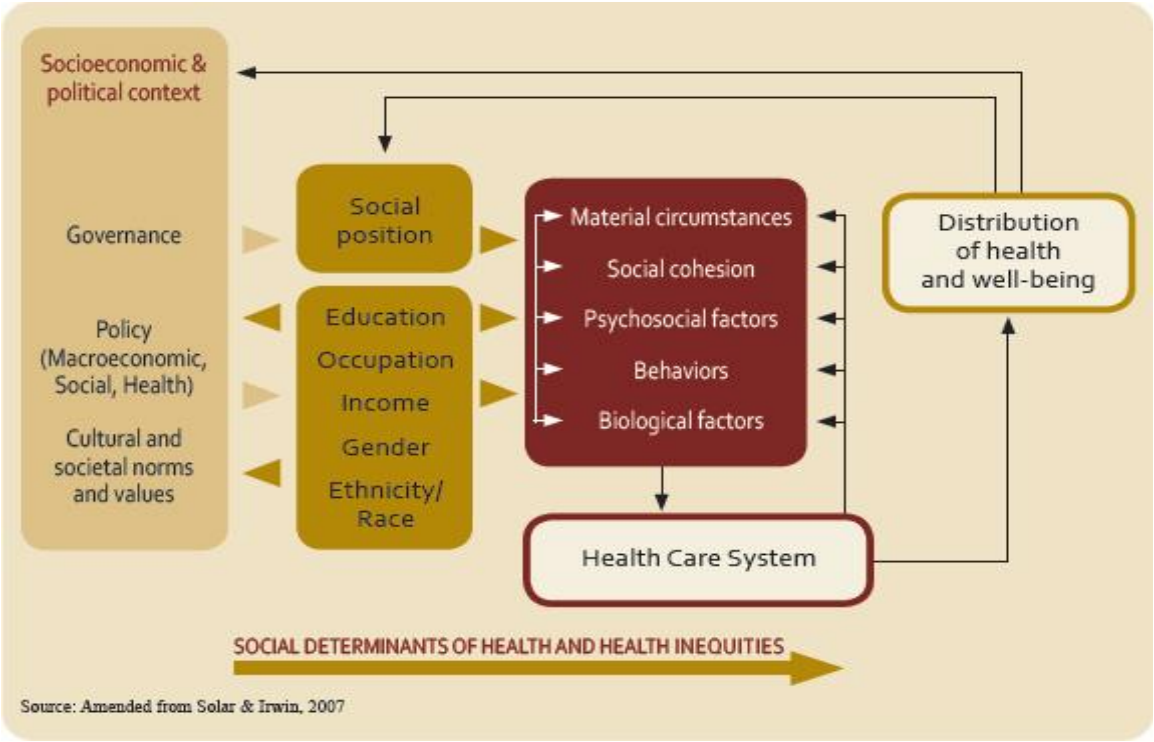

Figure 1. World Health Organization's Social Determinants of Health Conceptual Framework.

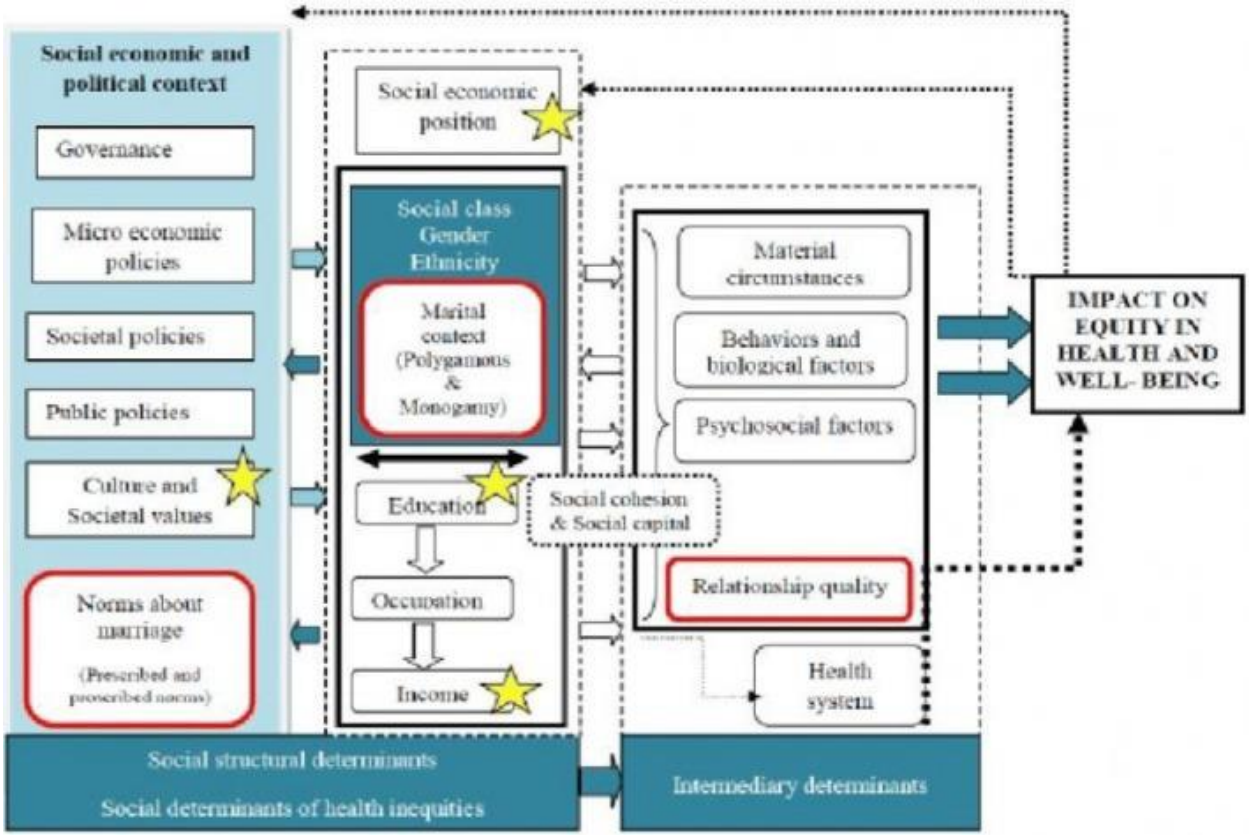

Figure 2. World Health Organization (2010) A conceptual framework for action on the social determinants of health. Geneva: World Health Organization; 2010.

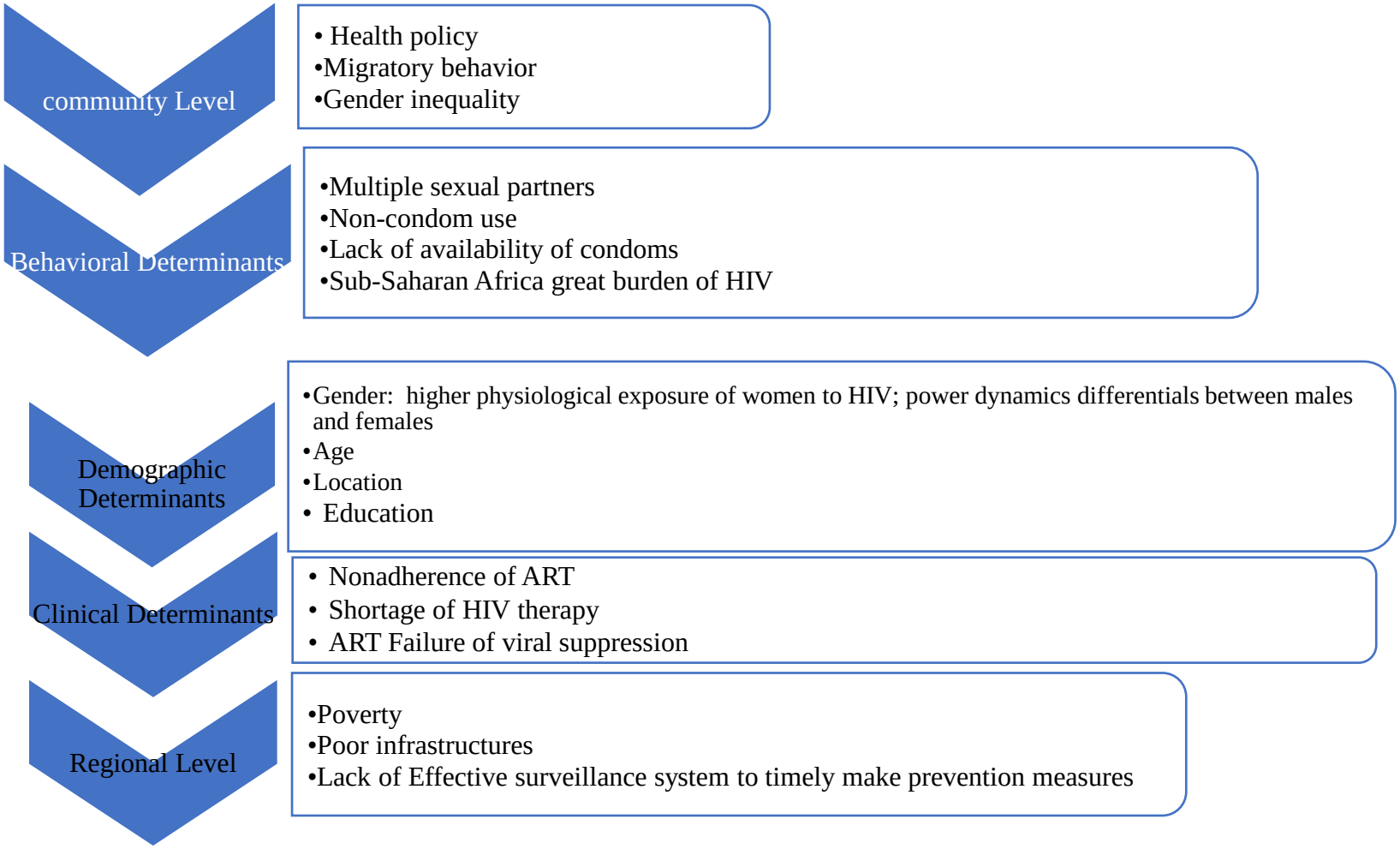

Figure 3. Modified World Health Organization (2010). A conceptual framework for action on the social determinants of health.

Overview of HIV

The human immunodeficiency virus (HIV) is a retrovirus that infects humans and may cause AIDS if left untreated. The HIV-1 is a ribonucleic acid (RNA)-coated virus that lacks deoxynucleic acid (DNA) and is believed to be etiologically responsible for the development of active immunodeficiency syndrome(AIDS) (Trovato, D'Apice, Prisco, & De, 2018). The major types of HIV classification include HIV type-1 and HIV type-2, with differences in genetic features and viral antigens. On the other hand, the immunodeficiency virus has two categories: human (human immunodeficiency virus, HIV) and nonhuman origin (simian immunodeficiency virus, SIV).

According to epidemiological and phylogenetic analyses, the origin of type-1 HIV was the Central African Chimpanzee, and the origin of type-2 HIV was the West African Sooty Mangabey (German Advisory Committee Blood Subgroup, 2016). The type-1 HIV (HIV-1) is globally more predominant, spreads at a faster rate, and varies in genetic structure and antigenicity, compared to type-2 HIV (HIV-2), which has limited distribution and a relatively low rate of progress (Júnior, Andrade, Ferreira, Oliveira, & Pinheiro, 2014). The transmission of HIV-1 from one partner to another mainly occurs via sexual activities, and from an HIV positive mother to her child during labor, delivery, and breastfeeding. HIV can also be acquired by a healthy person, from an infected person, through an injecting-needle exchange, and through occupational needle sticks blood exposure.

The human immunodeficiency virus contains two ribonucleic acids(RNA) and it acquires DNA through reverse transcription, which provides the opportunity to integrate,

assemble, and commence viral reproduction using the host cells as replication machinery. HIV mainly infects and destroys the cluster of differentiation 4 (CD4) immune cells, 60% of which are found in the gastrointestinal tract, and works by disrupting and dislocating the normal flora, progress into the stages of immunocompromising and succumbing the host to opportunistic infections (Williams-Orlando, 2017). The scale of HIV infection varies along gender lines, and in most situations, women are at a higher risk of acquiring the virus. Out of about 1 million HIV positive Zambians, 58% were women, indicating the level of vulnerability of females compared to males. The level of vulnerability was attributed to an uneven physiological risk in a heterosexual relationship and gender-related violence experienced by women (Viljoen et al., 2017).

The awareness of HIV serostatus has paramount importance in controlling new infections. In the United States, of 1.2 million people living with HIV, about 13% are not aware of their infection, which increases new infections, and weakens the public health efforts to slow down HIV prevalence (Wei, Mulatu, Rorie, Hui, & Gilford, 2017). There are three major types of HIV infections. Acute HIV infection (AHI) is characterized by the presence of viremia (the virus in the blood) in human blood, with the absence of specific HIV antibodies, and has a higher potential of infectiousness (Hino et al., 2018). In 2016, the mortality of approximately 35 million people from acquired immunodeficiency syndrome (AIDS)-associated calamities, and 36 million people living with HIV were reported (Word Health Organization, 2017). In an era of prevention and treatment advancements, HIV/AIDS remains a critical cause of death and suffering in the

SSA, accounting for 70% of worldwide emerging HIV infections and AIDS-related mortality and morbidity *(*Akinyemi, 2016).

In the era of highly active antiretroviral therapy (HAART) use and the subsequent changing pattern of HIV transmission, the heterosexual transmission now accounts for greater than 70% of the new cases identified worldwide, with the higher number of HIV infections victims being women (Devadas et al., 2018). HIV initially attaches to the human cells and then multiplies using the CD4 machinery of replication, progressing throughout the body in a seven-stage life cycle process, which informs the target of therapeutic interventions to suppress the virus. The life cycle stages of HIV are binding (attachment), fusion, reverse transcription, integration, replication, assembly, and budding, which are the targets of action of HIV medications (Adamson & Freed, 2010; Chupradit et al., 2017; Lucera et al., 2017; Malik, Chauhan, Rath, Murthy, & Goyal, 2017).

Distribution of HIV

HIV-1 and HIV-2 are the two main types of HIV. HIV-1 is more pathogenic than HIV-2, which is limited in distribution in West Africa (Williams-Orlando, 2017). It also has temporal and spatial distribution. The spatial distribution of HIV is a paradigm that deals with geographical distributions. The temporal distribution of HIV was assessed to understand factors that caused mortality, despite early commencement of antiretroviral therapy (ART), of HIV infected individuals in Nigeria, a Sub-Saharan African country with the highest burden of HIV infections (Akinyemi et al., 2015). Akinyemi (2016) found that the variations in the spatiotemporal distribution of HIV implied that the

direction of the focus of interventions should address high-risk communities and sections of society, to minimize new HIV acquisitions. The HIV prevention strategies were more effective with even distribution of HIV testing sites, including the increase in nonclinical tests and self-testing kits (Chen et al., 2017). Although the higher prevalence of HIV-2 is in West Africa and India, the report by Zbinden, Dürig, Shah, Böni, and Schüpbach (2016) demonstrated that the distribution of HIV-2 in the United States and Europe was due to migrations, and they recommended the consideration of diagnosis for coinfection of HIV-1 and HIV-2.

HIV Serostatus

Awareness of HIV serostatus provided the opportunity to start, link to, and adhere to antiretroviral medications. At a societal level, approximately 30% of new infections were attributed to unknown HIV serostatus persons infecting their sexual companions (Bradley, Vidot, Gaul, Sutton, & Pereyra, 2018). Based on Bradley and colleagues (2018), many public health practitioners highlighted the essentiality of HIV testing, specifically for communities that are excessively impacted by HIV. The National Institute of Health in South Africa suggested the “Seek, Test, Treat, and Retain” HIV prevention strategy for HIV serodiscordant couples (Doherty et al., 2016). Awareness of HIV serostatus has several public health benefits such as effective prevention, reduction of transmission, and managing epidemics. Authors in South Africa reported that about 24% of older adults living with HIV were untested and that efforts focused on self-reported HIV serostatus would lead to interventions, launching treatments, and taking prevention actions (Rohr et al., 2017).

HIV serostatus is classified into HIV positive, HIV negative, unknown serostatus, and mixed HIV serostatus. A mixed HIV serostatus in a couple relationship (serodiscordant couple) refers to one of the partners being HIV positive and the other being HIV negative (Bazzi, Leech, Biancarelli, Sullivan, & Drainoni, 2017). HIV positive refers to the acquisition of the retrovirus in blood, confirmed through serological tests, while the presence of the HIV antibody is an indicator of acquiring the virus in the body (Zemp, Johnson, & Bodenmann, 2019). An HIV negative serostatus confirms the absence of the virus in the blood post serological test, and HIV negativity informs to follow safety measures and practice prevention interventions to avoid new HIV infection and thereby control HIV pandemic (Mayaphi et al., 2018). Mixed serostatus is a condition where one partner is HIV positive, and the other partner is HIV negative within a couple's relationship. Researchers presented a possible explanation for the existence of a mixed HIV serostatus also called HIV seroconcordant couples. For an HIV serodiscordant couple, intervention is required to protect HIV uninfected women and HIV infected men from HIV acquisition from their HIV positive partners, specifically at the time of conception and limit HIV vertical transmission (Joseph et al., 2018). The identification of HIV during acute HIV infection underlines positive serostatus, and the disclosure at this stage will have a profound advantage for the prevention of HIV transmission (Hino et al., 2018). There is an interconnected congruence of HIV incidence, prevalence, and epidemics, and HIV prediction serves to measure incidence from prevalence, prevalence from incidence, outbreaks from the occurrence, and prevalence (Saffier, Kawa, & Harling, 2017).

HIV Incidence

HIV incidence varies with heterosexual partners, ages differences, occupation, demographics and population heterogeneity, and the state of risk associated with exposure to HIV infection. HIV incidence is the result of HIV seroconversion, discourse to the development of a detectable HIV antibody as a result of a response to HIV infection (Marty et al., 2018). Laeyendecker et al. (2018) reported that the implementation of advanced testing techniques was necessary to best estimate HIV incidence from HIV surveillance, and longitudinal cohorts depending on the availability of funds. The extent of risk factors was highly related to the incidence and the rise of HIV epidemics. Typically, injection drug users in the Middle East and North Africa showed elevated new epidemics and a higher prevalence of HIV (Mumtaz et al., 2018). Among the general population in sub-Saharan Africa, young women aged 15 to 24 years are at the highest risk of HIV infection, with 25% of new infections occurring among this group in 2015. Young women's increased risk of HIV acquisition is due to a complex interplay of biological and behavioral factors (Acharya et al., 2018).

Stages and Classification of HIV Infection

CD4 cells are part of the immune system in the white blood cells, whose roles are to fight infections. The CD4 cell (CD4+) counts have a direct relationship with the viral load and CD4+ counts with a threshold of 350 cells/mm^3 and initiate ART for new HIV infections (Govender et al., 2014). In contrast to the threshold of CD4 counts necessary to start HIV therapy, Yah (2017) advised providing treatments to HIV-infected individuals regardless of the CD4 counts, to advance prevention, and to reduce and control HIV-

associated illness, deaths, and opportunistic infection. ART is believed to reduce the viral load and reconstructs the CD4+ T-cells. Researchers in Nigeria showed the failure of immune reconstruction to the CD4 of 500 cells/mm^3 post taking ART for a year. Old age, comorbidity of infections with HIV, and development of immunological nonresponsiveness were the reasons for the failure of the immune revival (Motayo et al., 2017; Udeh et al., 2019).

HIV is categorized clinically and with regards to phases. The Center for Disease Control and Prevention (CDC) classified HIV infection into three clinical stages (A = 10, B = 16, and C = 8), which indicate the stages of disease development (Alvarez-Tostado, Inozemtseva, Aguiñiga, López, & Matute, 2016). The CD4+ count is considered the gold standard for measuring the advancement of HIV infection (Olusola et al., 2017). A study on the pre-AIDS stage of HIV infection indicated that HIV infection was defined by stable CD4+ T-cell counts, the viral load, and the length of the symptomless HIV infection (De Medeiros et al., 2016). HIV-1 has two phases of infection, acute and chronic, and stages during the development of the disease that causes the deterioration or reduction of the helper CD4+ cells, and the hyperactivation of the immune system (Gorenec et al., 2016). Depending on the signs and symptoms in HIV-infected individuals, HIV could be in the form of symptomatic, asymptomatic, and opportunistic infections (Gascón et al., 2018). Anto et al. (2018) recommended proteinuria, a urine test for monitoring HIV, for predicting the extent of HIV infection and the immediate use of HAART to increase CD4 counts for immune declined HIV infected people.

Types of HIV Tests

The most common HIV test types are the HIV Antibody test, HIV Antibody/Antigen combination test, and the HIV Nucleic Acid RNA test (Masciotra et al., 2017; Stafylis & Klausner, 2017). The nucleic acid test identified the presence of HIV RNA in the early stages of HIV infection. Each of the HIV test types has characteristics in terms of sensitivity, specificity, and efficacy, to minimize false results and assure the quality and cost-effectiveness of the tests (Delaugerre et al., 2017). The combination of antibody and antigen (AB/AG) test is more efficient for the detection of primary HIV infection (Ghisetti, Coignard, Allice, & Thoai Duong, 2017). As Fransen et al. (2017) indicated, a combination of testing agents showed the efficacy of specificity and sensitivity of the test to identify acute HIV infection, which was challenging due to asymptomatic signs. For urban and semiurban settings of low- and middle-income countries, Moshoeu, Kuupiel, Gwala, and Mashamba-Thompson (2019) demonstrated the application of home-based HIV testing and counseling, to address clinical determinants associated with HIV testing in high epidemics settings. In Zambia, oral HIV tests are utilized to increase testing coverage (Chanda et al., 2017). There are barriers and facilitators of HIV testing in Zambia (Qiao, Zhang, Li, & Menon, 2018). Rapid antibody tests and advanced medicine and technologies that have shaped HIV testing are the facilitators of HIV testing. Barriers to HIV testing include stigma and discrimination. Qiao and colleagues (2018) further emphasized that improvements in HIV testing allowed HIV status awareness and the beginning of cascades of treatment that preclude

HIV transmission, connection to HIV care, beginning of medication, sustaining to ART, and consequentially suppressing the virus in crucial communities.

Based on experimental evidence, universal testing and treating would progress HIV care and HIV prevention at community levels despite application at a broader scope (Perriat et al., 2018). HIV testing, concomitant with counseling at a community level in Zambia, was successful in teaching the sexual risk (behavioral determinant) for developing HIV awareness and strengthening HIV prevention and HIV care (Witzel, Lora, Lees, & Desmond, 2017). The preference of antigen/antibody tests was higher in effectiveness relative to the detection of an acute HIV infection and was able to reduce the risk of viral transmission and development of resistance. Although these tests were effective in the detection of acute infection, most primary infections can be asymptomatic; thus, retests were recommended after a month for any missed initial infection (Delaugerre et al., 2017). Peter et al. (2017) suggested that health professionals implement coordinated approaches, and familiarize themselves with a wide range of testing areas, with increased scalability and equitability to the HIV tests.

In a wide-scale community HIV testing in Zambia, authors advised on the practice of the right HIV testing algorithm and rigorous training to maximize the testing performance at large scale (Bock et al., 2017). The authors encouraged future research to consider the individuals in the community in ART, who contributed to false-negative results after the implementation of HIV population-based HIV testing.

HIV Prevention Strategies

The purpose of HIV prevention strategies is to reduce new infections, thereby precluding horizontal and vertical transmission, and improve the quality of the lives of people living with HIV/AIDS through HIV interventions, sexuality education programs, policies, and the implementation of evidence-based information (Anderson, Ghys, Ombam, & Hallett, 2017; Sharma, Barnabas, & Celum, 2017; Warren et al., 2018). A brief discussion of each of the HIV prevention strategies follows.

Advocacy on HIV Disclosure

Promoting open sexual communication is part of advocacy efforts to curb the spread of HIV. One of the advocacies relies on the implementation of voluntary medical male circumcision for reduction of HIV incidence (Sgaier et al., 2017). Biomedical HIV prevention deals with the practice of preventing the spread of HIV through vaccinations. Addressing infidelity, through teaching and counseling, in concurrent sexual partners was suggested as an effective HIV prevention strategy (Parker, Pettifor, Maman, Sibeko, & MacPhail, 2014). HIV prevention strategy targets the HIV serostatus of couples. For HIV discordant couples, prevention strategy depended on the concurrent actions of reducing risks and preserving the couple's relationship (Ngure et al., 2016). HIV serostatus disclosure allows for treatment services and facilitates HIV testing for a sexual partner. Both serostatus disclosure and partner testing will contribute to the reduction of new HIV infections and to the ultimate goal of eliminating HIV *(*Adeniyi et al., 2017). Advocacy for the reduction in HIV risk improves social interaction, influences public health policy,

prevents overdoses, and eventually decreases HIV transmissions (Story, Kao, Currin, Brown, & Charles, 2018).

Nutrition for People Living with HIV

The efficacy of ART increases with nutrition that promotes health and helps maintain the immune system. Essential nutrition, such as vitamins, minerals, micronutrients, and vitamin D was extensively studied and recommended as an integral component of HIV prevention. Vitamin D has a traditional homeostatic role in calcium regulation, and most importantly, it immunomodulates the immune system and defends the body from infections that include HIV (Myszka & Klinger, 2014; Mastaglia et al., 2017). Vitamin D deficiency increased the viral load and elevated inflammation with higher HIV related mortality and morbidity for Black Americans compared to White Americans; the severity of HIV was more pronounced for Black American women than White American women (Bobbitt et al., 2015; Coelho et al., 2015; Havers et al., 2014).

Cultural Competency

Perry-Mitchell and Davis-Maye (2017) stressed the use of evidence-based African-centered prevention that is culturally appropriate, to reduce disproportionate new infections and contain the fast spread of HIV in this community. Religion and culture possess taboos, metaphors, and understanding about HIV. The negative perceptions of people in Guinea Bissau, Africa, led to inadequate responses to HIV and succumbed the population to its spread, and increased mortality, and morbidity (Kelly-Hanku, Aggleton, & Shih, 2014; Shaw, McCrimmon, Mergenova, Sultangaliyeva, & El-Bassel, 2017). The integration of culturally relevant approaches proved beneficial for the promotion of HIV

prevention, addressing health behaviors at the individual, community, population, and policy levels (Wilson et al., 2016). From a holistic lens, the comprehensive consideration of the social determinants of health, and the design of strategies to use social capital, improve ART compliance, and address disparities (geographical, race/ethnic, gender, literacy level) will significantly reduce new HIV infections (Bayati, Feyzabadi, & Rashidian, 2017; Gonah & Mukwirimba, 2016; Jun-Fang et al., 2017; Perez-Brumer et al., 2017).

ABC-Strategy (Abstain, Be-faithful, Condomize)

The ABC-strategy promotes HIV-prevention factors such as abstaining, being faithful, and using condoms. The ABC-strategy was practiced in South Africa through advocacy and education showed success in turning the HIV epidemic into a manageable state (Burman, Aphane, & Delobelle, 2015). Eggers et al. (2017) advised implementing sexual abstinence interventions in conjunction with addressing HIV health awareness, understanding the ability to postpone sexual activities, and working on behavioral changes to drinking alcohol. Besides using an HIV prevention strategy, abstinence from sex was a suggestion as alternative protection of teenage pregnancy and other sexually transmitted infections (Mokwena & Morabe, 2016).

The Test-and-Treat Strategy

The test-and-treat strategy is the WHO's guideline to initiate ART for HIV infections, post-diagnosis, to maximize HIV medication and limit subsequent spread **(**Rozhnova, Van, Heijne, & Kretzschmar, 2016). The ART will be initiated instantly, irrespective of the number of CD4+ T-cells, in accordance with the Universal-Test-and-

Treat WHO strategy. Kabogo, Muniu, Wamunyokoli, Musoke, and Songok (2018) recommended UTT to Africa by developing a new strategy to improve medication compliance with children and youth. Similarly, the strategy of seek, test, treat, and retain (STTR) will be more conclusive in reducing HIV morbidity and mortality. The STTR strategy could be used for the general population, and specifically for prisoners (high-risk population), to improve testing, advance medication adherence, and maintain a connection to caring services during incarceration, and after release to society from imprisonment (Golin et al., 2016; Normand, Montaner, Chi-Tai, Zunyou, & Yi-Ming, 2013).

HIV Surveillance

The purpose of HIV surveillance varies across countries and settings. The primary purpose of HIV surveillance in the USA changed from the monitoring of HIV epidemics and the people affected, into assessing the impact of integrating HIV surveillance and field activities and connecting to healthcare providers (Hood et al., 2017; Beltrami, Dubose, Carson, & Cleveland, 2018). HIV surveillance was conducted in the USA based on algorithms categorized into a traditional algorithm (initial HIV antibody immunoassay followed by a Western blot or immunofluorescence antibody test), recommended algorithm (initial HIV antibody followed by HIV-1/2 type-differentiating antibody test), and rapid algorithm (rapid tests on the same date). The rapid diagnostic HIV test algorithm increased the number of people diagnosed, whereas the combination of traditional algorithm and the recommended test algorithms connected more HIV infected people with HIV care services than the traditional algorithm alone (Peruski, Dong, &

Selik, 2018). The HIV-1/2 antibody test was a procedure to detect concomitant infection type-1 HIV and type-2 (HIV-1 and HIV-2) in serological tests (Luo et al., 2019).

An adverse effect active surveillance system was used to monitor the Perspex male circumcision device in seven African countries, and such programs could increase its acceptability when supported with passive surveillance through an electronic information delivery system (Adamson, Tafuma, Davis, Xaba, & Herman-Roloff, 2017). Schwartz et al. (2017) reported, specifically for disproportionately high HIV-burden regions, the need to use a routine viral load monitoring tool to increase treatment efficacy and interoperable the surveillance data for facilitating the exchange of valid information in the healthcare institutions. A study conducted in six Sub-Saharan African countries identified gaps in HIV treatment distribution and delivery strategies, and HIV diagnosis policies to ensure continuity of health care for people living with HIV were recommended (Church et al., 2017). Likewise, a global study by UNAIDS focused on the maximization of antiretroviral drug distribution and increasing HIV testing, to understand the viral load and determine HIV therapy efficacy to meet the 90-90-90 therapy objectives for 2020 (Inzaule et al., 2016). Moreover, Buthelezi, Davidson, and Kharsany (2016) emphasized fast-track HIV surveillance data collection on incidence and prevalence, for resource-limited to understand obstacles, the pattern of spread, and forecast new HIV infections.

Biomedical HIV Prevention

Biomedical HIV prevention intervention includes the use of a condom, treatment, antiretroviral therapy, and male circumcision to reduce the risk of HIV transmission. HIV

treatment options include anti-HIV medications taken pre-and post-exposure, and ART taken after HIV infection occurs. HIV negative individuals use Pre-exposure prophylaxis (PrEP) to prevent HIV infection, and post-exposure prophylaxis (PEP) for individuals who have the probability of HIV exposure or are indeed exposed to HIV positive individuals, to deter HIV transmission (DiStefano & Takeda, 2017). The use of vaccines is ongoing in trials with a prospective promise to be part of the biomedical HIV prevention strategy. The efficacy of biomedical HIV preventions is maximized when used with the combination of a standardized testing for sexually transmitted infection, consistent treatment, use of counseling, and consistent compliance with all prevention strategies (Herbeck et al., 2018). In summary, the biomedical HIV prevention strategy involves the use of condoms, vaccines, ART, PrEP, and PEP for HIV negative individuals, microbicides, male circumcision, and management of STIs.

Herbal Inhibition of HIV

Bunluepuech, Tewtrakul, and WattanapiromsakuL (2016) claimed the first report on the screening of Thai plants to test the inhibitory behavior on HIV-1 protease and provided a suggestion for further study of HIV/AIDS treatments. These researchers reported that one of the 29 cotton extracts, C. gerrettiana, had the highest potential in inhibiting HIV-1 protease activities. In a similar study, Áy, Hunyadi, Mezei, Minárovits, and Hohmann (2019) observed that the herbal medication herbacitrin, extracted from cotton, had inhibited both the HIV-1 reverse transcriptase and integrase and further suggested that herbacitrin had probable efficacy to interfere with the life cycle of HIV at various stages.

Eradication of HIV

The suppression of the HIV-1 by antiretroviral drug therapy enables the establishment of a latent HIV reservoir in the resting CD4 cell memory. Following the aforementioned, HIV is neither targeted by ART nor detected by the immune system, hiding without apparent causes of damages. However, the Cessation of ART allows the regrowth and replication of the provirus (HIV-DNA in the reservoir), and the regrowth of new HIV will not be an easy target with ART in the reservoir (Fryer, Wolinsky, & McLean, 2018). The goal of HIV eradication evolves from overcoming the challenge of eliminating the virus that hides in reservoirs. Researchers are optimistic about the elimination of HIV and recognize the cascades of challenges and barriers to realizing such a breakthrough achievement. Viral latency is one of the most challenging in quantifying latency reversal and depletes the reservoir of provirus that would have the potential to resume infection under favorable pathogenic conditions (Spivak & Planelles, 2016). Bashiri, Rezaei, Nasi, and Cossarizza (2018) described sterilizing cure (stem cell transplant, genome edit, gene therapy) and functional cure (suppressing the viral load and boosting CD4 counts), whereas Pankrac, Klein, and Mann (2017) used therapeutic vaccinations to eradicate HIV. In both cases reversing the latency period provirus (HIV DNA) into detectable levels and eliminating the virus by the "shock and kill" strategy was used; "shock" refers to initiating the resting provirus into transcriptional form and making it detectable, and "kill" refers to eradicating the virus with therapeutic means or immune system.

Herbal medications are potential complements to ART in reducing drug resistance and performing a probiotics' role. According to an author's description, the herbs and medicinal plants are probiotics that increase the number of CD4 cells and initiate the activity of natural killer cells. The increase in the activity of killer cells during pathogenic invasion and attacks, deprives the virus of its replicating abilities, becoming an efficient means to wipe out the pathogens (Williams-Orlando, 2017). Xu et al. (2017) published about a German HIV-infected patient and the success in eradicating HIV in this patient through stem cell transplant and the development of mutant cells resistant to HIV infection after eight years. The success in the German patient signified a cure to HIV. In short, reversing the latency and clearing the provirus could be a target to eradicate HIV through the combination of ART, therapies, and prevention strategies (Margolis, Garcia, Hazuda, & Haynes, 2016). Drug resistance developed from non-compliance of HIV medications, and the use of low dosage medications adds another level of challenge to eradicating HIV.

The acquired drug resistance (ADR) HIV somewhat complicates the efforts to suppress the virus and reduce transmission. When the ADR virus transmits to ART naïve persons, it forms a transmitted drug resistance (De Luca & Zazzi, 2015). Dubé et al. (2018) warned to avoid unrealistic promises for the worldwide elimination of HIV and they instead advised a focus on suppressing HIV to sustainable levels for the millions of people living with HIV/AIDS. Derivatives of natural products were used as a "shock and kill" strategy to target HIV reservoirs, reactivate the latent HIV DNA, and kill them with the immune system or anti-HIV drugs. To date, such approaches have been unsuccessful

in consistently eliminating the reactivated latent HIV DNA (Andersen, Ntie-Kang, & Tietjen, 2018).

The derivatives of natural products are types of latency reversal agents. Maraviroc serves as an antiviral latency-reversing agent, and subsequent interventions are required for eradication of HIV-1, post activation of the viruses in the latency reservoir (Madrid-Elena et al., 2018). When the HIV DNA is in the latency period, the immune system does not recognize the virus, and there is no effect of the anti-viral drugs; consequently, latency reversal agents are needed to implement the "shock and kill" strategy. Antibodies are considered candidates for the eradication of HIV in HIV research. The administration of antibodies is being used as an immunotherapeutic approach to eradicating HIV (Mujib et al., 2017). This immunotherapeutic approach shows an eradication of the HIV infected cells in vitro, and facilitates the development of a combination of antibodies for the prospective effective elimination of HIV infected immune cells and the viral reservoir.

The Algorithm of HIV Prevention

The World Health Organization used the algorithm of HIV prevention for screening, diagnosis, treatment of HIV, and prevention of HIV transmission. The WHO recommended the validation of the HIV-1 testing algorithm for applying rapid diagnostic tests tailored to each country, and retesting HIV-1 positive results before starting ART to reliably assure quality in Sub-Saharan Africa *(*Kravitz et al., 2018). There were several available HIV prevention algorithms. "Simple risk score algorithms" were reliable means to detect individuals with extended high viremia in Sub-Saharan Africa **(**Powers et al., 2018). Harbertson et al. (2017) suggested increasing the specificity and sensitivity of a

rapid diagnostic test, to resolve the causes of the HIV positive diagnosis properly, and save costs in resource-constrained countries. HIV point-of-care testing (HIV-POCT) at non-facility-based community settings should follow the correct testing algorithm to ascertain quality assurance. In HIV-POCT, quality assurance can be proved possible by conducting rigorous training and supervisions to maximize sensitivity (Bock et al., 2017). The rapid diagnostic test does not always show high sensitivity and correct identification of HIV serostatus.

Kufa et al. (2017) determined that random diagnostic tests had low sensitivity, high false negatives, and few false positives in a community setting HIV testing. They associated false negatives with new infections and the initiation of ART. The result of the HIV diagnosis algorithm requires a confirmatory algorithm to ascertain the HIV serostatus of the tested individuals (Kufa et al., 2017). A confirmatory HIV diagnosis rules out the false-negative and false-positive results and determines the appropriate HIV serostatus. The source of false-negative results can be due to misclassification of results and the inability to detect early infections.

HIV diagnosis algorithms that assure quality testing are essential in linking HIV-infected individuals to treatment, and for strategizing prevention interventions. According to Johnson et al. (2017), who corroborated the HIV diagnosis algorithm, HIV testing strategy and retesting practices will prevent false results (false negative or false positive) that could occur due to testing mistakes and new testing procedures. The HIV test algorithm, which applied rapid diagnostic tests, was recommended for Sub-Saharan Africa and other resource-limited areas that lacked laboratory facilities, infrastructure,

and a trained workforce capable of using advanced diagnostic techniques such as immunoassays and immunoblots (Kosack et al., 2017). False HIV results impair prevention efforts, erode the trust of HIV testing centers, and harm individuals who were misled regarding their serostatus. At the community level, false HIV positive results and the initiation of anti-drug therapy endanger public health through unnecessary administration of medication, facilitating an increase of the viral load, and accelerating horizontal and/or vertical transmission (Johnson et al., 2017; Kosack et al., 2017; Bock et al., 2017).

Modeling and Simulation in HIV Prevention

Modeling and simulation is an approach to strategize based on scientific evidence for practical measures that drastically reduce HIV transmissions (Jacobsen & Walensky, 2016). The reduction of HIV transmission targets fundamental thresholds of intervention that consider global HIV treatments and cost-effective standards. A dynamic complex network determined a close similarity between the simulation and actual registry of new HIV incidents, implying the aspects of HIV expansion is a reason to teach male circumcision for HIV prevention in the Sub-Saharan Africa medication scenario (Campain et al., 2017). A simulated study on condom use helped to reduce new infections in HIV serodiscordant couples, and couples with unknown HIV serostatus (Monteiro et al., 2016). Researchers showed feasible modeling would be made using a geographic information system (GIS) simulation to predict HIV distribution effectively, and emphasized the need to conduct future research that outlines epidemics parameters (Shu et al., 2017).

Moreover, computer simulation modeling was a highly efficient tool for making public health and policy decisions (Shu et al., 2017). Computer simulation modeling allows assessing multilevel prevention interventions at downstream and upstream structures and minimizing costs. Minimization of costs could scale up prevention services in low- and medium resource countries. Anderson, Ghys, Omba, and Hallett (2017) strongly supported modeling tools that prioritized the geographical allocation of prevention interventions. This geographic allocation should augment the number of people living with HIV/AIDS (PLWHA), the patterns of HIV transmission among target populations, the specific choice of intervention tailored to the community and location, as indicators to strategize prevention interventions.

Behavioral Determinants of HIV Serostatus

Madiba and Ngwenya (2017) suggested the presence of increased HIV acquisition in women is due to the negative influence of male dominance leading to unsafe sexual practices. Mobility in the rural East Sub-Saharan African countries is pronounced with higher HIV sexual risk to women compared to men, associated with the exposure of unsafe sexual practices, induced by sexual violence and forced sex (Camlin et al., 2018). In Zambia and other Sub-Saharan African countries, adolescent HIV positive women who were with/without HIV medication were more prone to conceive children than adolescent HIV negative women, and an opposite trend was noted for women over 35 years old (Marston, Zaba, & Eaton, 2018). The increase in the number of sexual partners created pressure in living conditions of families and harmful effects in contracting HIV

and other sexually transmitted infections for a large percentage of adolescent women living with HIV in sub-Saharan Africa (Zgambo, Kalembo, & Mbakaya, 2018).

Condom use had several barriers in Sub-Saharan Africa. The availability of condoms, the consistent use of condoms, the types of condoms (efficacy of the condom), the cost of condoms, male willingness to pay for condoms, and the need to engage in HIV medication while using condoms were in strong association with women exposure to HIV infections (Nehl, Elifson, DePadilla, & Sterk, 2016; Evans et al., 2019). As reported by Zhang, Jemmott, and Heeren (2017), even though improvement in communication contributed to the ease of condom use and reduced sexual partners' instability in couple relations. Furthermore, the determination of fertility preferences was a challenging decision in Zambian women and the other Sub-Saharan Africa women. The current data were inadequate in determining the fertility preferences of HIV infected Zambian women to better understand the trend of HIV epidemics (Yeatman et al., 2016).

Demographic Determinants of HIV Serostatus

Shisana et al. (2016) suggested having a focus on unmarried populations to advocate for HIV prevention. The unmarried individuals had shown low social coherence and unstable sexual partnering that would increase the risk of HIV transmission. The HIV risk had an increased rate for unmarried individuals, especially people with low socioeconomic status and low literacy levels. In Sub-Saharan Africa, the study on gender inequality has shown an HIV prevalence disparity between females and males (Sia et al., 2016). In most of the SSA countries under this study, discrepancies in age, marriage situation, and careers contributed to higher HIV prevalence for females compared to

males. Besides, the relationship between jobs and education status, and the site of the HIV testing, impacted the effectiveness of volunteer counseling and testing efforts (Bibiana, Emmanuel, Amos, Ramsey, & Idris, 2018); whereas inadequate understanding of HIV became an obstacle to HIV testing and HIV serostatus cognizance (Nabukenya & Matovu, 2018). The demographic determinants (age difference between women and men and marital status) contributed to differences in HIV prevalence and the associated sexual risks to HIV infections between women and men (Sia et al., 2016). Knowledge of HIV serostatus was found critical for married couples to facilitate joint education and the prevention of HIV in marital relations (Musheke, Merten, & Bond, 2016).

Clinical Determinants of HIV Serostatus

Pilgram et al. (2018) noted an emphasis on the benefits of avoiding the negative perceptions of healthcare professionals by providing training on the potential use of pre-exposure prophylaxis (PrEP) for preventing new HIV infection, and the need and colleagues for improving the PrEP delivery system in adolescent and adult women. Pilgram et al. (2018) also advised taking clinical steps of increasing PrEP accessibility and healthcare delivery to prevent the community from horizontal and vertical HIV transmission. The initiation of anti-HIV drugs (PrEP) for naïve ART persons had shown a significant role in reducing the acquisition of HIV infections (Pilgrim et al., 2018), and the use of PrEP had shown increased recipients among the adult population with durable acting PrEP medications (Krogstad et al., 2018). Besides, Masters et al. (2016) revealed that the promotion of HIV self-testing to pregnant and postnatal women might warrant cognizance of HIV status to men, and could maximize couple HIV self-testing. The use

of HIV services is one of the indications of HIV medication compliance. Part of the HIV infected individuals at community clinics in Sub-Saharan Africa discontinued their medications for unknown reasons (Asiimwe, Kanyesigye, Bwana, Okello, & Muyindike, 2016). The cessation of HIV medications could jeopardize the health of HIV-infected individuals and might result in HIV transmission to the community.

Behavioral, Demographic, and Clinical Determinants of HIV Serostatus

Authors stated that demographic and behavioral factors predicted HIV, ethnicity, sexual partners, and sexual partners' behaviors were tested in the prediction model used for improving electronic health archives (Dube, Marshall, Ryan, & Omonijo, 2018). Adeniyi et al. (2017) reported a significant association between adolescents (18-24), and HIV serostatus that include demographic (age, gender, employment, education, marital status, location), behavioral (attitude towards sexual partner, HIV disclosure), and clinical (ART adherence) determinants of HIV serostatus disclosure. Youth who had multiple sex partners and persons with drinking behaviors were more likely to non-disclose HIV status in their sexual relationships. Sexual acts, marital status, and HIV care services were risk factors for adolescent Zambians to the spread of vertical and horizontal HIV infections (Okawa et al., 2018). A lack of guarantee in food security played a role in the increase of HIV risk and susceptibility to HIV-infected women (53% of the study participants) younger than 24, with education levels lower than high school (Nyirenda, 2018). The rate of HIV varied with gender, age, and race (demographic determinants), while sexual relations with multiple partners and sexual practices of not using condoms amplified the rate of HIV infection; macro-determinants of HIV signaled an impact in the spread of the

HIV epidemics (Araújo & Duarte, 2018). As opposed to Araújo and Duarte (2018), Agbor, Etokidem, and Ugwa (2017) reported a high prediction of HIV serostatus disclosure with the association of ages, marriage status, and locations.

Social factors, such as education, wealth, and media exposure, determined the level of knowledge and awareness and affected the behavior of women regarding STDs and HIV/AIDS (Rana, 2016). The promotion of health education was suggested to increase HIV awareness and reduce the erroneous perceptions of HIV as being a curse that is limited to Africa (Tecle & Andrasik, 2015; Zainiddinov & Habibov, 2016). The increase in general literacy levels and higher HIV health literacy was a demographic determinant that improved HIV awareness. Vanamail, Sehgal, and Kriplani (2014), and Vieira et al. (2017) concluded that education level was a critical demographic determinant for the prevention of mother to child transmission for people living with HIV. As a result of a qualitative study in Zambia, Musheke, Merten, and Bond (2016) noted that addressing the differences in gender power dynamics and improving couple's HIV test centers could guarantee the development of shared awareness and acceptance, and management of the HIV serostatus within heterosexual relations.

HIV in Sub-Saharan Africa

The lack of a contemporary HIV testing algorithm for the identification of an acute HIV infection with the absence of specific HIV antibodies is a potential risk to resource-limited regions of the world, including Sub-Saharan Africa. Public health practitioners require timely diagnosis that confirm the presence of HIV at the earliest stage, and design treatments and preventions to reduce the spread of the virus, disrupt the

chain of infection, and promote HIV health in communities of resource-limited regions (Hino et al., 2018). In Zambia, HIV acquisition in a heterosexual HIV serodiscordant couple is risky for both men and women who are HIV negative, and the level of risk increases for women (Joseph Davey et al., 2018). Bazzi, Leech, Biancarelli, Sullivan, and Drainoni (2017) inferred the use of pre-exposure prophylaxis (PrEP) for HIV uninfected women in the USA who have couples an HIV serodiscordant men (an HIV infected man to secure safe conception and prevent horizontal and vertical transmission of HIV. The differential power dynamics in a heterosexual relationship in most of Sub-Saharan Africa disproportionately burdened women with HIV risk associated with intimate partners' violence (Pulerwitz, Mathur, & Woznica, 2018).

Sub-Saharan Africa is a region with the highest burden of HIV. In 2013, of 3.2 million children who were living with HIV, the majority was from Sub-Sahara Africa. The routes of HIV transmission were from mothers to their children through prenatal, delivery, labor, and breastfeeding practices (Tadesse, Foster, & Berhan, 2015). Despite the disproportionate burden of HIV, Sub-Saharan Africa uses rapid HIV tests, which have no specificity for early detection, and provide false negative results to potentially infectious persons. The limitation to rapid HIV tests is due to low cost, and the use of HIV tests with high specificity and sensitivity was not possible due to the price and low availability in Sub-Saharan Africa (Mayaphi et al., 2016).

HIV in Zambia

The prevalence of HIV/AIDS in Zambia was much higher in adolescent girls (15-19) due to associated factors such as stigma, shamefulness, religion, culture, negative

social media messaging, and conditions of infections (Mackworth-Young et al., 2017). The HIV prevalence for persons 15-64 years rated at 12.3%, 10.6%, and 14.6% in Zambia, Malawi, and Zimbabwe, respectively. As part of the prevention program, global and timely HIV therapy was recommended for those infected, those aware of their status, and those who disclosed their status (Mwenge et al., 2017). Stigma and discrimination, including healthcare provider stigma, were a particularly salient barrier. Improving knowledge, social support, and acknowledgment of FSWs and women's role in society emerged as facilitators to testing. Interventions to improve HIV testing among FSWs in Zambia will need to address barriers and facilitators at multiple levels, to be maximally effective (Chanda et al., 2017). Zambian women, 10-14 years in Sub-Saharan Africa were in amplified exposure to new HIV acquisition. The low general education level, lack of sexual education, and cultural barriers in having parent-daughter conversations on the risk of HIV contributed to the continuation of new HIV infections (Butts et al., 2018).

HIV prevalence was 9.8% in urban Zambia compared to the rural communities where the prevalence is 5.0%; there existed a double risk in urban inhabitants than their rural counterparts (Chanda-Kapata et al., 2016). In communities with higher HIV prevalence, male circumcision helped reduce the rate of infection and minimized the cost of HIV prevention (Awad et al., 2015). The general trend in Sub-Saharan Africa was an increase in the rates of new HIV infections in adolescent women, which was attributed to the association of biological and behavioral determinants. The use of condoms was one of the prevention methods to reduce the risk of biological and behavioral determinants to new HIV infections (Acharya et al., 2018). Hegdahl, Fylkesnes, and Sandøy (2016) stated

that the constant vulnerability of women to HIV compared to men could indicate the roles of physiological characteristics in Zambia and other Sub-Saharan African countries. Besides, there was an increase in the prevalence ratio of HIV in younger Zambian women compared to younger Zambian men (Hegdahl, Fylkesnes, & Sandøy, 2016), and the overall trend implied 25% of new HIV acquisition occurred through individuals other than sexual partners (Kamali et al., 2015).

Summary and Conclusions

In Chapter 2, the World Health Organization's Commission for Social Determinants of Health assessed the disproportionate HIV burden in Zambian women related to gender, age, disparities with male partners, and unsafe sexual behaviors. The different types of HIV serostatus (HIV positive serostatus, HIV negative serostatus, unknown HIV serostatus) indicated an association with the risk of HIV infection, rates of mortality, and rates of morbidity with other sexually transmitted diseases (Moodley, 2017).

The association of HIV serostatus (HIV positive serostatus, HIV negative serostatus, unknown HIV serostatus) with behavioral determinants was reviewed. Scholars of HIV, in systematic reviews, indicated the importance of demographic determinants such as age and education, HIV serostatus awareness, and the level of risk to HIV transmission because of non-condom use. Previous studies lacked conclusive findings on the levels of association of HIV serostatus with key demographic determinants (age, location, gender). Systematic reviews also recommended additional study-linkage to treatment and the commencement of antiretroviral therapy. The findings

in this study aim to contribute to the literature, with inferences on the data that can be generalized to Zambian women (adolescent women ages 18 to 24 and adult women from ages 25 to 49). In Chapter 3, the methodology and analysis of the present study are discussed.

Chapter 3

Introduction

This study assessed the association between demographic, behavioral, and clinical determinants of HIV serostatus for Zambian adolescent women (18–24 years) and Zambian adult women (25–49 years). The purpose of this study was to minimize the HIV epidemic among Zambian women, recommend possible measures to reduce new HIV infections and to promote the quality of life of Zambian women living with HIV/AIDS. The research strategy involved comprehending the association of key behavioral, demographic, and clinical determinants of HIV serostatus to affect positive social change among Zambian women and to draw possible generalizations to women with similar settings in the other Sub-Saharan African countries. In what follows, I included a description of the secondary data analysis used in the study's research design and rationale. Following the research design and rationale section, I provided a brief description of the research methodology, which contains the study population, sampling and sampling procedures, and instrumentation and operationalization of constructs. Finally, I presented the data analysis information, ethical procedures, chapter summary, and transition to Chapter 4.

Research Design and Rationale

This dissertation research is an inferential study. The quantitative analysis would apply to secondary data from a demographic health survey. The research used the sample of women of 18 to 49 years old; the findings offered generalizations about the general population of Zambian women and possibly about communities in the other Sub-Saharan

African countries with similar settings. The independent variables were demographic factors (age, location, language, education, religion, and marital status), clinical factors (use of HIV services and attitudes toward use of HIV services), and behavioral factors (sexual activity; sexual partners; condom use; fertility preferences; attitudes toward and knowledge about HIV). The dependent variables were HIV serostatus and ever tested for HIV/AIDS. A cross-sectional survey design assessed the association between the independent variables and the dependent variables since the demographic survey data were collected at one point in time. A cross-sectional design is appropriate for the research questions focused on the association of independent variables with dependent variables from data collected by an on-site questionnaire for generalizing from a sample to a population (Cresswell, 2014).

In a technological era where archived data sets are abundantly available by downloading various publicly available databases and other resources through formal requests, a secondary data analysis saves time and it is cost-effective (Tripathy, 2013).

Methodology

The researcher used a quantitative method to conduct the study.

Population

The study population included Zambian women 18 to 49 years old who were permanent residents in 8 provinces. The target population was from a demographic health survey conducted between 2009 and 2010. The demographic health survey contained 1,4441 responses from Zambian women aged 18 to 49 years old about issues of fertility

preferences; HIV status; fertility preferences; attitudes toward and knowledge about HIV, and attitudes toward and use of HIV services (Bankole, 2017).

Sampling and Sampling Procedures

The sampling strategy divided each of the nine Zambian provinces Zambia into enumerative equal areas, based on the 2000 Zambian population and housing census. All households had the chance to be selected as part of the Zambian Demographic Health Survey (ZDHS) sample. The sampling procedure stratified the ZDHS sample into urban and rural areas. There were 18 sampling strata from the nine provinces. The samplers selected the EAs (enumeration areas) independently for all stratifications, beginning with the Census Supervisory Area (CSA) level and moving to the EA level. The sampling frame included Zambian women age 18 to 49 years old. The sampling frame excluded females younger than 18 years old, women older than 49 years old, and all males of any age.

The research sample was sub-sampled from the 2007 Zambia Demographic and Health Survey (ZDHS). The sample was designed to provide specific indicators, including reproductive health indicators and HIV prevalence for each of the nine provinces in Zambia. Sorting the sample frame followed an implicit stratification and proportional allocation based on the geographical/administrative order and by using a probability proportional to size. Stratification sampling was completed before the selection of the sample (Croswell 2014).

Specific procedures guided the sample selection. Households were listed from 319 EAs. From each EA, an average of 25 households was selected through equal

probability systematic sampling. Out of the average total of those EAs, the ones in Northern province and Lusaka province were sub-sampled that shall be used for this study. I used a power analysis to determine sample size. The power analysis to determine the sample size included the justification for the effect size, alpha level, the power level, and the citation of the source for calculating the sample size.

Using Archival Data

This study used archival data from the Walden University website. The data source for this study was the Inter-University Consortium for Political and Social Research (ICPSR) Datasets. The ICPSR datasets were accessed through Walden University under Research and Quality for Research. Regarding the Instrumentation and Operationalization of Constructs, an on-site questionnaire was the basic data collection of the ZDHS. The operationalization of the ZDHS data indicated the unweighted data but in the form of a weight variable (WGT) which was used directly in the study analysis. The scores represented numeric values for the independent variables (behavioral, demographic, and clinical determinants of HIV serostatus). There was no available operational definition for each of the variables. The on-site questionnaire was a vital instrument used for these survey data. I plan to use SPSS statistics 25 software for the data analyses. The study dataset indicated the availability of the data suitable for analyses in SPSS format. The restated research questions and the hypotheses are presented in the next section.

Research Questions and Hypothesis

Research Question 1: What is the association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years?

H_o1: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a1: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

Research Question 2: What is the association between behavioral determinants and HIV serostatus of Zambian female adults from age 25 to 49 years?

H_o2: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a2: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

Research Question 3: What is the association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years?

H_o3: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a3: There is a statistically significant association between

demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

Research Question 4: What is the association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years?

H_o4: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a4: There is a statistically significant association between demographic determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years.

Research question 5. What is the association between clinical determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24 years?

H_o5: There is no statistically significant association between clinical determinants and that of HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a5: There is a statistically significant association between clinical determinants and HIV serostatus in Zambian female adolescents from ages 18 to 24 years.

Research question 6. What is the association between clinical determinants and HIV serostatus of Zambian female adults from ages 25 to 49 years?

H_o6: There is no statistically significant association between clinical determinants and that of HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a6: There is a statistically significant association between clinical determinants and HIV serostatus in Zambian female adults from ages 25 to 49 years.

Research Question 7: What is the synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian adolescents from ages 18 to 24? years

H_o7: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adolescents from ages 18 to 24 years.

H_a7: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus in Zambian female adolescents from ages 18 to 24 years.

Research Question 8: What is the synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian adults from ages 25 to 49 years?

H_o8: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adults from ages 25 to 49 years.

H_a8: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus in Zambian female adults from ages 25 to 49 years.

Data Analysis Plan

For this study, a data-driven approach will be applied to answer the research questions by using the Zambia demographic health survey data available in the Walden University Inter-University Consortium for Political and Social Research (ICPSR)

databases (Cheng & Phillips, 2014). This study utilized quantitative variables. The outcome variables were HIV serostatus (HIV positive, HIV negative, unknown status, and serodiscordant status). The independent variables were a sexual activity, number of sexual partners, condom use, fertility preferences (behavioral determinants), age, gender, location, marital status, education, employment (demographic determinants), clinical services, and medication adherence (clinical determinants).

The confounding variables in these survey data were handled using a proportionate stratified sampling. The proportionate stratified sampling dealt with the selection of the study participants based on the stratum of the sampling frame for appropriate sampling representation (Salazar, Crosby, & DiClemente, 2015; Bankole, 2017). The Statistical Package for the Social Sciences (SPSS) version 25 was used for all the analyses and statistical significance tests with a p-value ≤ 0.05.

Preparing the Data

Cleaning data

The most common source of errors was missing data, coding errors, errors in data entry, inconsistency in responses, extreme outliers, abnormal distributions, and non-linear association among quantitative variables (Warner, 2013; Borkotoky & Unisa, 2014). Descriptive statistics for quantitative variables help to detect those errors by providing frequency tables, scatterplots, histograms, and observing whether the distribution shapes are approximately normally distributed (Warner, 2013). SPSS (version 25) was used for analysis and managing missing data by list-wise or pairwise deletions (Warner, 2013).

Multivariate analysis of variance (MANOVA) statistical tests was used to test this study's hypotheses.

This study contained multiple independent variables and three dependent variables. A multivariate analysis of variance (MANOVA) was used to test these hypotheses. As enumerated by Warner (2013), the statistical analysis procedure steps for multivariate analysis of variance were followed to assess the association between the independent variables and dependent variables of this study. In addition, an extensive description of the statistical significance testing is provided in the result section of this dissertation, and the meanings of these test results are discussed in depth.

There was no rationale for the inclusion of potential covariates for this two-way MANOVA. Data analyzers were required to observe the normal distribution (to transform or remove outliers if they exist); linearity (deviation from linearity compromises the analysis); homogeneity of variances (test of Homoscedasticity); homogeneity of variances and covariances (testing the homogeneousness of the dependent variables); and proceeded to the analyses (Warner, 2013).

Threats to Validity

External Validity

The survey data were collected using an equal probability of systematic sampling. Therefore, the probability of systematic sampling provided equal opportunity for selection; then, the sample of the survey was the representative of the population. This survey description clearly stated all households in Zambia had an equal likelihood of being selected as a part of the Zambia Demographic health survey sample with the

deliberate exclusion of restricted areas, such as military camps (Bankole, 2017). Therefore, the sample of community survey (Zambia demographic health survey) was representative of the population since each household had the probability of being selected from the whole population (Creswell, 2014).

Internal Validity

This Zambia demographic health survey applied proportional stratified sampling which was an accurate description of the broader population. The standardized questionnaire used further confirmed the internal validity of survey data (Babbie, 2017). After the survey data collection, the researchers removed temporary variables and labeled those variables with "temp" in the variable label. Some original variables in the dataset contained invalid values and discrepancies in the original variables. Those invalid variables and variables with differences were recorded. The data collector research institute advised me to use the recoded variables (cleaned data) for analysis and comparing cross-checking the recoded variables with the original ones would be necessary to perform data cleaning before performing analyses for this study (Bankole, 2017).

Ethical Procedures

Ethical procedures were the formal requirements for conducting this study. I gained access to the archived data through the Institutional Research Board at Walden University. Institutional permissions, IRB approval, and the IRB approval numbers will be described in the final dissertation. The data description indicated the data were anonymous and personal information identifications were excluded to protect the

anonymity of study participants. The dataset is publicly available and could be accessed through a formal request to the Guttmacher Center for Population Research Innovation and Dissemination who prepared this public-use dataset. The research institute provided no incentives for participation in the survey.

Summary

A demographic survey data collected in Zambia from 2009–2010 assessed the association between behavioral, demographic, and clinical determinants of HIV serostatus in Zambian women. The collection of demographic health survey data was from 1,4441 Zambian women 18-49 years old; the survey included questions about issues of fertility preferences; HIV status; fertility preferences; attitudes toward and knowledge about HIV; and attitudes toward and use of HIV services. Demographic variables included age, location, native language, education, religion, and marital status. Independent variables included behavioral factors (condom use, sexual partners, fertility preferences, sexual activity, and attitudes toward and knowledge about HIV), demographic factors (age, location, native language, education, religion, and marital status), and clinical factors (use of services and attitudes toward, attitudes toward and use of HIV services). Dependent variables were HIV test result, ever tested for HIV, and ever tested AIDS. HIV positive (HIV concordant positive couple, HIV discordant male, and HIV discordant female): each indicates HIV seropositivity. HIV negative (HIV concordant negative couple, HIV discordant male, and HIV discordant female): each shows HIV seronegativity.

Chapter 4: Results

Introduction

The purpose of the study was to investigate the association between dependent variables measuring HIV serostatus (whether participants know their HIV test result, ever tested for HIV, and whether participants had ever tested for AIDS) behavioral determinants (participants' sexual partners, condom use, and self-perceived HIV risk), demographic determinants (participants' location, education, and marital status), and clinical determinants (participants' use of government services, clinic services, and NGO services) for Zambian women aged 18–49 years using secondary data collected in 2009–2010. I compared adolescents (aged 18–24 years) to adults (aged 25–49 years) to determine whether there were differences in the associations between behavioral, demographic, and clinical determinants and HIV serostatus between these age groups.

The research questions that directed the study, along with the corresponding null and alternative hypotheses, were as follows.

Research Question 1

What is the association between behavioral determinants and HIV serostatus of Zambian women aged 18–24 years?

$H1_0$: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian women aged 18–24 years.

$H1_a$: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian women aged 18–24 years.

Research Question 2

What is the association between behavioral determinants and HIV serostatus of Zambian women aged 25–49 years?

$H2_0$: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian women aged 25–49 years.

$H2_a$: There is a statistically significant association between behavioral determinants and HIV serostatus of Zambian women aged 25–49 years.

Research Question 3

What is the association between demographic determinants and HIV serostatus of Zambian women aged 18–24 years?

$H3_0$: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian women aged 18–24 years.

$H3_a$: There is a statistically significant association between demographic determinants and HIV serostatus of Zambian women aged 18–24 years.

Research Question 4

What is the association between demographic determinants and HIV serostatus of Zambian women aged 25–49 years?

$H4_0$: There is no statistically significant association between demographic determinants and HIV serostatus of Zambian women aged 25–49 years.

$H4_a$: There is a statistically significant association between demographic determinants and HIV serostatus of Zambian women aged 25–49 years.

Research Question 5

What is the association between clinical determinants and HIV serostatus of Zambian women aged 18–24 years?

$H5_0$: There is no statistically significant association between clinical determinants and HIV serostatus of Zambian women aged 18–24 years.

$H5_a$: There is a statistically significant association between clinical determinants and HIV serostatus of Zambian women aged 18–24 years.

Research Question 6

What is the association between clinical determinants and HIV serostatus of Zambian women aged 25–49 years?

$H6_0$: There is no statistically significant association between clinical determinants and HIV serostatus of Zambian women aged 25–49 years.

$H6_a$: There is a statistically significant association between clinical determinants and HIV serostatus of Zambian women aged 25–49 years.

Research Question 7

What is the synergistic association between behavioral, demographic, and clinical determinants and HIV serostatus of Zambian women aged 18–24 years?

$H7_0$: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and HIV serostatus of Zambian women aged 18–24 years.

$H7_a$: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and HIV serostatus of Zambian women aged 18–24 years.

Research Question 8

What is the synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian women aged 25–49 years?

$H8_0$: There is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and HIV serostatus of Zambian women aged 25–49 years.

$H8_a$: There is a statistically significant synergistic association between behavioral, demographic, and clinical determinants and HIV serostatus of Zambian women aged 25–49 years.

Data Collection

I obtained the secondary data from the ZDHS identified via the Walden University database. Data collected for the ZDHS came from participants in the Northern and Lusaka Provinces in 2009–2010.

Results

Demographics

The sample from the ZDHS consisted of 1,441 women aged 18–49 years from Northern and Lusaka Provinces who were permanent residents of Zambia. Out of these participants, 442 (31%) were adolescents, and 999 (69%) were adults. Regarding location, 641 participants (44.5%) were from urban locations, and 800 (55.4%) were from

rural locations. Of those aged 18–24 years, 181 were urban, and 211 were rural; of those aged 25–49 years, 393 were urban, and 485 were rural. Tables 1–3 show cross-tabulations of several of the variables.

Table 1

Cross-tabulation of Education × Location for Zambian Women Aged 18–49 Years

	Location		
Education	Urban	Rural	Total
Primary	227	432	659
Secondary	267	185	452
Higher	43	16	59
N/A	40	74	114
Total	577	707	1,284

Note. N/A = not available response.

Table 2

Cross-tabulation of Marital Status × Location for Zambian Women Aged 18–49 Years old

	Location		
Marital status	Urban	Rural	Total
Widowed	45	32	77
Divorced	25	23	48
Separated	24	31	55
N/A	481	618	1,099
Total	575	704	1,279

Note. N/A = not available response.

Table 3

Descriptive Statistics for Dependent Variables and Clinical Determinants of Zambian Women Aged 18–49 Years

Government Services × Clinic Services and NGO services	*M*	*SD*	*n*
	HIV test result		
Yes × Yes			
Yes	18.76	34.517	41
No	32.62	41.405	168
Total	29.90	40.448	209
Yes × No			
Yes	32.12	41.200	154
No	36.68	42.209	816
Total	35.96	42.063	970
No × Yes			
Yes	2.00	0.000	3
No	32.92	42.177	25
Total	29.61	40.940	28
No × No			
Yes	2.00	—	1
No	44.93	44.698	14
Total	42.07	44.475	15
No × All			
Yes	2.00	0.000	4
No	37.23	42.908	39
Total	33.95	42.106	43
N/A × N/A			
N/A	88.00	0.000	7
Total	88.00	0.000	7
	Ever tested HIV		
Yes × Yes			
Yes	1.00	0.000	41
No	1.00	0.000	168
Total	1.00	0.000	209
Yes × No			
Yes	1.00	0.000	154
No	1.00	0.035	816
Total	1.00	0.032	970
No × Yes			
Yes	1.00	0.000	3
No	1.00	0.000	25
Total	1.00	0.000	28

(table continues)

Government Services × Clinic Services and NGO services	*M*	*SD*	*n*
No × No			
Yes	1.00	—	1
No	1.00	0.000	14
Total	1.00	0.000	15
N/A × N/A			
N/A	2.00	0.000	7
Total	2.00	0.000	7
N/A × All			
N/A	2.00	0.000	7
Total	2.00	0.000	7
	Ever tested AIDS		
Yes × Yes			
Yes	1.00	0.000	41
No	1.00	0.000	168
Total	1.00	0.000	209
Yes × No			
Yes	1.00	0.000	154
No	1.00	0.000	816
Total	1.00	0.000	970
No × Yes			
Yes	1.00	0.000	3
No	1.00	0.000	25
Total	1.00	0.000	28
No × No			
Yes	1.00	—	1
No	1.00	0.000	14
Total	1.00	0.000	15
N/A × N/A			
N/A	2.00	0.000	7
Total	2.00	0.000	7
N/A × N/A			
N/A	2.00	0.000	7
Total	2.00	0.000	7

Note. NGO = nongovernmental organization.

The sample for this study consisted of 1251 Zambian adolescent women aged 18-24 and 190 Zambian adult women aged 25 - 49. Figure 4 shows the frequencies for the HIV serostatus test for Zambian women aged 18–24 years (see figure 4).

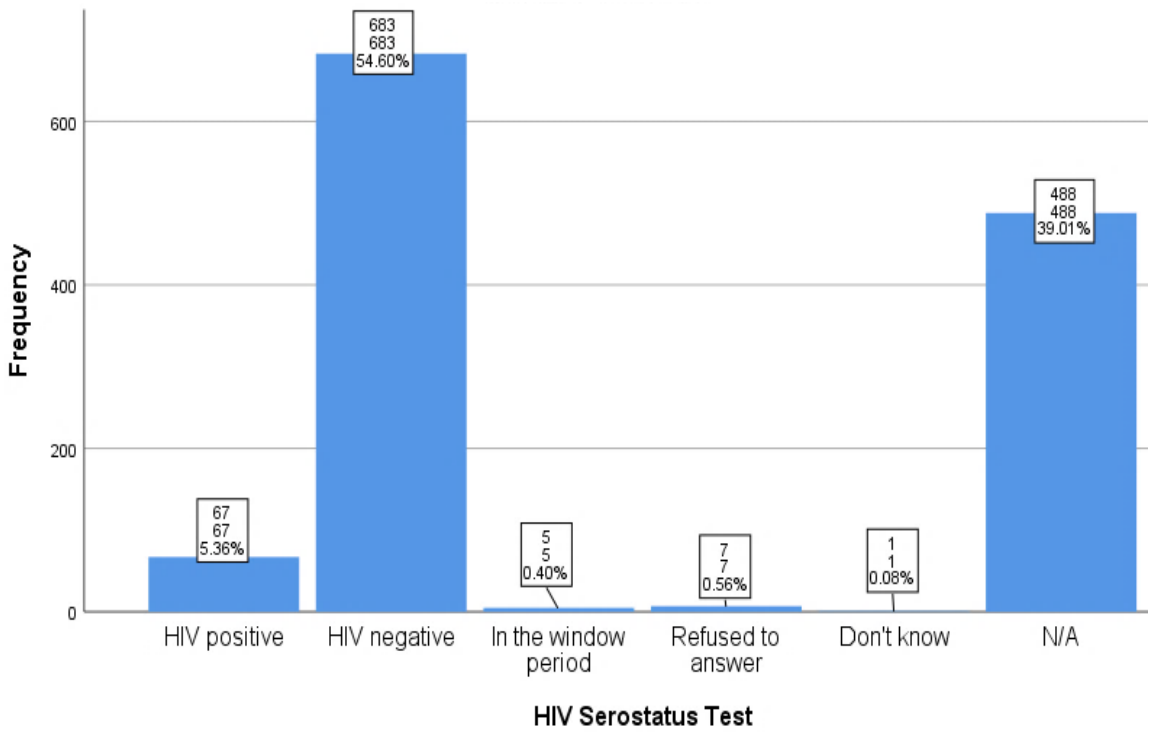

Figure 4. HIV status for Zambian women aged 18–24 years. Note. N/A = no reply

Figure 5 illustrates for the variable ever tested AIDS, revealing that eight women (0.55%) refused to be tested for AIDS, and 1433 (99.45) women were tested for AIDS of the Zambian women aged 18–49.

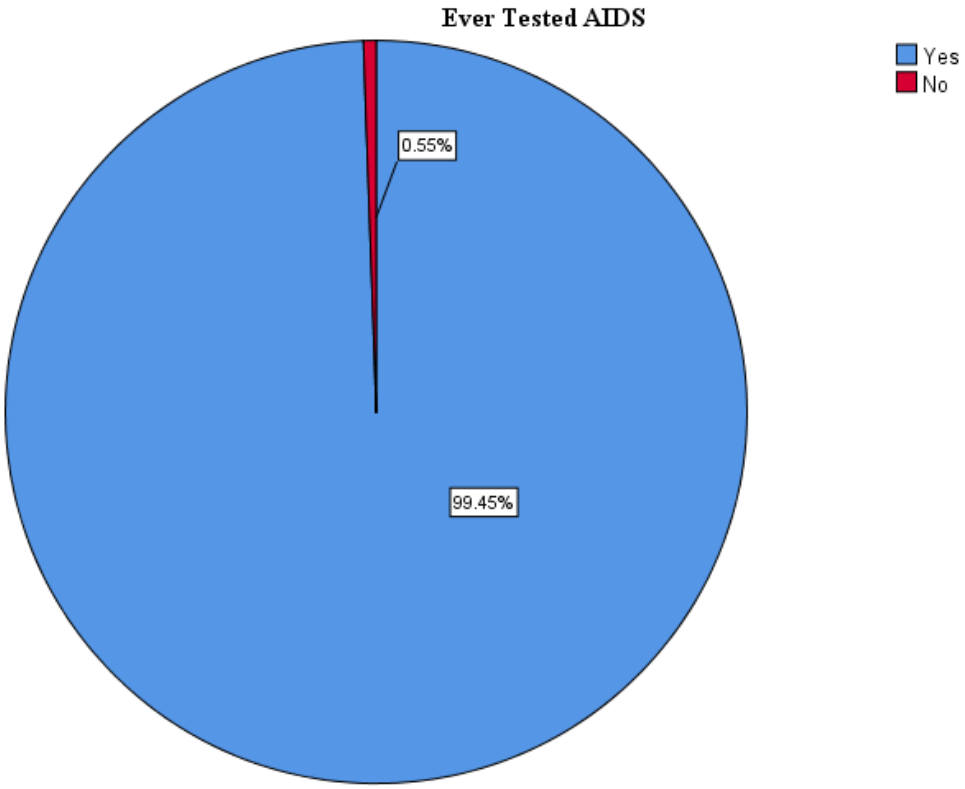

Figure 5. Pie graph for the variable ever tested AIDS in Zambian women aged 18–49 years.

Hypothesis Testing 1

Hypothesis 1 was as follows: There is no statistically significant association between behavioral determinants and HIV serostatus of Zambian female adolescents from ages 18 - 24. Tables 4, 5, and 6 indicated the test results of this hypothesis.

The MANOVA demonstrated a statistically significant ($p < 0.01$) for the association between the independent variable self-perceived HIV risk and the dependent variables HIV serostatus: HIV test result, ever tested HIV (see Table 4). Therefore, there is an association between the independent variables and the dependent variables for Zambian women aged 18–24 (see Table 4). Thus, I accepted the alternative hypothesis and rejected the null hypothesis.

Table 4

Multivariate Tests on Behavioral Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Intercept						
Pillai's trace	0.990	57,877.883[b]	2	1204	.000	.990
Wilks's lambda	0.010	57,877.883[b]	2	1204	.000	.990
Hotelling's trace	96.143	57,877.883[b]	2	1204	.000	.990
Roy's largest root	96.143	57,877.883[b]	2	1204	.000	.990
Sexual partners						
Pillai's trace	0.001	0.623[b]	2	1204	.537	.001
Wilks's lambda	0.999	0.623[b]	2	1204	.537	.001
Hotelling's trace	0.001	0.623[b]	2	1204	.537	.001
Roy's largest root	0.001	0.623[b]	2	1204	.537	.001
Condom use						
Pillai's trace	0.004	2.265[b]	2	1204	.104	.004
Wilks's lambda	0.996	2.265[b]	2	1204	.104	.004
Hotelling's trace	0.004	2.265[b]	2	1204	.104	.004
Roy's largest root	0.004	2.265[b]	2	1204	.104	.004
Self-perceived HIV risk						
Pillai's trace	0.897	163.283	12	2410	.000	.448
Wilks's lambda	0.121	375.987[b]	12	2408	.000	.652
Hotelling's trace	7.110	712.751	12	2406	.000	.780
Roy's largest root	7.089	1,423.669[c]	6	1205	.000	.876
Sexual Partners × Condom Use						
Pillai's trace	0.001	0.619[b]	2	1204	.539	.001
Wilks's lambda	0.999	0.619[b]	2	1204	.539	.001
Hotelling's trace	0.001	0.619[b]	2	1204	.539	.001

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Roy's largest root	0.001	0.619[b]	2	1204	.539	.001
Sexual Partners × Self-Perceived HIV Risk						
Pillai's trace	0.001	0.256	4	2410	.906	.000
Wilks's lambda	0.999	0.256[b]	4	2408	.906	.000
Hotelling's trace	0.001	0.256	4	2406	.906	.000
Roy's largest root	0.001	0.512[c]	2	1205	.599	.001
Condom Use × Self-Perceived HIV Risk						
Pillai's trace	0.002	0.500	4	2410	.736	.001
Wilks's lambda	0.998	0.500[b]	4	2408	.736	.001
Hotelling's trace	0.002	0.500	4	2406	.736	.001
Roy's largest root	0.002	0.921[c]	2	1205	.398	.002
Sexual Partners × Condom Use × Self-Perceived HIV Risk						
Pillai's trace	0.000	0.175[b]	2	1204	.840	.000
Wilks's lambda	1.000	0.175[b]	2	1204	.840	.000
Hotelling's trace	0.000	0.175[b]	2	1204	.840	.000
Roy's largest root	0.000	0.175[b]	2	1204	.840	.000

[a]Design: Intercept + SEXPARTN + CONDOUSE + HIVSELFRISK + SEXPARTN * CONDOUSE + SEXPARTN * HIVSELFRISK + CONDOUSE * HIVSELFRISK + SEXPARTN * CONDOUSE * HIVSELFRISK. [b]Exact statistic. [c]The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 5 presented the result of MANOVA using Tukey's Honestly Significant Difference for Behavioral Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years. The results of the MANOVA indicated the following results for Zambian women aged 18–24 years:

1. Mean scores for HIV test result were statistically significantly different between the *no risk at all* and *small risk* conditions ($p < .001$), the *no risk at all* and *has AIDS* conditions ($p < .001$), the *small* and *has AIDS* conditions ($p = .012$), the *small* and *don't know* conditions ($p = .039$), the *moderate* and *has AIDS* conditions ($p = .027$), and the *great* and *has AIDS* conditions ($p < .001$).
2. Mean scores for the ever tested HIV were statistically significantly different between the *moderate* and *has AIDS* conditions ($p = .027$).

Table 5

Tukey's Honestly Significant Difference for Behavioral Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

HIV self−perceived risks (*I* & *J*)	Mean difference (*I* − *J*)	*SE*	*p*	95% CI *LL*	95% CI *UL*
Dependent variable: HIV test result					
No risk at all					
Small	14.66	2.633	.000	6.88	22.43
Moderate	11.80	5.700	.371	−5.03	28.64
Great	2.97	5.569	.998	−13.48	19.41
Has AIDS	41.38	7.806	.000	18.33	64.43
Don't know	−0.10	4.774	1.000	−14.20	14.00
Small					
No risk at all	−14.66	2.633	.000	−22.43	−6.88
Moderate	−2.86	5.775	.999	−19.91	14.20
Great	−11.69	5.646	.371	−28.37	4.98
Has AIDS	26.72	7.860	.012	3.51	49.94
Don't know	−14.76	4.863	.039	−29.12	−0.40
Moderate					
No risk at all	−11.80	5.700	.371	−28.64	5.03
Small	2.86	5.775	.999	−14.20	19.91
Great	−8.84	7.579	.907	−31.22	13.55
Has AIDS	29.58	9.346	.027	1.98	57.18
Don't know	−11.90	7.015	.618	−32.62	8.81
Great					
No risk at all	−2.97	5.569	.998	−19.41	13.48
Small	11.69	5.646	.371	−4.98	28.37
Moderate	8.84	7.579	.907	−13.55	31.22
Has AIDS	38.42	9.267	.001	11.05	65.78
Don't know	−3.07	6.909	.999	−23.47	17.34
Has AIDS					
No risk at all	−41.38	7.806	.000	−64.43	−18.33
Small	−26.72	7.860	.012	−49.94	−3.51
Moderate	−29.58	9.346	.027	−57.18	−1.98
Great	−38.42	9.267	.001	−65.78	−11.05
Don't know	−41.48	8.811	.000	−67.51	−15.46
Don't know					
No risk at all	0.10	4.774	1.000	−14.00	14.20
Small	14.76	4.863	.039	0.40	29.12
Moderate	11.90	7.015	.618	−8.81	32.62
Great	3.07	6.909	.999	−17.34	23.47
Has AIDS	41.48	8.811	.000	15.46	67.51
Dependent variable: ever tested HIV					
No risk at all					
Small	0.00	0.002	.957	0.00	0.01
Moderate	0.00	0.004	.999	−0.01	0.01
Great	0.00	0.004	.999	−0.01	0.01
Has AIDS	0.00	0.005	1.000	−0.01	0.02
Don't know	0.00	0.003	.998	−0.01	0.01
No risk at all	0.00	0.002	.957	−0.01	0.00

(table continues)

HIV self−perceived risks (*I* & *J*)	Mean difference (*I* − *J*)	*SE*	*p*	95% CI	
				LL	*UL*
Moderate	0.00	0.004	1.000	−0.01	0.01
Great	0.00	0.004	1.000	−0.01	0.01
Has AIDS	0.00	0.005	1.000	−0.02	0.02
Don’t know	0.00	0.003	1.000	−0.01	0.01
Moderate					
No risk at all	0.00	0.004	.999	−0.01	0.01
Small	0.00	0.004	1.000	−0.01	0.01
Great	0.00	0.005	1.000	−0.02	0.02
Has AIDS	0.00	0.007	1.000	−0.02	0.02
Don’t know	0.00	0.005	1.000	−0.01	0.01
Great					
No risk at all	0.00	0.004	.999	−0.01	0.01
Small	0.00	0.004	1.000	−0.01	0.01
Moderate	0.00	0.005	1.000	−0.02	0.02
Has AIDS	0.00	0.006	1.000	−0.02	0.02
Don’t know	0.00	0.005	1.000	−0.01	0.01
Has AIDS					
No risk at all	0.00	0.005	1.000	−0.02	0.01
Small	0.00	0.005	1.000	−0.02	0.02
Moderate	0.00	0.007	1.000	−0.02	0.02
Great	0.00	0.006	1.000	−0.02	0.02
Don’t know	0.00	0.006	1.000	−0.02	0.02
Don’t know					
No risk at all	0.00	0.003	.998	−0.01	0.01
Small	0.00	0.003	1.000	−0.01	0.01
Moderate	0.00	0.005	1.000	−0.01	0.01
Great	0.00	0.005	1.000	−0.01	0.01
Has AIDS	0.00	0.006	1.000	−0.02	0.02

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 6 demonstrates a statistically significant association between condom use and HIV test result, $F(1, 1222) = 0.334$, $p = .042$, Partial $\eta^2 = .003$ for Tests of Between-Subjects Effects on Behavioral Determinants of HIV Serostatus for Zambian Women Aged 18–24 years. The association between self-perceived HIV risk and HIV test result, $F(1, 1222) = 6.195$, $p < .001$, Partial $\eta^2 = 0.030$ and the association between self-perceived HIV risk and ever tested HIV, $F(1, 122) = 1418.284$, $p < .001$, Partial $\eta^2 = 0.876$ were statistically significant for women aged 18–24 (see table 6). Finally, Tables 4, 5, and 6 confirmed for the acceptance of the alternative hypothesis for the hypothesis testing 1.

Table 6

Tests of Between-Subjects Effects on Behavioral Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	135,714.155[a]	16	8,482.135	5.052	.000	.063
Ever tested HIV	6.963[b]	16	0.435	532.897	.000	.876
Ever tested AIDS	6.960[c]	16	0.435	—	—	1.000
Intercept						
HIV test result	74,934.645	1	74,934.645	44.635	.000	.036
Ever tested HIV	94.435	1	94.435	115,629.835	.000	.990
Ever tested AIDS	94.287	1	94.287	—	—	1.000
Sexual partners						
HIV test result	2,090.963	1	2,090.963	1.245	.265	.001
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Condom use						
HIV test result	6,950.334	1	6,950.334	4.140	.042	.003
Ever tested HIV	0.000	1	0.000	0.334	.563	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Self-perceived HIV risk						
HIV test result	62,399.854	6	10,399.976	6.195	.000	.030
Ever tested HIV	6.950	6	1.158	1,418.284	.000	.876
Ever tested AIDS	6.949	6	1.158	—	—	1.000
Sexual Partners × Condom Use						
HIV test result	2,077.320	1	2,077.320	1.237	.266	.001
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Sexual Partners × Self-Perceived HIV Risk						
HIV test result	1,717.791	2	858.896	0.512	.600	.001
Ever tested HIV	0.000	2	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Condom Use × Self-Perceived HIV Risk						
HIV test result	2,411.591	2	1,205.796	0.718	.488	.001
Ever tested HIV	0.000	2	0.000	0.266	.767	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Condom Use × Self-Perceived HIV Risk						
HIV test result	586.483	1	586.483	0.349	.555	.000
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Error						
HIV test result	2,022,991.112	1205	1,678.831			
Ever tested HIV	0.984	1205	0.001			
Ever tested AIDS	0.000	1205	0.000			
Total						
HIV test result	3,728,050.000	1222				
Ever tested HIV	1246.000	1222				
Ever tested AIDS	1243.000	1222				
Corrected total						
HIV test result	2,158,705.267	1221				
Ever tested HIV	7.948	1221				
Ever tested AIDS	6.960	1221				

a. R Squared = .119 (Adjusted R Squared = .082)

b. R Squared = 1.000 (Adjusted R Squared = 1.000)

Hypothesis Testing 2

Hypothesis 2 described in the following way: there is no association between behavioral determinants and HIV serostatus of Zambian female adults from age 25 to 49. Tables 7, 8, and 9 demonstrated the MANOVA results to test hypothesis testing 2 for Zambian women aged 25 – 49.

The multivariate analysis of variance (MANOVA) provided the following results for the association between Self perceived HIV risk (no risk at all, small, moderate, great, has AIDS, don't know) with HIV serostatus (see table 7).

1. The mean scores for HIV test result were statistically significantly different between the *no risk at all* and *small* conditions ($p < .001$), the *no risk at all* and *has AIDS* conditions ($p < .001$), the *small* and *has AIDS* conditions ($p = .012$), the *small* and *don't know* conditions ($p = .039$), the *moderate* and *has AIDS* conditions ($p = .027$), and the *great* and *has AIDS* conditions ($p < .001$).
2. The mean scores for the ever tested HIV were statistically significantly different between the *moderate* and *has AIDS* conditions ($p = .027$).

Table 7

Tukey's Honestly Significant Difference for Behavioral Determinants of HIV Serostatus for Zambian Women Aged 25-49 Years

HIV self−perceived risks (*I* & *J*)	Mean difference (*I* − *J*)	*SE*	*p*	95% CI	
				LL	*UL*
Dependent variable: HIV test result					
No risk at all					
Small	14.66	2.633	0.000	6.88	22.43
Moderate	11.80	5.700	0.371	−5.03	28.64
Great	2.97	5.569	0.998	−13.48	19.41
Has AIDS	41.38	7.806	0.000	18.33	64.43
Don't know	−0.10	4.774	1.000	−14.20	14.00
Small					
No risk at all	−14.66	2.633	0.000	−22.43	−6.88
Moderate	−2.86	5.775	0.999	−19.91	14.20
Great	−11.69	5.646	0.371	−28.37	4.98
Has AIDS	26.72	7.860	0.012	3.51	49.94
Don't know	−14.76	4.863	0.039	−29.12	−0.40
Great					
No risk at all	−2.97	5.569	0.998	−19.41	13.48
Small	11.69	5.646	0.371	−4.98	28.37
Moderate	8.84	7.579	0.907	−13.55	31.22
Has AIDS	38.42	9.267	0.001	11.05	65.78
Don't know	−3.07	6.909	0.999	−23.47	17.34
Has AIDS					
No risk at all	−41.38	7.806	0.000	−64.43	−18.33
Small	−26.72	7.860	0.012	−49.94	−3.51
Moderate	−29.58	9.346	0.027	−57.18	−1.98
Great	−38.42	9.267	0.001	−65.78	−11.05
Don't know	−41.48	8.811	0.000	−67.51	−15.46
Dependent variable: Ever tested HIV					
No risk at all					
Small	0.00	0.002	0.957	0.00	0.01
Moderate	0.00	0.004	0.999	−0.01	0.01
Great	0.00	0.004	0.999	−0.01	0.01
Has AIDS	0.00	0.005	1.000	−0.01	0.02
Don't know	0.00	0.003	0.998	−0.01	0.01
Great					
No risk at all	0.00	0.004	0.999	−0.01	0.01
Small	0.00	0.004	1.000	−0.01	0.01
Moderate	0.00	0.005	1.000	−0.02	0.02
Has AIDS	0.00	0.006	1.000	−0.02	0.02
Don't know	0.00	0.005	1.000	−0.01	0.01
N/A	−1.00	0.011	0.000	−1.03	−0.97

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

The multivariate tests in Table 8 were for associations between the dependent variables: HIV test result, ever tested HIV, and ever tested AIDS) and behavioral determinants: sexual partners, condom use, and self-perceived risk for women aged 25–49. There was a statistically significant difference association between self-perceived HIV risk and a linear combination of the three dependent variables. In this main effect, self-perceived HIV risk was statistically significant: Pillai's trace was 0.897, $F(2, 2410) = 163.283$, $p < .001$; Wilks's lambda = 0.121, partial $\eta 2 = .448$. The other two variables, sexual partners and condom use were not statistically significant, and neither were associations between other combinations of the behavioral determinants (see table 8).

Table 8

Multivariate Tests on Behavioral Determinants of HIV Serostatus on Zambian Women Aged 25–49 Years

Effect and test	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Intercept						
Pillai's trace	0.990	57,877.883[a]	2	1204	.000	.990
Wilks's lambda	0.010	57,877.883[a]	2	1204	.000	.990
Hotelling's trace	96.143	57,877.883[a]	2	1204	.000	.990
Roy's largest root	96.143	57,877.883[a]	2	1204	.000	.990
Sexual partners						
Pillai's trace	0.001	0.623[a]	2	1204	.537	.001
Wilks's lambda	0.999	0.623[a]	2	1204	.537	.001
Hotelling's trace	0.001	0.623[a]	2	1204	.537	.001
Roy's largest root	0.001	0.623[a]	2	1204	.537	.001
Condom use						
Pillai's trace	0.004	2.265[a]	2	1204	.104	.004
Wilks's lambda	0.996	2.265[a]	2	1204	.104	.004
Hotelling's trace	0.004	2.265[a]	2	1204	.104	.004
Roy's largest root	0.004	2.265[a]	2	1204	.104	.004
Self-perceived HIV risk						
Pillai's trace	0.897	163.283	12	2410	.000	.448
Wilks's lambda	0.121	375.987[a]	12	2408	.000	.652
Hotelling's trace	7.110	712.751	12	2406	.000	.780
Roy's largest root	7.089	1,423.669[b]	6	1205	.000	.876
Sexual Partners × Condom Use						
Pillai's trace	0.001	0.619[a]	2	1204	.539	.001
Wilks's lambda	0.999	0.619[a]	2	1204	.539	.001
Hotelling's trace	0.001	0.619[a]	2	1204	.539	.001

(table continues)

Effect and test	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Roy's largest root	0.001	0.619[a]	2	1204	.539	.001
Sexual Partners × Self-Perceived HIV Risk						
Pillai's trace	0.001	0.256	4	2410	.906	.000
Wilks's lambda	0.999	0.256[a]	4	2408	.906	.000
Hotelling's trace	0.001	0.256	4	2406	.906	.000
Roy's largest root	0.001	0.512[b]	2	1205	.599	.001
Condom Use × Self-Perceived HIV Risk						
Pillai's trace	0.002	0.500	4	2410	.736	.001
Wilks's lambda	0.998	0.500[a]	4	2408	.736	.001
Hotelling's trace	0.002	0.500	4	2406	.736	.001
Roy's largest root	0.002	0.921[b]	2	1205	.398	.002
Sexual Partners × Condom Use × Self-Perceived HIV Risk						
Pillai's trace	0.000	0.175[a]	2	1204	.840	.000
Wilks's lambda	1.000	0.175[a]	2	1204	.840	.000
Hotelling's trace	0.000	0.175[a]	2	1204	.840	.000
Roy's largest root	0.000	0.175[a]	2	1204	.840	.000

a. Design: Intercept + SEXPARTN + CONDOUSE + HIVSELFRISK + SEXPARTN * CONDOUSE + SEXPARTN * HIVSELFRISK + CONDOUSE * HIVSELFRISK + SEXPARTN * CONDOUSE * HIVSELFRISK

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level

Table 9 were Tests of Between-Subjects Effects on Behavioral Determinants of HIV Serostatus for Zambian Women Aged 25–49 years on the associations between the dependent variables and behavioral determinants for women aged 25–49. there was a statistically significant association between condom use and HIV test result, $F(1, 1222) = 4.140$, $p = .04$, self-perceived HIV risk and HIV test result, $F(1, 1222) = 6.195$, $p < .001$, partial $\eta^2 = .030$, and self-perceived HIV risk and ever tested HIV, $F(1, 1222) = XX$, $p < .001$, partial $\eta^2 = .776$. Besides, there was a statistically significant difference association between self-perceived HIV risk and a linear combination of the three dependent variables. In this main effect, self-perceived HIV risk was statistically significant: $F(2, 1222) = 532.897$, $p < .001$; partial $\eta^2 = .876$. The other two variables, sexual partners and condom use, were not statistically significant with HIV test results (see table 9).

Table 9
Tests of Between-Subjects Effects on Behavioral Determinants of HIV Serostatus for Zambian Women Aged 25–49 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	135,714.155[a]	16	8482.135	5.052	.000	.063
Ever tested HIV	6.963[b]	16	0.435	532.897	.000	.876
Ever tested AIDS	6.960[c]	16	0.435	—	—	1.000
Intercept						
HIV test result	74,934.645	1	74,934.645	44.635	.000	.036
Ever tested HIV	94.435	1	94.435	115,629.835	.000	.990
Ever tested AIDS	94.287	1	94.287	—	—	1.000
Sexual partners						
HIV test result	2,090.963	1	2,090.963	1.245	.265	.001
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Condom use						
HIV test result	6,950.334	1	6,950.334	4.140	.042	.003
Ever tested HIV	0.000	1	0.000	0.334	.563	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Self-perceived HIV risk						
HIV test result	62,399.854	6	10,399.976	6.195	.000	.030
Ever tested HIV	6.950	6	1.158	1,418.284	.000	.876
Ever tested AIDS	6.949	6	1.158	—	—	1.000
Sexual Partners × Condom Use						
HIV test result	2,077.320	1	2,077.320	1.237	.266	.001
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Sexual Partners × Self-Perceived HIV Risk						
HIV test result	1,717.791	2	858.896	0.512	.600	.001
Ever tested HIV	0.000	2	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Condom Use × Self-Perceived HIV Risk						
HIV test result	2,411.591	2	1,205.796	0.718	.488	.001
Ever tested HIV	0.000	2	0.000	0.266	.767	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Condom Use × Self-Perceived HIV Risk						
HIV test result	586.483	1	586.483	0.349	.555	.000
Ever tested HIV	0.000	1	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Error						
HIV test result	2,022,991.112	1205	1,678.831			
Ever tested HIV	0.984	1205	0.001			
Ever tested AIDS	0.000	1205	0.000			
Total						
HIV test result	3,728,050.000	1222				
Ever tested HIV	1246.000	1222				
Ever tested AIDS	1243.000	1222				
Corrected total						
HIV test result	2,158,705.267	1221				
Ever tested HIV	7.948	1221				
Ever tested AIDS	6.960	1221				

a. R Squared = .053 (Adjusted R Squared = .036)

b. R Squared = .804 (Adjusted R Squared = .800)

c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Hypothesis Testing 3

Hypothesis 3 developed as follows: there is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from ages 18 to 24. Tables 10 and 11 indicate the MANOVA results of hypothesis testing 3 by analyzing the associations between demographic determinants (location, education, and marital status) with the dependent variable HIV serostatus. It appeared a statistically significant association between education and a linear combination of the three dependent variables (see table 10).

Table 10

Multivariate Tests on Demographic Determinants of HIV Serostatus on Zambian Women Aged 18–24 Years

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Intercept						
Pillai's trace	0.927	5,109.357[b]	3	1215.000	.000	.927
Wilks's lambda	0.073	5,109.357[b]	3	1215.000	.000	.927
Hotelling's trace	12.616	5,109.357[b]	3	1215.000	.000	.927
Roy's largest root	12.616	5,109.357[b]	3	1215.000	.000	.927
Location						
Pillai's trace	0.002	0.914[b]	3	1215.000	.433	.002
Wilks's lambda	0.998	0.914[b]	3	1215.000	.433	.002
Hotelling's trace	0.002	0.914[b]	3	1215.000	.433	.002
Roy's largest root	0.002	0.914[b]	3	1215.000	.433	.002
Education						
Pillai's trace	0.015	2.099	9	3651.000	.026	.005
Wilks's lambda	0.985	2.106	9	2957.141	.026	.005
Hotelling's trace	0.016	2.111	9	3641.000	.025	.005
Roy's largest root	0.015	5.930[c]	3	1217.000	.001	.014
Marital status						
Pillai's trace	0.003	0.363	9	3651.000	.953	.001
Wilks's lambda	0.997	0.363	9	2957.141	.953	.001
Hotelling's trace	0.003	0.362	9	3641.000	.953	.001
Roy's largest root	0.002	0.964[c]	3	1217.000	.409	.002
Location × Education						
Pillai's trace	0.002	0.225	9	3651.000	.991	.001
Wilks's lambda	0.998	0.224	9	2957.141	.991	.001
Hotelling's trace	0.002	0.224	9	3641.000	.991	.001

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
	0.001	0.496[c]	3	1217.000	.685	.001
Roy's largest root						
Location × Marital Status						
Pillai's trace	0.004	0.588	9	3651.000	.808	.001
Wilks's lambda	0.996	0.588	9	2957.141	.808	.001
Hotelling's trace	0.004	0.588	9	3641.000	.808	.001
Roy's largest root	0.004	1.576[c]	3	1217.000	.193	.004
Education × Marital Status						
Pillai's trace	0.012	0.587	24	3651.000	.944	.004
Wilks's lambda	0.988	0.587	24	3524.471	.944	.004
Hotelling's trace	0.012	0.588	24	3641.000	.944	.004
Roy's largest root	0.010	1.449[c]	8	1217.000	.172	.009
Location × Education × Marital Status						
Pillai's trace	0.007	0.506	18	3651.000	.957	.002
Wilks's lambda	0.993	0.506	18	3437.024	.957	.002
Hotelling's trace	0.007	0.505	18	3641.000	.957	.002
Roy's largest root	0.005	1.039[c]	6	1217.000	.398	.005

a. Design: Intercept + LOCATION + EDUCATION + MARITALST + LOCATION * EDUCATION + LOCATION * MARITALST + EDUCATION * MARITALST + LOCATION * EDUCATION * MARITALST

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Table 11, Tests of Between-Subjects Effects on Zambian women aged 18 - 24, showed a statistically significant association between education (demographic variable) and HIV serostatus, $F(3, 1245) = 5.992$, $p = .001$, $\eta^2 = 0.14$. The association between demographic variables location and marital status had no statistically significant variation with the ever tested HIV and ever tested AIDS (see table 11).

Table 11

Tests of Between-Subjects Effects on Demographic Determinants of HIV Serostatus on Zambian Women Aged 18–24 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	107,571.421[a]	27	3,984.127	2.323	.000	.049
Ever tested HIV	0.104[b]	27	0.004	0.596	.950	.013
Ever tested AIDS	0.089[c]	27	0.003	0.582	.957	.013
Intercept						
HIV test result	112,188.806	1	112,188.806	65.423	.000	.051
Ever tested HIV	86.655	1	86.655	13,443.028	.000	.917
Ever tested AIDS	86.629	1	86.629	15,341.789	.000	.927
Location						
HIV test result	4,509.737	1	4,509.737	2.630	.105	.002
Ever tested HIV	0.001	1	0.001	0.198	.657	.000
Ever tested AIDS	0.001	1	0.001	0.241	.624	.000
Education						
HIV test result	30,465.256	3	10,155.085	5.922	.001	.014
Ever tested HIV	0.009	3	0.003	0.455	.714	.001
Ever tested AIDS	0.008	3	0.003	0.460	.710	.001
Marital status						
HIV test result	4,825.666	3	1,608.555	0.938	.422	.002
Ever tested HIV	0.003	3	0.001	0.155	.926	.000
Ever tested AIDS	0.003	3	0.001	0.176	.912	.000
Location × Education						
HIV test result	1,840.615	3	613.538	0.358	.784	.001
Ever tested HIV	0.005	3	0.002	0.253	.859	.001
Ever tested AIDS	0.006	3	0.002	0.334	.801	.001
Location × Marital Status						

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
HIV test result	5,065.565	3	1,688.522	0.985	.399	.002
Ever tested HIV	0.016	3	0.005	0.831	.477	.002
Ever tested AIDS	0.015	3	0.005	0.895	.443	.002
Education × Marital Status						
HIV test result	19,802.422	8	2,475.303	1.443	.174	.009
Ever tested HIV	0.012	8	0.002	0.240	.983	.002
Ever tested AIDS	0.013	8	0.002	0.284	.971	.002
Location × Education × Marital Status						
HIV test result	10,603.796	6	1,767.299	1.031	.404	.005
Ever tested HIV	0.018	6	0.003	0.459	.839	.002
Ever tested AIDS	0.016	6	0.003	0.460	.838	.002
Error						
HIV test result	2,086,936.408	1217	1,714.820			
Ever tested HIV	7.845	1217	0.006			
Ever tested AIDS	6.872	1217	0.006			
Total						
HIV test result	3,774,579.000	1245				
Ever tested HIV	1,269.000	1245				
Ever tested AIDS	1,266.000	1245				
Corrected total						
HIV test result	2,194,507.828	1244				
Ever tested HIV	7.949	1244				
Ever tested AIDS	6.961	1244				

a. R Squared = .067 (Adjusted R Squared = .026)

b. R Squared = .111 (Adjusted R Squared = .071)

Hypothesis Testing 4

Hypothesis 4 stated as follows: there is no statistically significant association between demographic determinants and HIV serostatus of Zambian female adolescents from age 25 – 49. Tests of Between-Subjects Effects report the result on associations between demographic determinants and HIV serostatus for Zambian women aged 25–49 (see tables 12 and 13).

One of the three demographic determinant variables, education, had a statistically association with HIV test result, $F(3, 1217) = 5.922$, $p < .001$, partial $\eta 2 = .014$ (see table 12). In table 12, the other two demographic determinant variables, location, and marital status had no statistically significant association with ever tested HIV, ever tested AIDS (see table 12).

Table 12

Tests of Between-Subjects Effects on Demographic Determinants of HIV Serostatus on Zambian Women Aged 25–49 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	107,571.421[a]	27	3,984.127	2.323	.000	.049
Ever tested HIV	0.104[b]	27	0.004	0.596	.950	.013
Ever tested AIDS	0.089[c]	27	0.003	0.582	.957	.013
Intercept						
HIV test result	112,188.806	1	112,188.806	65.423	.000	.051
Ever tested HIV	86.655	1	86.655	13,443.028	.000	.917
Ever tested AIDS	86.629	1	86.629	15,341.789	.000	.927
Location						
HIV test result	4,509.737	1	4,509.737	2.630	.105	.002
Ever tested HIV	0.001	1	0.001	0.198	.657	.000
Ever tested AIDS	0.001	1	0.001	0.241	.624	.000
Education						
HIV test result	30,465.256	3	10,155.085	5.922	.001	.014
Ever tested HIV	0.009	3	0.003	0.455	.714	.001
Ever tested AIDS	0.008	3	0.003	0.460	.710	.001
Marital status						
HIV test result	4,825.666	3	1,608.555	0.938	.422	.002
Ever tested HIV	0.003	3	0.001	0.155	.926	.000
Ever tested AIDS	0.003	3	0.001	0.176	.912	.000
Location × Education						
HIV test result	1,840.615	3	613.538	0.358	.784	.001
Ever tested HIV	0.005	3	0.002	0.253	.859	.001
Ever tested AIDS	0.006	3	0.002	0.334	.801	.001
Location × Marital Status						

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
HIV test result	5,065.565	3	1,688.522	0.985	.399	.002
Ever tested HIV	0.016	3	0.005	0.831	.477	.002
Ever tested AIDS	0.015	3	0.005	0.895	.443	.002
Education × Marital Status						
HIV test result	19,802.422	8	2,475.303	1.443	.174	.009
Ever tested HIV	0.012	8	0.002	0.240	.983	.002
Ever tested AIDS	0.013	8	0.002	0.284	.971	.002
Location × Education × Marital Status						
HIV test result	10,603.796	6	1,767.299	1.031	.404	.005
Ever tested HIV	0.018	6	0.003	0.459	.839	.002
Ever tested AIDS	0.016	6	0.003	0.460	.838	.002
Error						
HIV test result	2,086,936.408	1217	1,714.820			
Ever tested HIV	7.845	1217	0.006			
Ever tested AIDS	6.872	1217	0.006			
Total						
HIV test result	3,774,579.000	1245				
Ever tested HIV	1,269.000	1245				
Ever tested AIDS	1,266.000	1245				
Corrected total						
HIV test result	2,194,507.828	1244				
Ever tested HIV	7.949	1244				
Ever tested AIDS	6.961	1244				

a. R Squared = .071 (Adjusted R Squared = .041)

b. R Squared = .010 (Adjusted R Squared = -.022)

c. R Squared = .006 (Adjusted R Squared = -.026)

Table 13 indicates a statistically significant association between education and the linear combination of the dependent variable for women aged 25–49 years. In this main effect education was statistically significant in its association with HIV serostatus: Pillai's trace was 0.015, $F(9, 3651) = 2.099$, $p = .026$; Wilks's lambda was 0.985, partial $\eta 2 = .005$.

Table 13

Multivariate Tests on Demographic Determinants of HIV Serostatus on Zambian Women Aged 25–49 Years

Effect and test[a]	Value	*F*	*df*		*p*	Partial η^2
			Hypothesis	Error		
Intercept						
Pillai's trace	0.927	5,109.357[b]	3	1215.000	.000	.927
Wilks's lambda	0.073	5,109.357[b]	3	1215.000	.000	.927
Hotelling's trace	12.616	5,109.357[b]	3	1215.000	.000	.927
Roy's largest root	12.616	5,109.357[b]	3	1215.000	.000	.927
Location						
Pillai's trace	0.002	0.914[b]	3	1215.000	.433	.002
Wilks's lambda	0.998	0.914[b]	3	1215.000	.433	.002
Hotelling's trace	0.002	0.914[b]	3	1215.000	.433	.002
Roy's largest root	0.002	0.914[b]	3	1215.000	.433	.002
Education						
Pillai's trace	0.015	2.099	9	3651.000	.026	.005
Wilks's lambda	0.985	2.106	9	2957.141	.026	.005
Hotelling's trace	0.016	2.111	9	3641.000	.025	.005
Roy's largest root	0.015	5.930[c]	3	1217.000	.001	.014
Marital status						
Pillai's trace	0.003	0.363	9	3651.000	.953	.001
Wilks's lambda	0.997	0.363	9	2957.141	.953	.001
Hotelling's trace	0.003	0.362	9	3641.000	.953	.001
Roy's largest root	0.002	0.964[c]	3	1217.000	.409	.002
Location × Education						
Pillai's trace	0.002	0.225	9	3651.000	.991	.001
Wilks's lambda	0.998	0.224	9	2957.141	.991	.001
Hotelling's trace	0.002	0.224	9	3641.000	.991	.001

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
	0.001	0.496[c]	3	1217.000	.685	.001
Roy's largest root						
Location × Marital Status						
Pillai's trace	0.004	0.588	9	3651.000	.808	.001
Wilks's lambda	0.996	0.588	9	2957.141	.808	.001
Hotelling's trace	0.004	0.588	9	3641.000	.808	.001
Roy's largest root	0.004	1.576[c]	3	1217.000	.193	.004
Education × Marital Status						
Pillai's trace	0.012	0.587	24	3651.000	.944	.004
Wilks's lambda	0.988	0.587	24	3524.471	.944	.004
Hotelling's trace	0.012	0.588	24	3641.000	.944	.004
Roy's largest root	0.010	1.449[c]	8	1217.000	.172	.009
Location × Education × Marital Status						
Pillai's trace	0.007	0.506	18	3651.000	.957	.002
Wilks's lambda	0.993	0.506	18	3437.024	.957	.002
Hotelling's trace	0.007	0.505	18	3641.000	.957	.002
Roy's largest root	0.005	1.039[c]	6	1217.000	.398	.005

a. Design: Intercept + LOCATION + EDUCATION + MARITALST + LOCATION * EDUCATION + LOCATION * MARITALST + EDUCATION * MARITALST + LOCATION * EDUCATION * MARITALST

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Hypothesis Testing 5

The 5th hypothesis stated as follows: there is no statistically significant association between clinical determinants (government services, clinic services, NGO services) with HIV serostatus of Zambian female adolescents from ages 18 to 24. Tables 14, 15, and 16 show the test results for hypothesis testing 5.

The multivariate tests demonstrated no statistically significant associations between clinical determinants (government services, clinic services, NGO services) with HIV serostatus (see table 14).

Table 14

Multivariate Tests on Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Effect and test[a]	Value	F^b	p	Partial η^2
Intercept				
Pillai's trace	0.986	43,506.206	.000	.986
Wilks's lambda	0.014	43,506.206	.000	.986
Hotelling's trace	71.380	43,506.206	.000	.986
Roy's largest root	71.380	43,506.206	.000	.986
Clinic services				
Pillai's trace	0.000	0.170	.844	.000
Wilks's lambda	1.000	0.170	.844	.000
Hotelling's trace	0.000	0.170	.844	.000
Roy's largest root	0.000	0.170	.844	.000
NGO Services				
Pillai's trace	0.003	1.658	.191	.003
Wilks's lambda	0.997	1.658	.191	.003
Hotelling's trace	0.003	1.658	.191	.003
Roy's largest root	0.003	1.658	.191	.003
Government services				
Pillai's trace	0.000	0.287	.751	.000
Wilks's lambda	1.000	0.287	.751	.000
Hotelling's trace	0.000	0.287	.751	.000
Roy's largest root	0.000	0.287	.751	.000
Clinic Services × NGO Services				
Pillai's trace	0.000	0.002	.998	.000
Wilks's lambda	1.000	0.002	.998	.000
Hotelling's trace	0.000	0.002	.998	.000
Roy's largest root	0.000	0.002	.998	.000

(table continues)

Effect and test[a]	Value	F^b	p	Partial η^2
Clinic Services × Government Services				
Pillai's trace	0.000	0.006	.994	.000
Wilks's lambda	1.000	0.006	.994	.000
Hotelling's trace	0.000	0.006	.994	.000
Roy's largest root	0.000	0.006	.994	.000
NGO Services × Government Services				
Pillai's trace	0.001	0.597	.551	.001
Wilks's lambda	0.999	0.597	.551	.001
Hotelling's trace	0.001	0.597	.551	.001
Roy's largest root	0.001	0.597	.551	.001
Clinic Services × NGO Services × Government Services				
Pillai's trace	0.000	0.089	.915	.000
Wilks's lambda	1.000	0.089	.915	.000
Hotelling's trace	0.000	0.089	.915	.000
Roy's largest root	0.000	0.089	.915	.000

Note. Hypothesis *df* = 2. Error *df* = 1219. NGO = nongovernmental organization.

a. Design: Intercept + GOVTEST + CLINICTEST + NGOTEST + GOVTEST * CLINICTEST + GOVTEST * NGOTEST + CLINICTEST * NGOTEST + GOVTEST * CLINICTEST * NGOTEST

b. Exact statistic

Unlike the multivariate test (see table 14), Tukey's Honestly Significant Difference (HSD) and Least Significant Difference (LSD) test in table 15 reports a statistically significant results for the association between clinical determinants of an independent variable, use of services (*yes*, *no*, and *N/A*) and HIV serostatus as follows:

1 Mean scores of HIV test result statistically significantly different between the *yes* and *N/A* conditions ($p < .001$) and the *no* and *N/A* conditions ($p = .003$).

2. Mean scores of ever tested HIV were statistically significantly different between the *yes* and N/A conditions ($p < .001$) and between the *no* and *N/A* conditions ($p < .001$).

Table 15

Tukey's Honestly Significant Difference (HSD) and Least Significant Difference (LSD) for Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

			Tukey's HSD			LSD		
				95% CI			95% CI	
Use of HIV services (*I* & *J*)	Mean difference (*I* − *J*)	*SE*	*p*	*LL*	*UL*	*p*	*LL*	*UL*
Dependent variable: HIV test result								
Yes								
No	−6.18	3.012	.100	−13.25	0.88	.040	−12.09	−0.28
N/A	−58.14	15.965	.001	−95.60	−20.67	.000	−89.46	−26.81
No								
Yes	6.18	3.012	.100	−0.88	13.25	.040	0.28	12.09
N/A	−51.95	15.791	.003	−89.00	−14.90	.001	−82.93	−20.97
N/A								
Yes	58.14	15.965	.001	20.67	95.60	.000	26.81	89.46
No	51.95	15.791	.003	14.90	89.00	.001	20.97	82.93
Dependent variable: ever tested HIV								
Yes								
No	0.00	0.002	.876	−0.01	0.00	.624	−0.01	0.00
N/A	−1.00	0.011	.000	−1.03	−0.97	.000	−1.02	−0.98
No								
Yes	0.00	0.002	.876	0.00	0.01	.624	0.00	0.01
N/A	−1.00	0.011	.000	−1.02	−0.97	.000	−1.02	−0.98
N/A								
Yes	1.00	0.011	.000	0.97	1.03	.000	0.98	1.02
No	1.00	0.011	.000	0.97	1.02	.000	0.98	1.02

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Tests of Between-Subjects Effects on Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 indicated no statistically significant associations between clinical determinants and the HIV serostatus (see table 16). The clinical determinants allude to the use of HIV services GOV, the use of HIV services Clinic, and the use of HIV services NGO and the dependent variables.

Table 16

Tests of Between-Subjects Effects on Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	40,836.240[a]	8	5,104.530	2.945	.003	.019
Ever tested HIV	6.949[b]	8	0.869	1,061.046	.000	.874
Ever tested AIDS	6.960[c]	8	0.870	—	—	1.000
Intercept						
HIV test result	76,667.166	1	76,667.166	44.238	.000	.035
Ever tested HIV	71.139	1	71.139	86,896.369	.000	.986
Ever tested AIDS	71.126	1	71.126	—	—	1.000
Government services						
HIV test result	990.538	1	990.538	0.572	.450	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Clinic services						
HIV test result	584.172	1	584.172	0.337	.562	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
NGO Services						
HIV test result	5,742.330	1	5,742.330	3.313	.069	.003
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Government Services × Clinic Services						
HIV test result	19.771	1	19.771	0.011	.915	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Government Services × NGO Services						
HIV test result	2,071.387	1	2,071.387	1.195	.274	.001
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Clinic Services × NGO Services						
HIV test result	4.953	1	4.953	0.003	.957	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Government Services × Clinic Services × NGO Services						
HIV test result	306.166	1	306.166	0.177	.674	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Error						
HIV test result	2,114,345.002	1220	1,733.070			
Ever tested HIV	0.999	1220	0.001			
Ever tested AIDS	0.000	1220	0.000			
Total						
HIV test result	3,673,895.000	1229				
Ever tested HIV	1,253.000	1229				
Ever tested AIDS	1,250.000	1229				
Corrected total						
HIV test result	2,155,181.242	1228				
Ever tested HIV	7.948	1228				
Ever tested AIDS	6.960	1228				

Note. NGO = nongovernmental organization.

a. R Squared = .023 (Adjusted R Squared = .002)

b. R Squared = 1.000 (Adjusted R Squared = 1.000)

Hypothesis Testing 6

Multivariate analysis of variance was performed to test hypothesis 6 stated as follows: there is no statistically significant association between clinical determinants and that of HIV serostatus of Zambian female adults from age 25 to 49. Tables 17, 18, and 19 validate hypothesis testing 6 for Zambian women aged 25–49 years.

Table 17 reports on associations between clinical determinants and HIV serostatus for Zambian women aged 25 – 49. The results of the Tukey's Honestly Significant Difference (HSD) and Least Significant Difference (LSD) for the use of services variable with three levels (*yes*, *no*, and *N/A*) are as follows:

1. Mean scores of HIV test results were statistically significantly different between the *yes* and *N/A* conditions ($p < .001$) and between the *N/A* and *no* conditions ($p < .001$).
2. Mean scores of ever tested HIV were statistically significantly different between the *yes* and *N/A* conditions ($p < .001$) and between the *no* and *N/A* conditions ($p < .001$) (see table 17).

Table 17

Tukey's Honestly Significant Difference (HSD) and Least Significant Difference (LSD) for Clinical Determinants of HIV Serostatus for Zambian Women of Aged 25–49 Years

			Tukey's HSD			LSD		
				95% CI			95% CI	
Use of HIV services (*I* & *J*)	Mean difference (*I* − *J*)	*SE*	*p*	*LL*	*UL*	*p*	*LL*	*UL*
Dependent variable: HIV test result								
Yes								
No	−7.28	3.225	.063	−14.84	0.29	.024	−13.60	−0.95
N/A	−59.24	16.009	.001	−96.81	−21.67	.000	−90.65	−27.83
No								
Yes	7.28	3.225	.063	−0.29	14.84	.024	0.95	13.60
N/A	−51.96	15.788	.003	−89.01	−14.92	.001	−82.94	−20.99
N/A								
Yes	59.24	16.009	.001	21.67	96.81	.000	27.83	90.65
No	51.96	15.788	.003	14.92	89.01	.001	20.99	82.94
Dependent variable: ever tested HIV								
Yes								
No	0.00	0.002	.898	−0.01	0.00	.659	−0.01	0.00
N/A	−1.00	0.011	.000	−1.03	−0.97	.000	−1.02	−0.98
No								
Yes	0.00	0.002	.898	0.00	0.01	.659	0.00	0.01
N/A	−1.00	0.011	.000	−1.02	−0.97	.000	−1.02	−0.98
N/A								
Yes	1.00	0.011	.000	0.97	1.03	.000	0.98	1.02
No	1.00	0.011	.000	0.97	1.02	.000	0.98	1.02

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

As shown in Table 18, there were no statistically significant differences between clinical determinants and a linear combination of the three dependent variables (HIV serostatus, ever tested HIV, ever tested AIDS) for adult Zambian women (25 - 49).

Table 18

Multivariate Tests on Clinical Determinants of HIV Serostatus for Zambian Women Aged 25–49 Years

Effect and test[a]	Value	F^b	p	Partial η^2
Intercept				
Pillai's trace	0.986	43,506.206	.000	.986
Wilks's lambda	0.014	43,506.206	.000	.986
Hotelling's trace	71.380	43,506.206	.000	.986
Roy's largest root	71.380	43,506.206	.000	.986
Clinic services				
Pillai's trace	0.000	0.170	.844	.000
Wilks's lambda	1.000	0.170	.844	.000
Hotelling's trace	0.000	0.170	.844	.000
Roy's largest root	0.000	0.170	.844	.000
NGO Services				
Pillai's trace	0.003	1.658	.191	.003
Wilks's lambda	0.997	1.658	.191	.003
Hotelling's trace	0.003	1.658	.191	.003
Roy's largest root	0.003	1.658	.191	.003
Government services				
Pillai's trace	0.000	0.287	.751	.000
Wilks's lambda	1.000	0.287	.751	.000
Hotelling's trace	0.000	0.287	.751	.000
Roy's largest root	0.000	0.287	.751	.000
Clinic Services × NGO Services				
Pillai's trace	0.000	0.002	.998	.000
Wilks's lambda	1.000	0.002	.998	.000
Hotelling's trace	0.000	0.002	.998	.000
Roy's largest root	0.000	0.002	.998	.000

(table continues)

Effect and test[a]	Value	F^b	p	Partial η^2
Clinic Services × Government Services				
Pillai's trace	0.000	0.006	.994	.000
Wilks's lambda	1.000	0.006	.994	.000
Hotelling's trace	0.000	0.006	.994	.000
Roy's largest root	0.000	0.006	.994	.000
NGO Services × Government Services				
Pillai's trace	0.001	0.597	.551	.001
Wilks's lambda	0.999	0.597	.551	.001
Hotelling's trace	0.001	0.597	.551	.001
Roy's largest root	0.001	0.597	.551	.001
Clinic Services × NGO Services × Government Services				
Pillai's trace	0.000	0.089	.915	.000
Wilks's lambda	1.000	0.089	.915	.000
Hotelling's trace	0.000	0.089	.915	.000
Roy's largest root	0.000	0.089	.915	.000

Note. Hypothesis *df* = 2. Error *df* = 1219. NGO = nongovernmental organization.

a. Design: Intercept + GOVTEST + CLINICTEST + NGOTEST + GOVTEST * CLINICTEST + GOVTEST * NGOTEST + CLINICTEST * NGOTEST + GOVTEST * CLINICTEST * NGOTEST

b. Exact statistic

Tests of Between-Subjects Effects for Clinical Determinants of HIV Serostatus for Zambian women aged 25–49 demonstrate no statistically significant outcomes for the association between clinical determinants and the dependent variables (see table 19).

Table 19

Tests of Between-Subjects Effects for Clinical Determinants of HIV Serostatus for Zambian Women Aged 25–49 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	40,836.240[a]	8	5,104.530	2.945	.003	.019
Ever tested HIV	6.949[b]	8	0.869	1061.046	.000	.874
Ever tested AIDS	6.960[c]	8	0.870	—	—	1.000
Intercept						
HIV test result	76,667.166	1	76,667.166	44.238	.000	.035
Ever tested HIV	71.139	1	71.139	86896.369	.000	.986
Ever tested AIDS	71.126	1	71.126	—	—	1.000
Clinic services						
HIV test result	584.172	1	584.172	0.337	.562	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
NGO Services						
HIV test result	5,742.330	1	5,742.330	3.313	.069	.003
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Government services						
HIV test result	990.538	1	990.538	0.572	.450	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Clinic Services × NGO Services						
HIV test result	4.953	1	4.953	0.003	.957	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Clinic Services × Government Services						
HIV test result	19.771	1	19.771	0.011	.915	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
NGO Services × Government Services						
HIV test result	2,071.387	1	2,071.387	1.195	.274	.001
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Clinic Services × NGO Services × Government Services						
HIV test result	306.166	1	306.166	0.177	.674	.000
Ever tested HIV	0.000	1	0.000	0.001	.972	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Error						
HIV test result	2,114,345.002	1220	1,733.070			
Ever tested HIV	0.999	1220	0.001			
Ever tested AIDS	0.000	1220	0.000			
Total						
HIV test result	3,673,895.000	1229				
Ever tested HIV	1253.000	1229				
Ever tested AIDS	1250.000	1229				
Corrected total						
HIV test result	2,155,181.242	1228				
Ever tested HIV	7.948	1228				
Ever tested AIDS	6.960	1228				

Note. NGO = nongovernmental organization.

a. R Squared = .024 (Adjusted R Squared = .016)

b. R Squared = .799 (Adjusted R Squared = .797)

c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Hypothesis Testing 7

Multivariate analysis of variance was also performed to test hypothesis 7 stated as follows: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adolescents from age 18 to 24. Tables 20, 21, 22, and 23 show the test results for hypothesis testing 7. The synergistic associations between sexual partners, location, and government with HIV test results were not statistically significant, leading to failing to reject hypothesis testing 7 (see table 20).

Table 20

Multivariate Tests on Synergistic Analysis of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Effect and test[a]	Value	*F*	*df*		*p*	Partial η^2
			Hypothesis	Error		
Intercept						
Pillai's trace	0.991	63,188.837[b]	2	1195.0	.000	.991
Wilks's lambda	0.009	63,188.837[b]	2	1195.0	.000	.991
Hotelling's trace	105.755	63,188.837[b]	2	1195.0	.000	.991
Roy's largest root	105.755	63,188.837[b]	2	1195.0	.000	.991
Sexual partners						
Pillai's trace	0.001	0.257	4	2392.0	.905	.000
Wilks's lambda	0.999	0.257[b]	4	2390.0	.905	.000
Hotelling's trace	0.001	0.257	4	2388.0	.905	.000
Roy's largest root	0.001	0.508[c]	2	1196.0	.602	.001
Location						
Pillai's trace	0.001	0.438[b]	2	1195.0	.645	.001
Wilks's lambda	0.999	0.438[b]	2	1195.0	.645	.001
Hotelling's trace	0.001	0.438[b]	2	1195.0	.645	.001
Roy's largest root	0.001	0.438[b]	2	1195.0	.645	.001
Government services						
Pillai's trace	0.870	460.457	4	2392.0	.000	.435
Wilks's lambda	0.130	1,058.488[b]	4	2390.0	.000	.639
Hotelling's trace	6.680	1,993.840	4	2388.0	.000	.770
Roy's largest root	6.679	3,994.196[c]	2	1196.0	.000	.870
Sexual Partners × Location						
Pillai's trace	0.004	1.285	4	2392.0	.273	.002

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Wilks's lambda	0.996	1.285[b]	4	2390.0	.273	.002
Hotelling's trace	0.004	1.285	4	2388.0	.273	.002
Roy's largest root	0.004	2.471[c]	2	1196.0	.085	.004
Sexual Partners × Government Services						
Pillai's trace	0.001	0.416[b]	2	1195.0	.660	.001
Wilks's lambda	0.999	0.416[b]	2	1195.0	.660	.001
Hotelling's trace	0.001	0.416[b]	2	1195.0	.660	.001
Roy's largest root	0.001	0.416[b]	2	1195.0	.660	.001
Location × Government Services						
Pillai's trace	0.000	0.039	4	2392.0	.997	.000
Wilks's lambda	1.000	0.038[b]	4	2390.0	.997	.000
Hotelling's trace	0.000	0.038	4	2388.0	.997	.000
Roy's largest root	0.000	0.077[c]	2	1196.0	.926	.000
Sexual Partners × Location × Government Services						
Pillai's trace	0.000	—[b]	0	0.0	—	—
Wilks's lambda	1.000	—[b]	0	1195.5	—	—
Hotelling's trace	0.000	—[b]	0	2.0	—	—
Roy's largest root	0.000	0.000[b]	2	1194.0	1.000	.000

a. Design: Intercept + SEXPARTN + LOCATION + GOVTEST + SEXPARTN * LOCATION + SEXPARTN * GOVTEST + LOCATION * GOVTEST + SEXPARTN * LOCATION * GOVTEST

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Tests of Between-Subjects Effects on Synergistic Analysis of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 demonstrated no statistically significant association between government services (clinical determinant) and location (demographic determinant) with HIV test result (dependent variable) (see table 21). The research failed to reject the null hypothesis that stated there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adolescents from age 18 to 24 (see table 21).

Table 21

Tests of Between-Subjects Effects on Synergistic Analysis of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	34,498.711[a]	10	3,449.871	1.976	.033	.016
Ever tested HIV	6.957[b]	10	0.696	840.657	.000	.875
Ever tested AIDS	6.959[c]	10	0.696	—	—	1.000
Intercept						
HIV test result	160,018.881	1	160,018.881	91.663	.000	.071
Ever tested HIV	104.444	1	104.444	126,203.238	.000	.991
Ever tested AIDS	104.376	1	104.376	—	—	1.000
Sexual partners						
HIV test result	966.880	2	483.440	0.277	.758	.000
Ever tested HIV	0.000	2	0.000	0.228	.796	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Location						
HIV test result	1,286.787	1	1,286.787	0.737	.391	.001
Ever tested HIV	0.000	1	0.000	0.153	.695	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Government services						
HIV serostatus test	19,569.150	2	9,784.575	5.605	.004	.009
HIV test result	6.590	2	3.295	3,981.198	.000	.869
Ever tested AIDS	6.603	2	3.301	—	—	1.000
Sexual Partners × Location						
HIV test result	749.435	2	374.717	0.215	.807	.000
Ever tested HIV	0.004	2	0.002	2.380	.093	.004

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Government Services						
HIV test result	400.014	1	400.014	0.229	.632	.000
Ever tested HIV	0.001	1	0.001	0.619	.431	.001
Ever tested AIDS	0.000	1	0.000	—	—	—
Location × Government Services						
HIV test result	268.757	2	134.378	0.077	.926	.000
Ever tested HIV	0.000	2	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Location × Government Services						
HIV test result	0.000	0	—	—	—	.000
Ever tested HIV	0.000	0	—	—	—	.000
Ever tested AIDS	0.000	0	—	—	—	—
Error						
HIV test result	2,087,891.405	1196	1,745.729			
Ever tested HIV	0.990	1196	0.001			
Ever tested AIDS	0.000	1196	0.000			
Total						
HIV test result	3,635,110.000	1207				
Ever tested HIV	1,231.000	1207				
Ever tested AIDS	1,228.000	1207				
Corrected total						
HIV test result	2,122,390.116	1206				
Ever tested HIV	7.947	1206				
Ever tested AIDS	6.959	1206				

a. R Squared = .041 (Adjusted R Squared = .023)

b. R Squared = .876 (Adjusted R Squared = .874) c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Table 22 shows the results of multivariate tests on associations between synergistic combinations of the behavioral determinant (condom use) demographic determinant (education), and clinical determinant (clinic services) with the dependent variables. Those tests lacked statistically significant associations between the combined effect of the independent variables and the dependent variables (see table 22).

Table 222

Multivariate Tests on Synergistic Analysis of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Effect and test[a]	Value	*F*	*df*		*p*	Partial η^2
			Hypothesis	Error		
Intercept						
Pillai's trace	0.987	43,460.100[b]	2	1183	.000	.987
Wilks's lambda	0.013	43,460.100[b]	2	1183	.000	.987
Hotelling's trace	73.474	43,460.100[b]	2	1183	.000	.987
Roy's largest root	73.474	43,460.100[b]	2	1183	.000	.987
Condom use						
Pillai's trace	0.000	0.115	4	2368	.977	.000
Wilks's lambda	1.000	0.115[b]	4	2366	.977	.000
Hotelling's trace	0.000	0.115	4	2364	.977	.000
Roy's largest root	0.000	0.158[c]	2	1184	.854	.000
Education						
Pillai's trace	0.008	1.527	6	2368	.165	.004
Wilks's lambda	0.992	1.528[b]	6	2366	.165	.004
Hotelling's trace	0.008	1.530	6	2364	.164	.004
Roy's largest root	0.008	3.038[c]	3	1184	.028	.008
Clinic services						
Pillai's trace	0.776	375.283	4	2368	.000	.388
Wilks's lambda	0.224	658.140[b]	4	2366	.000	.527
Hotelling's trace	3.463	1,023.418	4	2364	.000	.634
Roy's largest root	3.463	2,050.299[c]	2	1184	.000	.776
Condom Use × Education						
Pillai's trace	0.003	0.281	12	2368	.992	.001

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Wilks's lambda	0.997	0.280[b]	12	2366	.992	.001
Hotelling's trace	0.003	0.280	12	2364	.992	.001
Roy's largest root	0.002	0.368[c]	6	1184	.899	.002
Condom Use × Clinic Services						
Pillai's trace	0.001	0.172	4	2368	.953	.000
Wilks's lambda	0.999	0.172[b]	4	2366	.953	.000
Hotelling's trace	0.001	0.172	4	2364	.953	.000
Roy's largest root	0.000	0.257[c]	2	1184	.774	.000
Education × Clinic Services						
Pillai's trace	0.002	0.347	8	2368	.947	.001
Wilks's lambda	0.998	0.347[b]	8	2366	.947	.001
Hotelling's trace	0.002	0.347	8	2364	.948	.001
Roy's largest root	0.002	0.446[c]	4	1184	.775	.002
Condom Use × Education × Clinic Services						
Pillai's trace	0.002	0.476	6	2368	.826	.001
Wilks's lambda	0.998	0.476[b]	6	2366	.826	.001
Hotelling's trace	0.002	0.476	6	2364	.827	.001
Roy's largest root	0.002	0.739[c]	3	1184	.529	.002

a. Design: Intercept + CONDOUSE + EDUCATION + CLINICTEST + CONDOUSE * EDUCATION + CONDOUSE * CLINICTEST + EDUCATION * CLINICTEST + CONDOUSE * EDUCATION * CLINICTEST

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Tests of Between-Subjects Effects on Synergistic Association of Behavioral (condom use), Demographic (education), and Clinical (clinic service) Determinants with HIV Serostatus for Zambian Women Aged 18–24 was not statistically significant (see table 23).

Table 233

Tests of Between-Subjects Effects on Synergistic Association of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 18–24 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	86,213.651[a]	22	3,918.802	2.279	.001	.041
Ever tested HIV	6.961[b]	22	0.316	379.814	.000	.876
Ever tested AIDS	6.959[c]	22	0.316	—	—	1.000
Intercept						
HIV test result	86,864.115	1	86,864.115	50.510	.000	.041
Ever tested HIV	72.287	1	72.287	86,776.980	.000	.987
Ever tested AIDS	72.206	1	72.206	—	—	1.000
Condom use						
HIV test result	501.097	2	250.548	0.146	.864	.000
Ever tested HIV	0.000	2	0.000	0.086	.918	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Education						
HIV test result	15,671.279	3	5,223.760	3.038	.028	.008
Ever tested HIV	0.000	3	0.000	0.029	.993	.000
Ever tested AIDS	0.000	3	0.000	—	—	—
Clinic services						
HIV test result	10,211.055	2	5,105.527	2.969	.052	.005
Ever tested HIV	3.402	2	1.701	2,041.941	.000	.775
Ever tested AIDS	3.402	2	1.701	—	—	1.000
Condom Use × Education						
HIV test result	2,855.722	6	475.954	0.277	.948	.001
Ever tested HIV	0.001	6	0.000	0.289	.942	.001

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Ever tested AIDS	0.000	6	0.000	—	—	—
Condom Use × Clinic Services						
HIV test result	494.468	2	247.234	0.144	.866	.000
Ever tested HIV	0.000	2	0.000	0.196	.822	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Education × Clinic Services						
HIV test result	2,362.905	4	590.726	0.343	.849	.001
Ever tested HIV	0.001	4	0.000	0.356	.840	.001
Ever tested AIDS	0.000	4	0.000	—	—	—
Condom Use × Education × Clinic Services						
HIV test result	2,398.792	3	799.597	0.465	.707	.001
Ever tested HIV	0.001	3	0.000	0.475	.700	.001
Ever tested AIDS	0.000	3	0.000	—	—	—
Error						
HIV test result	2,036,176.465	1184	1,719.744			
Ever tested HIV	0.986	1184	0.001			
Ever tested AIDS	0.000	1184	0.000			
Total						
HIV test result	3,635,110.000	1207				
Ever tested HIV	1,231.000	1207				
Ever tested AIDS	1,228.000	1207				
Corrected total						
HIV test result	2,122,390.116	1206				
Ever tested HIV	7.947	1206				
Ever tested AIDS	6.959	1206				

a. R Squared = .041 (Adjusted R Squared = .023)
b. R Squared = .876 (Adjusted R Squared = .874)
c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Hypothesis Testing 8

Tables 24, 25, 26, and 27 present MANOVA results to test hypothesis testing 8. Multivariate analysis of variance (MANOVA) was also performed to test hypothesis 8 stated as follows: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of the HIV test result of Zambian female adults from age 25 to 49 (see table 24). The researcher failed to accept the null hypothesis.

Table 24*4*

Tests of Between-Subjects Effects on Synergistic Analysis of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 25–49

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	34,498.711[a]	10	3,449.871	1.976	.033	.016
Ever tested HIV	6.957[b]	10	0.696	840.657	.000	.875
Ever tested AIDS	6.959[c]	10	0.696	—	—	1.000
Intercept						
HIV test result	160,018.881	1	160,018.881	91.663	.000	.071
Ever tested HIV	104.444	1	104.444	126,203.238	.000	.991
Ever tested AIDS	104.376	1	104.376	—	—	1.000
Sexual partners						
HIV test result	966.880	2	483.440	0.277	.758	.000
Ever tested HIV	0.000	2	0.000	0.228	.796	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Location						
HIV test result	1,286.787	1	1,286.787	0.737	.391	.001
Ever tested HIV	0.000	1	0.000	0.153	.695	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Government services						
HIV test result	19,569.150	2	9,784.575	5.605	.004	.009
Ever tested HIV	6.590	2	3.295	3,981.198	.000	.869
Ever tested AIDS	6.603	2	3.301	—	—	1.000
Sexual Partners × Location						
HIV test result	749.435	2	374.717	0.215	.807	.000
Ever tested HIV	0.004	2	0.002	2.380	.093	.004

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Government Services						
HIV test result	400.014	1	400.014	0.229	.632	.000
Ever tested HIV	0.001	1	0.001	0.619	.431	.001
Ever tested AIDS	0.000	1	0.000	—	—	—
Location × Government Services						
HIV test result	268.757	2	134.378	0.077	.926	.000
Ever tested HIV	0.000	2	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Sexual Partners × Location × Government Services						
HIV test result	0.000	0	—	—	—	.000
Ever tested HIV	0.000	0	—	—	—	.000
Ever tested AIDS	0.000	0	—	—	—	—
Error						
HIV test result	2,087,891.405	1196	1,745.729			
Ever tested HIV	0.990	1196	0.001			
Ever tested AIDS	0.000	1196	0.000			
Total						
HIV test result	3,635,110.000	1207				
Ever tested HIV	1,231.000	1207				
Ever tested AIDS	1,228.000	1207				
Corrected total						
HIV test result	2,122,390.116	1206				
Ever tested HIV	7.947	1206				
Ever tested AIDS	6.959	1206				

a. R Squared = .016 (Adjusted R Squared = .008)

b. R Squared = .875 (Adjusted R Squared = .874) c. R Squared = 1.000 R Squared = 1.000)

Tests of Between-Subjects Effects indicate no statistically significant association between the Synergistic associations of Behavioral (sexual partners, condom use, HIV self-perceived risk), demographic (education, location, marital status), and Clinical (use of HIV services GOV, use of HIV services Clinic, use of HIV services NGO) determinants of HIV Serostatus for Zambian women aged 25–49 (see table 25). Therefore, the researcher failed to accept the null hypothesis stated as: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adults from age 25 to 49.

Table 255

Tests of Between-Subjects Effects on Synergistic Association of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 25–49 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	86,213.651[a]	22	3,918.802	2.279	.001	.041
Ever tested HIV	6.961[b]	22	0.316	379.814	.000	.876
Ever tested AIDS	6.959[c]	22	0.316	—	—	1.000
Intercept						
HIV test result	86,864.115	1	86,864.115	50.510	.000	.041
Ever tested HIV	72.287	1	72.287	86,776.980	.000	.987
Ever tested AIDS	72.206	1	72.206	—	—	1.000
Condom use						
HIV test result	501.097	2	250.548	0.146	.864	.000
Ever tested HIV	0.000	2	0.000	0.086	.918	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Education						
HIV test result	15,671.279	3	5,223.760	3.038	.028	.008
Ever tested HIV	0.000	3	0.000	0.029	.993	.000
Ever tested AIDS	0.000	3	0.000	—	—	—
Clinic services						
HIV test result	10,211.055	2	5,105.527	2.969	.052	.005
Ever tested HIV	3.402	2	1.701	2,041.941	.000	.775
Ever tested AIDS	3.402	2	1.701	—	—	1.000
Condom Use × Education						
HIV test result	2,855.722	6	475.954	0.277	.948	.001
Ever tested HIV	0.001	6	0.000	0.289	.942	.001
Ever tested AIDS	0.000	6	0.000	—	—	—

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Condom Use × Clinic Services						
HIV test result	494.468	2	247.234	0.144	.866	.000
Ever tested HIV	0.000	2	0.000	0.196	.822	.000
Ever tested AIDS	0.000	2	0.000	—	—	—
Education × Clinic Services						
HIV test result	2,362.905	4	590.726	0.343	.849	.001
Ever tested HIV	0.001	4	0.000	0.356	.840	.001
Ever tested AIDS	0.000	4	0.000	—	—	—
Condom Use × Education × Clinic Services						
HIV test result	2,398.792	3	799.597	0.465	.707	.001
Ever tested HIV	0.001	3	0.000	0.475	.700	.001
Ever tested AIDS	0.000	3	0.000	—	—	—
Error						
HIV test result	2,036,176.465	1184	1,719.744			
Ever tested HIV	0.986	1184	0.001			
Ever tested AIDS	0.000	1184	0.000			
Total						
HIV test result	3,635,110.000	1207				
Ever tested HIV	1,231.000	1207				
Ever tested AIDS	1,228.000	1207				
Corrected total						
HIV test result	2,122,390.116	1206				
Ever tested HIV	7.947	1206				
Ever tested AIDS	6.959	1206				

a. R Squared = .041 (Adjusted R Squared = .023)

b. R Squared = .876 (Adjusted R Squared = .874)

c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Table 26 indicates that there were no statistically significant associations between the synergistic combination of the behavioral, demographic, and clinical variables self-perceived HIV risk, marital status, and NGO services and the dependent variables for Zambian women aged 25–49 years. The researcher failed to reject the null hypothesis, stated as: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adults from age 25 to 49.

Table 26

Multivariate Tests on Synergistic Association of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 25–49 Years

Effect and test[a]	Value	*F*	*df*		*p*	Partial η^2
			Hypothesis	Error		
Intercept						
Pillai's trace	0.987	43575.177[b]	2	1183	.000	.987
Wilks's lambda	0.013	43575.177[b]	2	1183	.000	.987
Hotelling's trace	73.669	43575.177[b]	2	1183	.000	.987
Roy's largest root	73.669	43575.177[b]	2	1183	.000	.987
Self-perceived HIV risk						
Pillai's trace	0.011	1.292	10	2368	.229	.005
Wilks's lambda	0.989	1.294[b]	10	2366	.228	.005
Hotelling's trace	0.011	1.297	10	2364	.226	.005
Roy's largest root	0.011	2.597[c]	5	1184	.024	.011
Marital status						
Pillai's trace	0.000	0.051	6	2368	.999	.000
Wilks's lambda	1.000	0.051[b]	6	2366	.999	.000
Hotelling's trace	0.000	0.051	6	2364	.999	.000
Roy's largest root	0.000	0.102[c]	3	1184	.959	.000
NGO Services						
Pillai's trace	0.001	0.552[b]	2	1183	.576	.001
Wilks's lambda	0.999	0.552[b]	2	1183	.576	.001
Hotelling's trace	0.001	0.552[b]	2	1183	.576	.001
Roy's largest root	0.001	0.552[b]	2	1183	.576	.001
Self-Perceived HIV Risk × Marital Status						
Pillai's trace	0.008	0.329	28	2368	1.000	.004
Wilks's lambda	0.992	0.329[b]	28	2366	1.000	.004

(table continues)

Effect and test[a]	Value	*F*	*df* Hypothesis	*df* Error	*p*	Partial η^2
Hotelling's trace	0.008	0.329	28	2364	1.000	.004
Roy's largest root	0.008	0.657[c]	14	1184	.817	.008
Self-Perceived HIV Risk × NGO Services						
Pillai's trace	0.002	0.186	10	2368	.997	.001
Wilks's lambda	0.998	0.186[b]	10	2366	.997	.001
Hotelling's trace	0.002	0.186	10	2364	.997	.001
Roy's largest root	0.002	0.370[c]	5	1184	.869	.002
Marital Status × NGO Services						
Pillai's trace	0.002	0.333	6	2368	.920	.001
Wilks's lambda	0.998	0.333[b]	6	2366	.920	.001
Hotelling's trace	0.002	0.333	6	2364	.920	.001
Roy's largest root	0.002	0.665[c]	3	1184	.574	.002
Self-Perceived HIV Risk × Marital Status × NGO Services						
Pillai's trace	0.002	0.264	10	2368	.989	.001
Wilks's lambda	0.998	0.264[b]	10	2366	.989	.001
Hotelling's trace	0.002	0.264	10	2364	.989	.001
Roy's largest root	0.002	0.527[c]	5	1184	.756	.002

Note. NGO = nongovernmental organization.

a. Design: Intercept + CONDOUSE + EDUCATION + CLINICTEST + CONDOUSE * EDUCATION + CONDOUSE * CLINICTEST + EDUCATION * CLINICTEST + CONDOUSE * EDUCATION * CLINICTEST

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Tests between Subjects Effects indicate no statistically significant synergistic associations between behavioral, demographic, and clinical determinants with HIV serostatus for Zambian women aged 25–49 years (see table 27). I failed to reject the null hypothesis, stated as: there is no statistically significant synergistic association between behavioral, demographic, and clinical determinants and that of HIV serostatus of Zambian female adults from age 25 to 49.

Table 27

Tests of Between-Subjects Effects for Synergistic Association of Behavioral, Demographic, and Clinical Determinants of HIV Serostatus for Zambian Women Aged 25-49 Years

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Corrected model						
HIV test result	150,999.243[a]	38	3,973.664	2.357	.000	.070
Ever tested HIV	6.950[b]	38	0.183	217.110	.000	.874
Ever tested AIDS	6.960[c]	38	0.183	—	—	1.000
Intercept						
HIV test result	69,307.004	1	69,307.004	41.114	.000	.034
Ever tested HIV	73.285	1	73.285	86991.580	.000	.987
Ever tested AIDS	73.280	1	73.280	—	—	1.000
Self-perceived HIV risk						
HIV test result	21,857.469	5	4,371.494	2.593	.024	.011
Ever tested HIV	0.000	5	0.000	0.001	1.000	.000
Ever tested AIDS	0.000	5	0.000	—	—	—
Marital status						
HIV test result	514.632	3	171.544	0.102	.959	.000
Ever tested HIV	0.000	3	0.000	0.000	1.000	.000
Ever tested AIDS	0.000	3	0.000	—	—	—
NGO Services						
HIV test result	1,860.719	1	1,860.719	1.104	.294	.001
Ever tested HIV	0.000	1	0.000	0.000	.991	.000
Ever tested AIDS	0.000	1	0.000	—	—	—
Self-Perceived HIV Risk × Marital Status						
HIV test result	15,497.342	14	1,106.953	0.657	.818	.008
Ever tested HIV	0.000	14	0.000	0.003	1.000	.000

(table continues)

Source and dependent variable	Type III sum of squares	*df*	Mean square	*F*	*p*	Partial η^2
Ever tested AIDS	0.000	14	0.000	—	—	—
Self-Perceived HIV Risk × NGO Services						
HIV test result	3,121.318	5	624.264	0.370	.869	.002
Ever tested HIV	0.000	5	0.000	0.002	1.000	.000
Ever tested AIDS	0.000	5	0.000	—	—	—
Marital Status × NGO Services						
HIV test result	3,358.103	3	1,119.368	0.664	.574	.002
Ever tested HIV	0.000	3	0.000	0.002	1.000	.000
Ever tested AIDS	0.000	3	0.000	—	—	—
Self-Perceived HIV Risk × Marital Status × NGO Services						
HIV test result	4,404.772	5	880.954	0.523	.759	.002
Ever tested HIV	0.000	5	0.000	0.004	1.000	.000
Ever tested AIDS	0.000	5	0.000	—	—	—
Error						
HIV test result	1,995,883.167	1184	1,685.712			
Ever tested HIV	0.997	1184	0.001			
Ever tested AIDS	0.000	1184	0.000			
Total						
HIV test result	3,666,131.000	1223				
Ever tested HIV	1247.000	1223				
Ever tested AIDS	1244.000	1223				
Corrected total						
HIV test result	2,146,882.410	1222				
Ever tested HIV	7.948	1222				
Ever tested AIDS	6.960	1222				

Note. NGO = nongovernmental organization.

a. R Squared = .041 (Adjusted R Squared = .023)

b. R Squared = .876 (Adjusted R Squared = .874) c. R Squared = 1.000 (Adjusted R Squared = 1.000)

Summary

This section summarizes the results of the MANOVA for each research question.

Research Question 1

The results showed a statistically significant association between HIV serostatus and the sexual partners' behavioral determinant for Zambian women aged 18–24. They also showed no significant association between HIV serostatus and the other two behavioral determinants (condom use and self-perceived HIV risk).

Research Question 2

The results for women aged 25–49 years showed a significant association between HIV serostatus and self-perceived HIV risk and no association between HIV serostatus and the other behavioral determinants (sexual partners and condom use).

Research Question 3

The results showed a statistically significant association between education and HIV serostatus among Zambian women aged 18–24 years. Unlike in previous studies, I found no statistically significant differences for the demographic variables' location and marital status or pairwise interactions of location and marital status, location and education, or marital status and education.

Research Question 4

The results also indicated a statistically significant association between education and HIV serostatus among Zambian women aged 25–49 years. As with the results of Research Question 3, I found no statistically significant differences for the demographic

variables location and marital status or pairwise interactions of location and marital status, location and education, or marital status and education.

Research Question 5

MANOVA pairwise comparisons of clinical determinants indicated statistically significant variations among HIV services. Aggregate use of HIV services was associated with HIV serostatus for Zambian women aged 18–24 years. However, the use of government HIV services, clinic services, and NGO services were not individually associated with HIV serostatus among this age group.

Research Question 6

The results for women aged 25–49 were similar to those for women aged 18–24 concerning the use of HIV services. There was a statistical association between aggregate use of services and HIV serostatus, but there were no associations between the use of government services, clinic services, or NGO services individually and HIV serostatus.

Research Question 7

Multivariate tests indicate no statistically significant synergistic association between behavioral, demographic, and clinical determinants of HIV serostatus for adolescent (18 -24) Zambian women.

Research Question 8

Multivariate tests show no statistically significant outcomes for the synergistic associations between behavioral and demographic determinants with HIV serostatus for Zambian women aged 25–49 years.

Chapter 5 presents detailed discussions, conclusions, and recommendations

based on the results regarding associations between behavioral, demographic, and clinical determinants and HIV serostatus for Zambian women.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of the study was to determine the association between the demographic, behavioral, and clinical determinants and HIV serostatus in Zambian adolescents (aged 18–24 years) and adult (aged 25–49 years) women. I tested the hypotheses in the study using MANOVA.

Interpretation of the Findings

The findings of this study converged with those of existing studies in some ways and diverged from them in other ways.

Behavioral Determinants of HIV Serostatus

For both women aged 18–24 years and women aged 25–49 years, there was a significant association between HIV serostatus and self-perceived HIV risk but not sexual partners or condom use. This finding is partly consistent with Adeniyi et al. (2017), who also examined behavioral, demographic, and clinical determinants and HIV serostatus. However, Adeniyi et al. (2017) studied only one HIV serostatus variable compared to this study's three serostatus variables. They also found a significant association of sexual behavior and the use of clinical services with HIV serostatus disclosure.

The findings indicate a link between the HIV test result variable and self-perceived HIV risk for women aged 18–24 years. There was a strong association between the perception of no risk or small risk and HIV serostatus. Toska et al. (2017) reported the presence of a direct association between HIV acquisition of adolescent women (aged 18–24 years) and having multiple sexual partners, although the finding was inconclusive.

That finding was in harmony with a secondary analysis of a cross-sectional study conducted in Uganda, which indicated an association between self-perceived HIV risk and incidence of HIV infection among women of all ages. This study elucidates the impact of self-perceived HIV risk. It suggests a prevention strategy for Zambian women and also probably women in similar settings and socioeconomic statuses in other parts of sub-Saharan Africa. Rosenberg et al. (2017), reporting on a population-based study, said that the spread of HIV had accelerated in older adults in South Africa and recommended the commencement of prevention activities for analogous communities in sub-Saharan African countries.

Demographic Determinants of HIV Serostatus

The findings indicated a statistically significant association between education and HIV serostatus among women in both age groups. However, unlike previous studies, there were no statistically significant differences for the demographic variables of location and marital status and pairwise interactions of location and marital status, location and education, and marital status and education. Omonaiye, Kusljic, Nicholson, and Manias (2018), Pinchoff, Boyer, Mutombo, Chowdhuri, and Ngo (2017), and Okawa et al. (2018) reported that age and education were critical to determining HIV serostatus for adolescent and adult women at individual and societal levels.

Lack of associations between HIV serostatus and age (adolescent versus adult) and location (urban versus rural) also contrasted with the findings of authors who stated strong and significant associations between HIV serostatus and age, gender, and location (Chanda-Kapata et al., 2016; McCarraher et al., 2018). Mee et al. (2018) found that being

in school increased students' awareness of HIV and the practice of preventive measures and eventually contributed to the diminishing of the spread of HIV infection.

Other researchers failed to find an association between education and the use of HIV services (Sabapathy et al., 2018). Bunyasi and Coetzee (2017) suggested a direct association between accomplishment in education and the reduction of HIV prevalence. It is possible that the main reason for the association between lower incidence of HIV and higher educational achievement is the ability of educated people to implement safer sexual practices and abstain from sexual activity. Increased health literacy and academic progress could empower educated people to make informed decisions and take responsibility for themselves and their communities.

Clinical Determinants of HIV Serostatus

The findings indicated a significant association between aggregate use of HIV services and HIV serostatus for women in both age groups. This result neither confirmed nor refuted the findings reported by authors of systematic reviews, who implied that it was essential to conduct further studies to maximize prevention through the use of HIV medications (Mark et al., 2017; Williams, Renju, Ghilardi, & Wringe, 2017). However, there were no significant associations between HIV serostatus and the use of government services, clinic services, and NGO services considered individually. This finding agreed with the results of Mustapha, Musiime, Bakeera-Kitaka, Rujumba, and Nabukeera-Barungi (2018) regarding the use of HIV services by women in Uganda. Those authors stated that HIV services for women were substandard in one sub-Saharan country, Uganda. Mustapha et al. (2018) reported that women received motivation to use services

from knowing HIV status and demotivation to use services from not knowing HIV serostatus, discrimination, and economic constraints.

Authors of systematic studies described the benefits of team-based HIV service access for triggering improved HIV prevention in sub-Saharan African countries. Reviewers of quantitative and qualitative studies explicitly described associations between HIV serostatus and the use of team-based services versus institutionalized HIV services—government, clinic, and NGO (Mukumbang, Van Belle, Marchal, & Wyk, 2017). The availability of HIV services in HIV-prone sub-Saharan African countries could be positive indicators of the containment of HIV spread and the deterrence of new infection. The use of HIV services in communities has the same level of importance. Along with HIV services, the implementation of precise HIV diagnostic tests to minimize false test outcomes is critical in sub-Saharan African countries (Kravitz et al., 2018).

Demographic, Behavioral, and Clinical Determinants of HIV Serostatus

Multivariate tests indicated no significant association between the synergistic association of Demographic, Behavioral, and Clinical Determinants with HIV Serostatus for Zambian women aged 18–24. Likewise, there was no significant association between the synergistic association of Demographic, Behavioral, and Clinical Determinants with HIV Serostatus for Zambian women aged 25 to 49. The community strategy outlined by health professionals, policymakers, and other entities involved in HIV prevention should be a collective drive to manage HIV epidemics in sub-Saharan Africa (Bibiana, Emmanuel, Amos, Ramsey, & Idris, 2018). The finding regarding the synergistic association between behavioral, demographic, and clinical determinants with HIV

serostatus could not address the recommendation by Kharsany and Karim (2016) for a study of behavioral determinants and the HIV literacy (education) gap with respect to HIV serostatus cognizance at the community level.

The linkage between the Findings and the Conceptual Framework

The World Health Organization's Commission for Social Determinants of Health formed the conceptual framework used for this study. The commission addresses intrinsic disparities in HIV health between sub-Saharan Africa and the rest of the world. The framework emphasizes the complexity of behavioral, demographic, and clinical determinants and their role in HIV epidemics in this part of the globe. The study findings agreed with the strong associations of self-perceived HIV risk and educational attainment with HIV serostatus included in the framework. Other authors emphasized the impacts of health and academic literacy, race, age, and unsafe sexual practices on the acceleration of HIV infection (Araújo & Duarte, 2018).

Limitations of the Study

This study had certain limitations. The exclusion of those aged younger than 18 years and older than 49 years, prisoners, and military personnel was one of the limitations. Because resource constraints dictated that the ZDHS surveyed only two provinces, the other eight provinces were excluded from data collection. The complete absence of men could be a significant limitation. Another limitation was that the study was cross-sectional rather than longitudinal. It lacked the benefits of conducting longitudinal research, including the ability to identify temporal effects and associated changes in the dynamics of sexual behaviors, demographic shifts, and capacity and

acceptability of HIV prevention services. The last limitation was the age of the data from the ZDHS. The laps of 10 years since the data were collected means that the data may not reflect the current situation. However, I could overcome this to some extent by extrapolating the findings through the lens of other consistent HIV research findings in sub-Saharan Africa. Generalization of the findings beyond the specific setting to other similar settings appears reasonable.

Recommendations

The recommendations in this section apply to Zambian women and women living in similar settings throughout sub-Saharan Africa. The consequences and risks of HIV prevail in older women. Future researchers can improve the robustness of their findings by including older women. Including this age group in HIV prevention efforts and will assist in significantly diminishing HIV in sub-Saharan Africa. According to Maughan-Brown and Venkataramani (2018), the high prevalence of HIV in South Africa was due to risky sexual behaviors among older women. National and international collaboration are pivotal to lessen the spread of HIV throughout the world because HIV is a public health threat in every country. A unified approach to HIV prevention and control would have collateral health benefits when supported with measurable goals and comprehensive strategies (Baron et al., 2018; Jones, Sullivan, & Curran, 2019).

Implications

The dynamics of sexual behaviors and their associations with HIV serostatus indicate their impact on HIV prevalence, incidence, and epidemics in sub-Saharan Africa. One of the focuses was the paramount importance of the consolidation of leadership to

mobilize communities for harmonized HIV response (Fakoya, Dybul, & Sands, 2019). In conjunction with the findings on the associations of behavioral, demographic, and clinical determinants with HIV serostatus for Zambian women aged 18–49, the inclusion of female participants younger than 18 years and older than 49 years would yield more holistic findings that could be applied to fighting HIV (Rosenberg et al., 2017).

Conclusion

The findings regarding the associations of behavioral, demographic, and clinical determinants with HIV serostatus can be used to project risk, inform prevention efforts, and initiate longitudinal research. These findings suggest that self-perceived HIV risk, education, and type of HIV services are reliable indicators of HIV serostatus. The only difference between adolescent and adult Zambian women found was the synergistic association between HIV serostatus and behavioral, demographic, and clinical determinants, with a statistically significant association with the use of clinic services for women aged 25–49 and an association with the use of government services for women aged 18–24.

Effective HIV prevention and control in sub-Saharan countries should focus on developing awareness using educational advancement as a tool, recognizing HIV risks through health literacy, and addressing social determinants of HIV health. These findings complement growing evidence indicating the benefits of collaborative HIV prevention efforts that involve HIV researchers and health professionals at both the local and international levels. The willingness of policymakers and government officials to allocate

resources and collaborate is a step toward the eradication of HIV, a goal that can only be reached with leadership from all entities and professionals related to HIV.

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