2021

Age-of-Consent Policies and HIV Among Adolescents in Sub-Sahara Africa

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Walden University
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Abstract

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by

Suzanne Marie King

MPH, Purdue Global 2019

BS, Kaplan University 2018

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

August 2021

Abstract

Age of consent policies have recently been identified as a barrier to HIV testing among adolescents in HIV endemic Sub-Sahara Africa. Grounded in the modified social ecological model, the purpose of this study was to determine if these policies were related to HIV testing rates and prevalence. In this quantitative research secondary data sets from the Demographic Health Survey were used. This study included all sexually active respondents aged 18 years or below (N=37,015) and then was further limited by respondents that had HIV test results (N=25,107). Binary logistic regression showed that respondents with lower age of consent had higher rates of HIV testing. Compared to respondents with an age of consent of 18 years, respondents with age of consent of 16 were 3 times more likely to have been tested ($p<0.001$, OR 2.876, 95% CI [2.697, 3.067]), age of consent of 15 were 1.5 times more likely to be tested, age of consent of 14 were 0.5 times less likely to be tested, age of consent of 13 were 5 times more likely to be tested, age of consent of 12 were 3 times more likely to be tested, and age of consent of 11 were 2 times more likely to have been tested. Age of consent was also related to HIV prevalence. For each year decrease in age of consent, odds of being HIV positive increased by 1.2%. The outcomes of this study showed further relationships between HIV testing and age of consent policies. This research can be used to inform updated age of consent policies to ensure that all adolescents can access HIV testing. This research could shed light on the importance of HIV testing for adolescents, their families, and their communities leading to positive social change.

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Dedication

This doctoral study is dedicated to my husband, Tracy King, and my children, Hope, Destiny, and Skylan. This would not have been possible without the faith and guidance of my husband, my biggest fan, and my best friend. Thank you for pushing me, for waiting around, and for standing by me in the difficult times. Also thank you for believing in me. For my children, thank you for understanding that I had to put everything on hold. I did this to show you that anything is possible.

Acknowledgments

I would like to express my gratitude to all of the instructors, tutors, and staff that I had the pleasure of learning from at Walden University. My deepest thanks to my committee chair, Dr. Pete Anderson, for all of your wisdom, patience, and support during this process. You showed me that I could reach my goals, and your timely turn around was critical to reaching those goals. Dr. Patrick Dunn, thank you for your support and positive insights on my doctoral study. Dr. Richard Palmer, thank you for serving as my URR. Thank you so much for all of the time you spent serving as my committee to assist me in completing my doctorate.

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Section 1: Foundation of the Study and Literature Review

Introduction

HIV and AIDS have become the leading cause of death among the adolescent population in Sub-Sahara Africa (SSA; Mark et al., 2017). This public health crisis remains despite the advancements in HIV understanding and treatment and the HIV prevention efforts across the SSA region (Tonen-Wolyec et al., 2020). Further research is necessary to understand how to begin to curb this crisis and reduce HIV among adolescents in SSA. One variable that has been cited frequently as a contributor to HIV in this population in previous research is the age-of-consent policies (Bodika et al., 2016; Rodriguez, 2017; Shanaube et al., 2017; Shayo & Kalomo, 2019; Tonen-Wolyec et al., 2019, 2020). However, there has been little research into how the age-of-consent policies across SSA impact HIV testing rates or HIV prevalence (McKinnon & Vandermorris, 2018). This research study examined HIV prevalence and HIV testing rates among adolescents within 32 countries to determine if there was any relationship between age and HIV testing and prevalence while accounting for age of consent policies. This research is pertinent to determine the impact of age-of-consent policies as a barrier to HIV testing, and then to inform potential policy changes within these SSA countries. Implications of this research study will be to understand if the HIV testing age-of-consent policy is a barrier that inhibits HIV testing in the adolescent populations. If these policies do create a barrier to testing, this research could be used by public health professionals and healthcare providers to lobby for updated age-of-consent policies across SSA.

Section 1 of this study provides information on the background of the HIV crisis within the SSA adolescent population, how the age-of-consent policies have been linked to the HIV crisis in previous research, and the current problem statement for this research. Then, the purpose of the study will be highlighted, along with the research questions, null hypotheses, and alternative hypotheses. Next, the theoretical foundation for the study will discuss the theories used to answer the research questions. The nature of the study will discuss the proposed research design, variables, and methodology. The literature review will provide contextual research on the study variables, previous literature related to the research questions, and previous studies with similar theoretical frameworks. This section will also provide key terms and databases used in the literature review. Finally, the independent variables, dependent variable, and covariates are defined, the assumptions, scope, and limitations are reviewed, and this section is concluded with the potential significance of the research outcome in clinical practice.

Background

HIV within SSA has been extensively researched to better delineate the disease, the contributing factors, success of prevention programs, effectiveness of treatment, and the impact of the disease on the population (Bhana, 2017; Gatuguta et al., 2018; Groves et al., 2018; Gust et al., 2017; Mkandawire, 2017; Wallace et al., 2018; Wambura et al., 2019). A particular focus of research is HIV within the adolescent population, who currently represents a high burden population within the region (Eba & Lim, 2017; Groves et al., 2018; Mark et al., 2017; McKinnon & Vandermorris, 2018; Simms, 2017; Ssebunya et al., 2019; Tonen-Wolyec et al., 2019, 2020). As previously noted, an area of concern that has been cited throughout research is the testing barrier of age of consent (Shayo & Kalomo, 2019; Tonen-Wolyec et al., 2019, 2020). The age-of-consent policy may prevent adolescents from being able to access HIV testing, and then counseling and treatment if needed (Rodriguez, 2017; Shanuabe et al., 2017; Shayo & Kalomo, 2019; Tonen-Wolyec et al., 2019). Although numerous researchers have identified age of consent as a barrier to HIV testing within SSA, there has not been adequate research to understand this relationship between age of consent and HIV testing. Previous researchers have identified that age of consent has been a barrier for the SSA adolescent population, and researchers have begun to analyze the relationship between age of consent and HIV testing rates. Eba and Lim (2017) explored the age-of-consent policies across SSA countries to understand the current policies. Finally, McKinnon and Vandermorris (2018) examined age-of-consent policies across SSA by analyzing the relationship between higher and lower age-of-consent policies and HIV testing rates. The researchers found that countries with an age of consent of 15 years old and below have higher testing rates than countries with an age of consent of 16 years old and above (McKinnon & Vandermorris, 2018).

Further researcher is needed to determine if and how the age-of-consent policy is related to the HIV crisis within the region. There is no research that examines age of consent to determine if there is a statistical difference between HIV testing and age, accounting for age of consent. Further research is necessary to analyze if lower age-of-consent policies have any relationship to HIV prevalence within the younger population.

This research is needed to address the current gap in research and understanding age of consent and its relationship to the HIV crisis within the SSA adolescent population. The HIV crisis among SSA adolescents has not responded to the current prevention programs, so further research and understanding is essential to curbing this pandemic (Mark et al., 2018). Age-of-consent policy research has shown some relation to the HIV crisis; therefore, further research is warranted to determine if this is a plausible path to reducing the devastation caused by this disease. This research study adds to the current body of knowledge and provides some guidance that may help improve adolescent directed prevention programs.

Problem Statement

SSA continues to experience disproportionately high rates of HIV, most notably in the adolescent population (Williams et al., 2017). Most adolescents affected by HIV live within this region. There are 1.8 million adolescents affected by HIV globally, and 84% of those (1.5 million) live within SSA (McKinnon & Vandermorris, 2018). Not only are these adolescents affected with the virus, but many are also not diagnosed and treated within a timely manner, which has increased the morbidity and mortality of the disease. Currently, HIV/AIDS is the leading cause of death for the adolescent population within this region (Tonen-Wolyec et al., 2019). This population faces numerous barriers that contribute to this HIV crisis, including lack of access to health care, low health literacy levels, cultural beliefs, and religious practices (Nunu et al., 2020; Toska et al., 2017). An additional barrier for adolescents is age of consent for HIV testing (McKinnon & Vandermorris, 2018; Tonen-Wolyec et al., 2019).

Age-of-consent policies exist within each SSA country to identify what age a person must be to access HIV testing, treatment, and counseling without parental consent. Currently, across SSA, there is no consistency for what age an adolescent can consent to HIV testing, with ages ranging from 12-18 years (McKinnon & Vandermorris, 2018). Although these policies are meant to protect the adolescent from dealing with a serious medical diagnosis alone, many adolescents do not have a guardian that will consent for testing, meaning that many cannot be tested for HIV (Tonen-Wolyec et al., 2019). Additionally, the testing rates for adolescents within SSA remains very low. According to McKinnon and Vandermorris (2018) only 23% of adolescent females and 16% of adolescent males within SSA have been tested within the last year. These low testing rates may contribute to the rapid spread of the disease and the mortality associated with HIV. Proper treatment and counseling cannot be given until testing has been done and a diagnosis has been made.

Current research has shown a link between age of consent and HIV testing rates within several countries in this region. This research showed higher rates of testing in countries that had an age of consent of 15 years or lower when compared to countries with an age of consent of 16 and higher (McKinnon & Vandermorris, 2018). Eba and Lim (2017) additionally examined each SSA country age-of-consent policy. Further research is needed to clarify whether the age-of-consent policies in different SSA countries affect HIV testing rates and HIV prevalence within the SSA adolescent population. In this research study, I aimed to add to this growing body of research focusing on age of consent and expand on the previous research. This research examined additional countries and age groups to attempt to expand the current knowledge. This research could potentially inform improved policy changes and future HIV prevention, testing, and treatment to begin to address the HIV pandemic within the region.

Purpose of the Study

The purpose of this study was to determine if there is a relationship between a respondents' HIV age-of-consent policies, if a respondent has ever been tested for HIV, and HIV prevalence among adolescents within countries in SSA. McKinnon and Vandermorris (2018) theorized that higher age-of-consent policies potentially contribute to reduced HIV testing rates and pose a barrier to accessing HIV testing and counseling. Through this quantitative study, I aimed to examine if there is a potential relationship between age and HIV testing rates among sexually active, nonmarried SSA adolescents, and if age of consent was a potential contributing factor. Then, I sought to analyze if there is any relationship between age and HIV prevalence among sexually active, nonmarried adolescents that have had an HIV test within the last year and if and how age of consent contributed to this relationship. The independent variable was age; the dependent variables were tested for HIV with 12 months and HIV positive test results. Covariates used in this study included age of consent, gender, education level, and wealth index.

Research Questions and Hypothesis

RQ1-Quantitative: Is there an association between respondents' age and having been tested for HIV within the last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index?

$H_0$1: There is no association between respondents’ age and having been tested for HIV within the last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

H_a1: There is a statistically significant between respondents’ age and having been tested for HIV within the last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

RQ2-Quantitative: Is there an association between respondents’ age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index?

$H_0$2: There is no association between respondents’ age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

H_a2: There is a statistically significant association between respondents’ age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

Theoretical Foundation for the Study

This study used the modified social-ecological model (MSEM) framework to test whether there is a relationship between the age and HIV testing and prevalence. The social ecological model (SEM) was developed from the individual works of Bronfenbrenner, McLeroy, and Stokol between 1979 and 2003 (Gombachika et al, 2012;

Nyambe et al. 2016). Bronfenbrenner's early ecological systems theory nested the levels of influence to show how each level influences the individual, McLeroy's ecological model of health behaviors linked the levels of influence and how they impact health behaviors, and Stokol's SEM of health promotion identified the theoretical constructs (Gombachika et al., 2012). In 2013, Baral et al. built on the SEM to create the MSEM, which better addresses the varied complexities of HIV, including the epidemiological factors of the HIV crisis. This updated theory provides the best strategy to address HIV policy.

The MSEM is a theory used by researchers who argue that there are numerous levels of influence that impact an individual and utilizes the impact of these levels to create positive behavioral change associated with HIV (Kilanowski, 2017). The SEM has frequently been used in public health HIV research due to the use of intrapersonal (microsystem), interpersonal (mesosystem), organizational (exosystem), community (macrosystem), and policy (chronosystem) levels of influence (Kilanowski, 2017). The MSEM incorporates an additional level of the epidemic to address and prevent HIV transmission across a population (Baral et al., 2013). There will be more detailed descriptions of the MSEM and its application to this research study later in this section.

The MSEM is used to approach behavior from many levels of influence, which is critical to understanding the HIV crisis within the adolescent population in SSA. In SSA, the factors that contribute to the HIV crisis are complex and stem from every level of influence and must be addressed accordingly (Poteat et al., 2015). The use of the MSEM will allow me to focus on the meta-level of the age-of-consent policy while also including covariates from other levels, including the micro and mesosystems.

Nature of the Study

The nature of this study was quantitative research with a cross-sectional design. Logistic regression was used to analyze if age (scale independent variable) can predict HIV testing rates within the last 12 months (categorical dependent variable) and HIV prevalence (categorical dependent variable) within adolescents in SSA. Logistic regression has been successfully used to examine potential relationships between age and HIV testing rates in the study by McKinnon and Vandermorris (2018). Logistic regression analysis was also used to determine if covariates or confounders contribute to HIV testing and HIV prevalence. This study design was useful in determining if there was a relationship between age and HIV while controlling for age of consent among many different countries in SSA.

The independent variable age represents the respondent’s current age in years. HIV testing is the first dependent variable, and measures if the respondent has had HIV testing within the last 12 months. The second dependent variable examines HIV prevalence by determining the respondent’s HIV status. The covariates included in the study are the respondent’s age of consent (scale), gender (nominal) as male or female, highest level of education completed (scale), and wealth index (scale).

Secondary data from the Demographic and Health Surveys (DHS) was used within this study. The DHS has collected nationally representative data across more than 90 countries that include household data, health information, service provisions, HIV, and malaria information (Demographic and Health Surveys Program, n.d.). The DHS has granted me access to data from the 32 SSA countries with data related to HIV. Ten countries were excluded due to lack of HIV data. The data sets will be merged and analyzed within SPSS v. 27.

Literature Search Strategy

This research project on age-of-consent policies within SSA and their potential association with age, HIV testing rates, and HIV prevalence was grounded within and developed from recent scholarly literature. I performed an extensive and exhaustive search of the literature to understand what research has been done and what gaps exist. The literature review focused on articles that pertain to HIV within SSA countries, primarily focusing on age-of-consent policies. However, other topics included behaviors associated with HIV, HIV within the adolescent population, barriers to healthcare access, HIV testing, current HIV programs, and current prevention strategies. The literature search performed is outlined below.

List of Accessed Library Databases and Search Engines

The literature review included primary searches of Walden University's Thoreau multi-database, which consist of CINAHL & MEDLINE combined search, CINAHL Plus with full text, Embase, MEDLINE with full text, ProQuest Health & Medical Collection, ProQuest Nursing & Allied Health Database, and PsycINFO. External searches used Google Scholar and SAGE Journals to supplement the Thoreau multidatabase and capture publications globally. Finally, organizational websites including WHO, UNAIDS, and Avert were used to ascertain HIV-related data, statistics, and current policies.

Key Search Terms

Keywords and phrases used in the search included the following terms and phrases: *human immunodeficiency virus* OR *HIV, adolescent* OR *teenager* OR *young adult* OR *teens* OR *youth*, *age of consent*, and *sub-Sahara Africa* OR *Africa OR sub-Saharan* OR *Angola* OR *Burundi* OR *Congo* OR *Cameroon* OR *Central African Republic* OR *Chad* OR *Guinea* OR *Gabon* OR *Kenya* OR *Nigeria* OR *Rwanda* OR *Sao Tome* OR *Tanzania* OR *Uganda* OR *Sudan* OR *Djibouti* OR *Eritrea* OR *Ethiopia* OR *Somalia* OR *Botswana* OR *Comoros* OR *Lesotho* OR *Madagascar* OR *Malawi* OR *Mauritius* OR *Mozambique* OR *Namibia* OR *Seychelles* OR *South Africa* OR *Swaziland* OR *Zambia* OR *Zimbabwe* OR *Benin* OR *Mali* OR *Burkina Faso* OR *Cape Verde* OR *Ivory Coast* OR *Gambia* OR *Ghana* OR *Guinea* OR *Liberia* OR *Mauritania* OR *Niger* OR *Senegal* OR *Sierra Leone* OR *Togo*.

Scope of Literature Review

This literature review was limited to include the most recent scholarly literature. Searches were limited to the last 5 years (2015 to 2020) and primarily included peer-reviewed articles. When necessary, literature was included from other credible sources including the WHO, UNAIDS, and Avert to include data on the latest policies, current statistics, and other HIV-related facts about transmission, testing, prevention, and treatment. Older literature and seminal articles were included within the review to provide contextual background and history related to HIV and theoretical application.

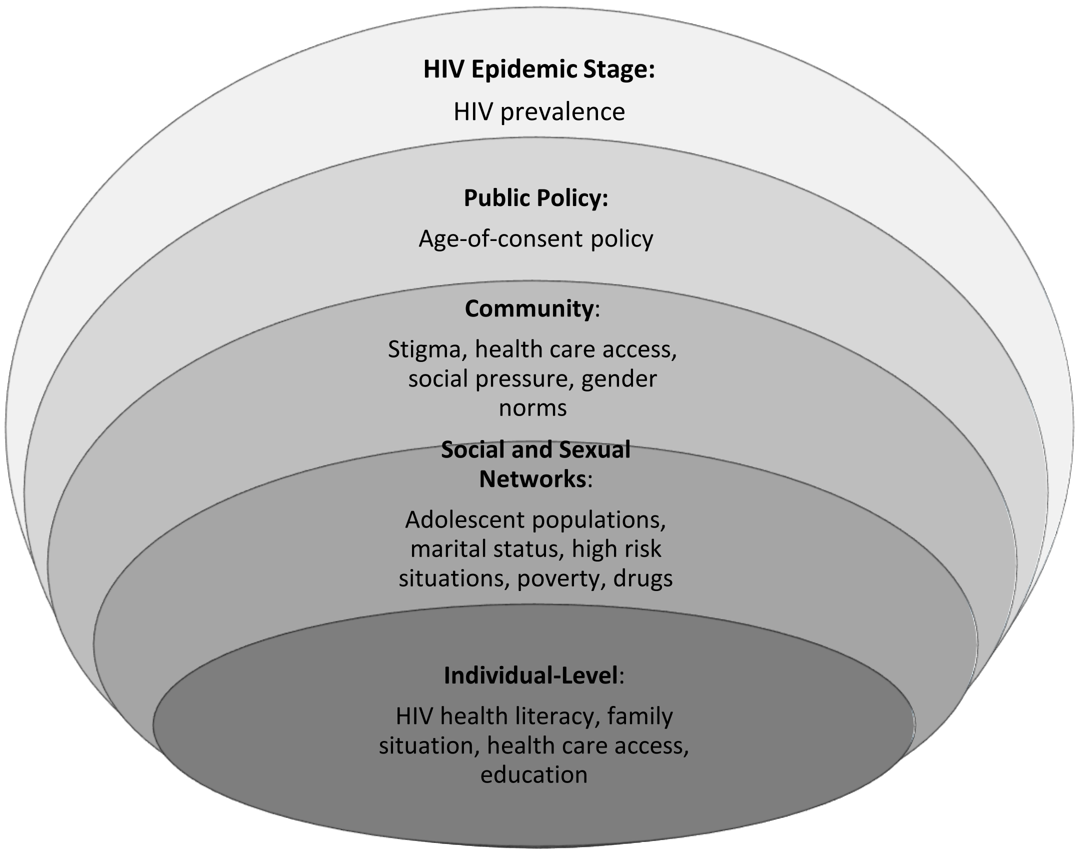
Theoretical Framework

HIV must be addressed with a multidimensional strategy to begin to create positive outcomes within the SSA adolescent population (Scheibe et al., 2014). The underlying theoretical constructs should include the many layers of influence to have successful outcomes (Bronfenbrenner, 1977). Baral et al. (2013) noted that narrow interventions that target individual behaviors will fail if they do not account for outside influences including community, policy, and epidemic stages. The MSEM includes each level of influence to provide a comprehensive theory that will be suitable for this policy research (Baral et al., 2013).

This theoretical model has been adapted and modified several times since Bronfenbrenner first proposed the idea of an ecological model in the 1970s, as was inspired by the work of Lewin (Richard et al., 2011). Bronfenbrenner (1977) named levels of influence that affected human development, including the microsystem, the mesosystem, the exosystem, and the macrosystem, and each level had specific influence over development and behavior. McLeroy, Bibeau, Steckler, and Glanz incorporated a fifth level of influence in 1988 to have intrapersonal, interpersonal, institutional, community, and policy (Golden & Earp, 2012). Additionally, the researchers matched specific interventions to work with each level of influence (Golden & Earp, 2012). In 2003, Stokols further adapted the SEM and added that the most effective strategy to address a health issue is to target at least two levels of influence (Richard et al., 2011). In 2013, Baral et al. modified the SEM, specifically targeting large scale crises like HIV. The MSEM added a stage to the outer most rings of the SEM to encompass the epidemic stage as noted in Figure 1. The MSEM incorporates the HIV epidemic stage and provides a theoretical model more appropriate to address HIV on a population level (Baral et al., 2013).

Figure 1

Modified Social Ecological Model (MSEM)



Note. From "Modified social ecological model: a tool to guide the assessment of the risks and risk contexts of HIV epidemics" by S. Baral, C. H. Logie, A. L. Wirtz, & C. Beyrer, 2013, *BMC Public Health*, *2013*(13), p. 482.

The primary theoretical proposition of the MSEM is that no single level of the SEM can dictate risk of HIV, but that the epidemiological stage of HIV determines the adolescent's risk of disease (Baral et al., 2013). The MSEM theorizes that disease risks are contextualized by the higher levels of influence, including network, community, and policy and that successful disease prevention must account for these different levels (Ruiseñor-Escudero et al., 2017). The first level is individual factors, which includes behaviors and biological risk factors (Baral et al., 2013). Social and sexual networks account for the interpersonal relationships, including family, friends, and sexual relationships. According to the MSEM, these networks significantly impact HIV risk factors due to proximity and relationships (Baral et al., 2013). The community level includes the larger environment, culture, religion, organizations, schools, and neighborhoods and can positively or negatively influence health risk (Baral et al., 2013). Policies, like age of consent, can significantly impact disease risk and prevention efforts, and are often developed based on culture, religion, and moral ideals (Baral et al., 2013). The outermost level is the epidemic stage, which includes the incidence and prevalence of disease (Baral et al., 2013). Areas such as SSA, with a significant HIV epidemic, have a higher risk of disease exposure and transmission than areas that are not experiencing an epidemic.

The MSEM has been successfully used in recent HIV research due to the inclusion of the epidemiological approach to the disease. Baral et al. (2013) initially created and adopted the MSEM to understand the broader epidemiological factors associated with HIV in a pandemic setting. Scheibe et al. (2014) then used the theory to research what economic factors exist that contribute to HIV within the population of men who have sex with men within SSA. The authors used the MSEM to understand factors from each of the five levels of influence, including epidemic stage, public policy, community, social and sexual networks, and individual factors (Scheibe et al., 2014). In 2017, Ruiseñor-Escudero et al. used the MSEM to further understand what variables contributed to higher prevalence of HIV among MSM in Western Africa compared to the prevalence in Eastern and Southern Africa. These authors chose this theory to address the limitations of previous research, including the lack of application of epidemiological data to all levels of influence (Ruiseñor-Escudero et al., 2017). These researchers aimed to better understand the many levels of influence that contribute to the HIV crisis, and the use of the MSEM provided a wider and more comprehensive theoretical framework for the research.

I choose the MSEM for this research to provide a broader and more complete view of the factors contributing to the adolescent HIV crisis within SSA. This model has been successfully used in SSA HIV research and includes the individual and meta levels of influence that were addressed within this research project. The focus of age-of-consent policy must be viewed in light of the current SSA HIV epidemic during this research. The MSEM highlights that there are many levels that contribute to HIV, and this was necessary within this research. Furthermore, this research used variables from multiple levels of influence to understand if there was a relationship between age of consent and HIV testing and prevalence.

Literature Review Related to Key Variables and Concepts

Rationale for Study Variables

HIV within SSA has been studied extensively, including behaviors that contribute to HIV transmission, factors that correlate with the choice to access HIV testing, and the populations most affected by HIV within this region. However, there has been limited research on whether the age-of-consent policies contribute to the HIV crisis within the adolescent population (McKinnon & Vandermorris, 2018). Based on current research, I tested whether age (Independent Variable) is related to the HIV testing rates (Dependent Variable) and HIV prevalence (Dependent Variable), independent of covariates including age of consent, gender, education level, and wealth index. Age was selected as the independent variable to understand if there is a statistically significant difference in HIV testing and HIV prevalence based on the respondents age, and if age of consent (Covariate) contributes to any difference. The dependent variables were chosen as representative indicators of the HIV crisis among this population. Additionally, these variables were chosen due to the lack of sufficient research surrounding the variable. The covariates selected were used in McKinnon and Vandermorris' (2018) research on age of consent and represent the variables that may contribute to differences among HIV testing and prevalence within the adolescent population in SSA.

Current Research Related to Variables

In this sub-section, I provide an extensive review of literature related to the study variables. This sub-section highlights research on these variables within literature over the last 5 years to justify the use of the variables, the relationship between the variables, and to explore how this study can build on current knowledge.

Age

Research has shown that the SSA adolescent population has a higher risk of HIV, coupled with reduced access to testing and treatment. Therefore, respondents' age will be the independent variable within this research. HIV has become a significant contributing factor to poor health outcomes for the adolescent population, despite the advances in testing, treatment, and prevention (Tonen-Wolyec et al., 2020). While HIV has declined in most populations, it has increased to become the leading cause of death among SSA adolescents (McKinnon & Vandermorris, 2018). Eba and Lim (2017) noted that while HIV and AIDS-related deaths decreased by 30% between 2005 and 2012, adolescent deaths increased by 50% during that time. Tonen-Wolyec et al. (2019) found that despite the increased death rate, testing options were limited for the adolescent population and urged for rising testing rates. Mark et al. (2018) found that of the adolescents in SSA living with HIV, only 43% have access to ART. Adolescents within SSA have a higher risk of HIV infection and, for this reason, need increased access to testing and treatment.

This research project was limited to adolescents aged 12 to 18 years old. Despite this narrow age limit, it will be important to understand if there is a significant difference in HIV testing and prevalence based on age. Eba and Lim (2017), Mark et al. (2018), McKinnon and Vandermorris (2018), and Tonen-Wolyec et al. (2020) have linked adolescent age with higher rates of HIV within SSA but is this different due to potential barriers related to HIV age of consent. From the ages of 12 to 18, an adolescent matures and changes a great deal. Eba and Lim (2017) noted that adolescence is a period of physical, cognitive, sexual, and reproductive maturation. McKinnon and Vandermorris (2018) additionally found that HIV testing was higher as age increased during adolescence. Ybarra et al. (2018) found that instances of sexual activity increased with age among the adolescent population. Testing rates may vary with the differences in the age of the respondents within this study. Therefore, it will be essential to control for covariates to properly understand any potential relationships between age of consent and HIV testing and HIV prevalence.

HIV Testing

The first dependent variable is HIV testing within the last 12 months and due to the increased risk of HIV exposure, testing is a critical part of the solution to end this epidemic. HIV testing is essential to early diagnosis, access to treatment, and follow up care (Mkandawire, 2017). Adolescents who test positive can access long-term treatment and counseling, while those who test negative can access education to improve sexual behaviors and reduce the associated HIV risks (Mkandawire, 2017). Testing is essential to provide linkage to care for those adolescents who are HIV infected. Antiretroviral treatment (ART) has significantly increased life expectancy in adults (Vollmer et al., 2017). Furthermore, Mark et al. (2018) noted that ART is equally effective for children and adolescents. However, this is only the case if testing is done early to initiate treatment. Mark et al. found that only 43% of HIV-infected adolescents have access to ART, even though disease progression is more rapid in this population. Further, Mark et al. noted that globally, despite the growth of ART programs, adolescents continue to have difficulties accessing testing and treatment. Therefore, HIV testing is key to ensuring that adolescents living with HIV have linkage to ART therapy and long-term care necessary to improve life expectancy and reduce HIV-related morbidity and mortality (Vollmer et al., 2017).

Despite the benefits of HIV testing, the majority of adolescents have not accessed testing. Tonen- Wolyec et al. (2020) noted that few adolescents have been tested and are aware of their status. Ssebunya et al. (2019) corroborated that many young people are not aware of their HIV status despite the increased risk to the adolescent population. Among the adolescent SSA population, 23% of girls and 16% of boys have been tested (Shayo & Kalomo, 2019). Additionally, further study results showed that in SSA, only 13% of girls and 9% of boys have been tested and got the test results (Shanaube et al., 2017). Other estimates show that in SSA, 15% of girls and 10% of boys have been tested, although the average testing within SSA is 40% for the general adult population (Eba & Lim, 2017; Mkandawire, 2017). To further complicate this issue, many adolescents in the region who have had provider-initiated testing and counseling are not aware of their results. Simms et al. (2017) noted that over one-third of the adolescents with HIV had not been diagnosed after two years, even when a provider ordered testing. The small percentage of adolescents who have been tested suggests that the actual prevalence of HIV with this population may be much higher (Kumwenda et al., 2019). HIV testing is an essential part of addressing the HIV crisis but remains significantly underused by the adolescent population within this region.

As noted above, HIV testing is the gateway to accessing proper treatment and follow up care, making testing a critical step in addressing the crisis within SSA. Barriers to testing, such as age of consent, may be contributing to the rapid spread of HIV due to the lack of awareness of status and ability to access treatment if positive (Eba & Lim, 2017; McKinnon & Vandermorris, 2018). HIV testing within the last 12 months is the first dependent variable used in this study. It will be tested to determine any relationship or association between HIV testing and the respondents' age, while controlling for covariates.

HIV Prevalence

The second dependent variable is testing positive for HIV to determine HIV prevalence, which can indicate disease burden and the success of current HIV initiatives. Since the first case of HIV in the early 1980s, there have been significant advancements in understanding the disease. Despite these advancements, HIV remains a public health burden. HIV continues to be a public health concern globally, affecting 37.9 million people in 2018 (Avert, 2019). The highest burden of HIV is centered within SSA. More than half of all total people infected with HIV (54.6% or 20.7 million) live in southern and eastern Africa, making HIV a public health crisis within SSA (Avert, 2020). This region only houses 6.2% of the global population, meaning the burden is significantly disproportionate compared to the rest of the world (Avert, 2020). Africa also has the largest burden of new infections, with 64.7% of all new infections in 2018 (WHO Africa, 2020). Further compounding the HIV crisis within SSA is that the highest percentage of new infections are in the adolescent population (Ssebunya et al., 2019; Mkandawire, 2017).

Statistically, SSA has the highest HIV-burden globally, but the adolescent population carries most of this disease burden. While SSA has just over half of the world's population of people with HIV, more than 80% of all adolescents living with HIV are in this region (Eba & Lim, 2017; Groves et al., 2018; Ssebunya et al., 2019). In

2017, approximately 1.8 million adolescents were infected with HIV, and 1.5 million of them resided in SSA (McKinnon & Vandermorris, 2018; Simms, 2017). Furthermore, there is a new adolescent infected with HIV every two minutes (Mark et al., 2017; Tonen-Wolyec et al., 2019). Deaths due to HIV and AIDS have tripled since 2000, further showing the need for immediate intervention (Mark et al., 2017); and HIV and AIDS have become the leading cause of death among adolescents aged ten to 19 years (Groves et al., 2018; Tonen-Wolyec et al., 2020). HIV presents a significant burden to the adolescent population's health and is not appropriately tested for, diagnosed, or treated (McKinnon & Vandermorris, 2018). Additionally, this population is at higher risk due to complex factors like vulnerability, impact on health, and social issues (Wallace et al., 2018). These factors continue to contribute to the spread of HIV throughout this population. Further complicating the HIV crisis, HIV testing is not as readily accessible to these populations.

HIV prevalence provides an overview of the burden of HIV within the overall population and within the specific adolescent population. Current researchers have shown that the adolescent population within SSA has been disproportionately affected by HIV. This dependent variable should provide insight into if the age of consent within a country has any relationship to the prevalence of HIV within the adolescent population.

HIV and Age of Consent

Age of consent is a covariate within this research study and designates the age at which adolescents can access HIV testing without a legal guardian's consent. The current age-of-consent policies across the region vary from 12 years to 18 years old, and some countries have no specified age for consent (Eba & Lim, 2017). Adolescents who reside in countries with higher ages of consent have trouble obtaining testing if they do not have a parent or guardian who can provide consent (McKinnon & Vandermorris, 2018). Rodriguez (2017) found that policies like the age of consent present a significant barrier to testing across SSA. Shayo and Kalomo (2019) found that reasons for lower testing rates include a higher age of consent.

Further, Tonen-Wolyec et al. (2020) found that the age-of-consent policy presented a significant obstacle to accessing HIV testing and treatment. Recent research has shown that the age-of-consent policies present a barrier to accessing HIV testing and treatment (Tonen-Wolyec et al., 2019). These previous researchers have shown that the age-of-consent policy is a barrier that prevents some adolescents within SSA from accessing HIV testing.

The actual age-of-consent policy should protect the adolescent population but has unintended harmful consequences for this vulnerable and high burden population. Within SSA, the age-of-consent policy does not prevent typical adolescents from accessing HIV testing, but it does require the adolescent to have a legal guardian to provide informed consent (McKinnon & Vandermorris, 2018). Many adolescents may not have a legal guardian in SSA, or the guardian may not agree to allow testing. Rojo et al. (2020) found that many adolescents could not participate in their HIV study due to the lack of a legally recognized guardian. Rojo et al. further noted that 120 of the 400 (30%) responding adolescents were orphaned, and only one of those orphans had a court-appointed guardian. These policies significantly reduced the number of adolescents who were able to participate in their HIV research. In Zambia, Shanaube et al. (2017) found that adolescents under 16 years have less access to testing due to stringent age-of-consent policies and lack of guardians willing to provide consent. Many parents and guardians may refuse to provide consent for HIV testing. Chandri-Mouli et al. (2018) noted that many parents do not provide consent due to fear of HIV-related stigma or lack of acceptance that the adolescent child is a sexual being that needs testing. Another barrier that is present for adolescents is the fear of asking parents or guardians for consent. Many adolescent females would not seek out testing due to fear of parental repercussions, including violence or disclosure (McKinnon & Vandermorris, 2018; Shayo & Kalomo, 2019). These situations present additional barriers that may prevent adolescents from accessing HIV testing, further increasing transmission, delaying treatment, and reducing health outcomes for those who are HIV infected.

Higher age-of-consent policies create barriers or difficulties that make HIV testing unattainable for some SSA adolescents. There has been limited research into the actual effect of age-of-consent policies on adolescent HIV rates and testing prevalence within SSA (Eba & Lim, 2017). The limited research available has shown that age-of-consent policies contribute to the lower testing rates within some countries in SSA (McKinnon & Vandermorris, 2018). Tonen-Wolyec et al. (2019) found that countries within SSA typically have the age of consent set between 16 and 18 years of age and that the age-of-consent policies should be de facto reduced to improve access to testing. Eba and Lim (2017) found that as of March 2017, 28 of the SSA countries had updated or created laws related to the HIV response to increase access. McKinnon & Vandermorris

(2018) further noted that only 19 of the 33 SSA countries had clear laws for adolescents. Although some progress is being made to address adolescent access to HIV testing and treatment, there are a great deal more research and policy updates needed to ensure this population has adequate access to care (Tonen-Wolyec et al., 2019). This project built upon prior research to determine if the age-of-consent policies are related to HIV testing rates and HIV prevalence within the adolescent population in these SSA countries.

The age-of-consent policies vary based on current country regulations. Eba and Lim (2017) performed an overview of the policies related to HIV testing across 28 SSA countries, noting that these policies were inadequate and did not account for human rights privileges. Additionally, the authors found that of the 28 countries reviewed, only seven had lowered their age of consent to below 18 years. Tonen-Wolyec et al. (2020) noted that many countries had set the age-of-consent policy between 16 and 18 years. Botswana, Ivory Coast, Zambia, and Zimbabwe are 16 years; Kenya is 15 years; Malawi is 13 years; Lesotho and South Africa are 12 years; and the Democratic Republic of the Congo is 18 years. The variability between the age-of-consent policies across the region further shows the need for research to understand the strengths and weaknesses of a lower and higher age-of-consent policies.

There are further variations and concerns noted within the HIV age-of-consent policies that may impede the adolescent attempts to access testing. Eba and Lim (2017) found numerous concerns with the HIV-related policies across the 28 included countries. The authors compared the current countries’ policies against the recommendations provided by the World Health Organization (WHO, 2020). Eba and Lim found that

Burundi, Chad, and Equatorial New Guinea had no provisions for HIV testing, counseling, or treatment (HTC) for adolescents or children. Cape Verde lacked the confidentiality of test results, which can be provided to the parents without the minor's consent. The remaining 24 countries have some provision for adolescent HTC; however, none of the countries addressed all four WHO recommendations. The authors found that 11 countries set an explicit age of consent between 11 and 18 years, but only seven of these countries were 17 or younger. Thirteen other countries lacked an explicit age for consent but expressly exclude minors from accessing HTC independently. Many countries do not define a minor child, so these terms are often up for the healthcare provider's interpretation. Eight countries have an age of consent of 18 years or higher but do provide independent testing for those who have reached maturity, which is undefined. Several SSA countries have specific situations that will allow for independent access to HTC (Eba & Lim, 2017). Comoros and Madagascar provided for testing among emancipated minors, and Kenya and Sierra Leone allow pregnant adolescents to access HTC. Kenya, Madagascar, and Niger allow married adolescents access. Kenya and Sierra Leone will provide HTC to an adolescent who is a parent or if the minor is at higher risk of HIV infection. Comoros, the Democratic Republic of the Congo, and Madagascar provide adolescent testing if it is in their best interest, although this is not defined. Guinea Bissau and Mali each have disagreements between the legislation and policy. The legislation allows for HTC during specific situations; however, HIV related laws do not allow for adolescents' independent access. The Congo, Gambia, Kenya, Sierra Leone, and Uganda allow adolescent access to HTC and have regulations providing confidentiality for test results. Kenya has competing laws and policies for the age of testing, with one set at 15 years and the other set at 18 years. Although several provisions allow for adolescent access to HTC, none of the 28 countries provide adolescent access to HIV treatment. Eba and Lim (2017) provided extensive detail into HIV-related policies within these countries in SSA. The authors found many significant areas of concern that need to be updated to meet the needs of the highest risk population for HIV within this region. The researchers have highlighted the lack of consistency and accessibility for the adolescent population. These variations across the policies in this region further complicate HIV testing and show a need for better unity and clarity for adolescents to access HIV testing.

Recent researchers have concluded that age of consent is one of the barriers faced by the adolescent population within SSA and that current age-of-consent policies are inconsistent across the region. There are many facets of the age-of-consent policy that may create a relationship between HIV testing rates and HIV prevalence within adolescents in SSA. This vulnerable population faces challenges like orphanhood, parents or guardians who will not consent, fear of parental repercussion, or stigma. Other challenges documented include the inconsistency between policies and the variation in exceptions within the policy. The researchers provided a clear view of the age-of-consent policies across SSA and the associated implications of these policies. In this research study, I sought to further understand age of consent by determining if these implications relate to the testing rates and prevalence of HIV.

HIV and Gender

The second covariate used in this study is gender, as research has shown a relationship between gender and HIV prevalence. Throughout the region, adolescent girls have a higher incidence of HIV compared to boys. Bhana (2017) noted girls in South Africa had four times the HIV burden. Wambura et al. (2019) reported two to four times the infection rate in girls in Tanzania, Lesotho, and Mozambique. Finally, Bodika et al. (2016) found that girls in Botswana have twice the infection rate. Wallace et al. (2018) found that although HIV programs across SSA have been targeting the adolescent female population, there has only been a reduction of 6% in new infections within the population between 2010 and 2015. This increased HIV rate within the young female population across SSA adds additional contributing factors and increases the difficulty of addressing this health challenge. Ninsiima et al. (2018) noted that gender norms associated with females often increase exposure and transmission of HIV. Early pregnancy and early marriage, along with other cultural and religious practices, may contribute to the increased rate of HIV within the adolescent female population. Ninsiima et al. (2018) have asserted that the female gender is associated with higher rates of HIV across SSA. Further solidifying this relationship, Hegdahl et al. (2016) observed the male and female HIV prevalence across 18 countries in SSA over time. The researchers used logistic regression and controlled for location, educational attainment, and marital status. The researchers found that females consistently had a higher prevalence of HIV across the region and across time. Further, Hegdahl et al. found that the prevalence gap was higher in the adolescent population, showing that adolescent females have a higher HIV burden within these SSA countries. Based on the previous correlation between gender and HIV status, gender will be controlled during the statistical analysis.

Education

Educational level will be the third covariate within the research study. Researchers have had inconsistent findings associated with the relationship between education and HIV status. Hargreaves et al. (2015) had mixed results dependent on location in their study. The researchers examined seven SSA countries and found that HIV was more prevalent in females with higher education in Ethiopia and Malawi. In Lesotho, Kenya, and Zimbabwe, higher education acted as a protective factor concerning HIV (Hargreaves et al., 2015). The researchers noted that these differences might be due to cultural, historical, social, religious, economic, and health care access differences between countries. Whiteside et al. (2017) found that in Swaziland, higher education was related to lower HIV prevalence. Similarly, Mabaso et al. (2018) found that education was a protective factor against HIV in the adolescent population in South Africa, and Igulot and Magadi (2018) found that higher education reduced HIV risk by 37% in all populations of Uganda. Higher education may reduce risky health behaviors that contribute to HIV in some cultures, while in other cultures, higher education may provide increased access to frivolous lifestyles (Hargreaves et al., 2015). These researchers have shown a link between the highest education completed and HIV status. Therefore, the educational level will be a covariate that is controlled within this research study.

Wealth Index

The fourth covariate will be wealth index, which accounts for the respondent’s household socioeconomic status. Researchers have linked both extremes of wealth index to HIV infection. Hensley (2018) found that higher wealth index levels, including home and land ownership, have reduced the risk of HIV infection among Zimbabwean women. Mabaso et al. (2018) found that living in the least poor households served as a protective factor against HIV. Igulot and Magadi (2018) noted that poverty could lead to additional risk factors, including homelessness, reduced education due to drop out, and early marriage due to necessity. However, Igulot and Magadi found that wealth often leads to lavish lifestyles, increased sexual partners, and other risky behaviors. The researchers found that socioeconomic status and HIV were positively associated at the population level, in females, and rural areas (Igulot and Magadi, 2018). These researchers have shown that there is a link between respondents’ wealth index and their HIV status. Therefore, this study will include wealth index as a covariate. The inclusion of these covariates should provide more precise results of any potential association between the independent and dependent variables.

Marital Status

The fifth covariate included in this study is marital status. Marriage has been linked to HIV prevalence within SSA, so marital status was initially used as an inclusion criterion within the sampling process. The relationship between marital status and HIV within SSA has been debated within recent research but has recently been shown as a protective factor against HIV infection. Tlou (2019) found in his secondary quantitative study of respondents in rural Mtubatuba, South Africa, that monogamous marriage was associated with a reduced risk of HIV. Shisana et al. (2016) also found a correlation between HIV and marital status, with married cohabitating couples having a statistically significantly lower risk of HIV. Ninsiima et al. (2018) noted that almost half of all adolescent females are married before age 18 in Uganda, and this is a commonplace practice across SSA. Early marriage often occurs from necessity within this region (Tlou, 2019) but may function as a protective factor against HIV that should be controlled for within the statistical analysis. Research has shown that being married is a protective factor against HIV.

Review and Analysis of Research Related to Research Questions

Minimal research has been performed on how the age-of-consent policies impact HIV within the adolescent population. Many articles present age of consent as a barrier faced by the adolescent population (Rodriguez, 2017; Shanuabe et al., 2017; Shayo & Kalomo, 2019; Simms et al., 2017; Tonen-Wolyec et al., 2019, 2020). However, few researchers have focused on the impact of the age-of-consent policies and how they relate to HIV testing and HIV prevalence (Eba & Lim, 2017; McKinnon & Vandermorris, 2018). In this section, I discuss articles that cover this topic, the results and implications of these studies, and how I added to previous research through this study.

The initial researchers that explored this topic focused on understanding the current age-of-consent policies across the SSA region. Eba and Lim (2017) reviewed the adolescent-related HIV laws and policies within SSA. The researchers analyzed what policies and laws were currently in place and then compared them against the WHO recommendations to determine strengths and weaknesses and areas that need to be addressed. The authors found that each country's HIV policies regarding the adolescent population were lacking and did not meet the WHO's current guidelines. Eba and Lim concluded that to address HIV within adolescents, these policies must be adjusted to increase access to testing, address maturity and consent, and ensure that healthcare providers are adequately trained on these changes. Eba and Lim's review provided a clear outline of the weaknesses that need to be addressed within these age-of-consent policies to affect positive change. While these researchers have successfully examined the current HIV age-of-consent policies within SSA, they did not show how the age of consent impacts the HIV testing rates or HIV prevalence. This study's limitation was the lack of statistical analyses to understand if a relationship exists between the age-of-consent policies and HIV testing rates within the population. This was addressed within the current study by analyzing any potential relationship between age of consent and HIV testing rates and HIV prevalence.

Researchers then performed exploratory research to determine any broad relationship between the independent variable of age of consent and the dependent variable of HIV testing. McKinnon and Vandermorris (2018) sought to determine if the age-of-consent policies across SSA impacted HIV testing rates within the adolescent population. Secondary data was used from the DHS from 15 SSA countries. The authors compared data for populations with an age of consent of 15 years or less and populations with an age of consent of 16 or greater. A propensity-matched score was used to control for HIV prevalence and other potential confounding factors. McKinnon and

Vandermorris noted that countries with an age of consent at or below 15 years had statistically significantly higher testing rates than countries with an age of consent at or above 16 years. Additionally, the authors noted that age of consent presents a significant barrier to accessing HIV testing. McKinnon and Vandermorris further showed the need to lower the age of consent to improve HIV testing rates. McKinnon and Vandermorris did show a correlation between age of consent and HIV testing rates among adolescents within SSA. However, they did not evaluate if there is a relationship between age of consent and HIV prevalence. Additionally, they only evaluated two categories of age of consent, age of consent at 15 years and younger, and age of consent of 16 years and older. Further limitations include the lack of accounting for specific cultural and sociopolitical differences between countries. Through this current research project, I addressed these limitations by further dividing respondents' age of consent and including a dependent variable of HIV prevalence. This study examined if there were differences between HIV testing and prevalence based on age, and then if any differences are correlated to age of consent policies.

This minimal research has begun to examine the impact of age-of-consent policies and their impact on the HIV crisis within the SSA adolescent population. Both articles by Eba and Lim (2017) and McKinnon and Vandermorris (2018), have revealed that a higher age of consent is a significant barrier to HIV testing for SSA adolescents and may correlate with lower testing rates and a higher incidence of HIV. Eba and Lim successfully evaluated the current age-of-consent policies across SSA. However, the researchers did not evaluate how the variable age-of-consent policies affected HIV testing or HIV prevalence within the SSA adolescent population. McKinnon and Vandermorris further examined age-of-consent policies. The researchers only examined age of consent in 15 SSA countries. A further limitation was the division between countries with an age of consent 15 and younger and countries with age of consent 16 and higher. The researchers did analyze how higher or lower age-of-consent policies affected HIV testing rates but did not include HIV prevalence.

There has been some conflicting research on the ethics of lowering the age-of-consent policies across SSA. HIV is a difficult diagnosis in the adult population. Adolescents are not physically or mentally as mature as adults, which may present an ethical challenge when considering what age is appropriate to provide consent. Tonen-Wolyec et al. (2019) noted that HIV testing in adolescents, especially those without parental support, should have sufficient counseling before and after testing tailored to the adolescent population. Additionally, Groves et al. (2018) determined to ensure that the age-of-consent policies are ethical, there must be consideration of the vulnerability of the adolescent. McKinnon and Vandermorris (2018) found in their research that a lower age-of-consent policy is ethical and necessary to meet this population’s changing needs. Additionally, these researchers found that a lower age of consent meets the ethical standards of the International Convention on the Rights of the Child. Ethically, it is essential to provide HIV testing for the adolescent population but testing programs must consider their emotional needs. Ultimately, it is unethical to withhold testing and treatment from this high-risk population that has been devastated by HIV. Testing programs must use care and sound evidence-based counseling in addition to testing to meet the needs of the adolescent population within SSA. These researchers have identified the ethical concerns that must be addressed in the age-of-consent policies, but they have also shown that it would be unethical to continue to withhold HIV testing access to this vulnerable population.

In sum, there has been limited research on the relationship of age-of-consent policies on the HIV crisis within SSA. Eba and Lim (2017) provided an in-depth analysis of the current policies addressing age of consent across the region. McKinnon and Vandermorris (2018) further explored potential relationships between age of consent and HIV testing rates. McKinnon and Vandermorris did find a relationship between countries with a lower age of consent and increase testing rates among the adolescent population. However, further research is necessary to test whether a correlation exists between age of consent, HIV testing, and HIV prevalence to strengthen the evidence showing this relationship (McKinnon & Vandermorris, 2018). In this research, I overcame the limitations of the previous research by including more SSA countries and compared the age of consent instead of dividing them into two groups. Additionally, this research included HIV testing rates while determining any potential correlation between age, age of consent, and HIV prevalence within the adolescent population. Therefore, this study's outcomes provided data that can be used to inform future HIV testing and treatment programs across SSA to impact the HIV crisis better.

Definitions

Age of consent: Each country in SSA has a policy that dictates at what age an adolescent can access HIV testing without a parent or legal guardians' permission. This policy represents that countries age of consent (Eba & Lim, 2017). This variable will represent each respondent's age of consent based on their resident country and will range from 12 to 18 years (McKinnon & Vandermorris, 2018).

HIV testing within the last 12 months: This dependent variable refers to if the respondent has had an HIV test within the last 12 months, regardless of whether they obtained the results and where/ how the test was obtained (Mkandawire, 2017).

HIV prevalence: This dependent variable references the results of the HIV testing, and whether the respondent is HIV positive or HIV negative (Vollmer et al., 2017).

Marital Status: This covariate refers to the respondent's current marital status at the time of the data collection (Shisana et al., 2016).

Education level/ highest level of education: This covariate measures the highest level of education completed by the respondent (McKinnon & Vandermorris, 2018).

Wealth index: This covariate considers measures of employment status and household wealth to understand the financial status of the respondent (Bunyasi & Coetzee, 2017).

Assumptions

There are several assumptions that are critical to this research. Vogt (1999) defined assumptions as presumed statements that are necessary to perform specific research. These assumptions may not be testable but are critical concepts necessary to the statistical analyses. This research was guided by the following assumptions: (a) that respondents participated in the survey willingly and without ulterior motive, (b) the respondents answered questions honestly, (c) the survey respondents are representative of the adolescent population within SSA, and (d) that the secondary data is accurate and consistent across the 32 included countries. The secondary data sets used comparable questionnaires, large sample sizes, and confidentiality procedures that make these assumptions possible (Demographic and Health Surveys Program, n.d.). These assumptions are crucial to accept the secondary data and perform the necessary analyses to answer the research questions.

Scope and Delimitations

In this study, I assumed that age of consent, gender, education level, and wealth index were confounding variables that may influence HIV testing rates and prevalence within the SSA adolescent population. I controlled for these variables within the regression analysis to determine if a relationship existed between age and the independent variables. This study focuses on Sub-Sahara Africa, and specifically the 32 countries that included HIV data within the DHS data sets. The scope of this study is SSA, and the results are not generalizable to nonendemic countries. However, the results should be generalizable for other countries in SSA that did not report HIV data. In this study, I am focusing on the adolescent population and age-of-consent policies, so respondents over the age of 18 are excluded, as well as countries that do not report HIV data. Further, the variables were limited to age, HIV testing, HIV prevalence, age of consent, gender, educational level, and wealth index. The research questions were also limited by the use of the secondary data set.

Limitations

There are several notable limitations within this study. A primary limitation of this study is the use of secondary data and the limitations that are associated with that data collection, interpretation, and input. Another limitation is the reliance of the truthfulness of the reporting about HIV testing (McKinnon & Vandermorris, 2018). There is a potential for over or under reporting based on current political, religious, or individual beliefs related to HIV. However, the DHS data is collected in a confidential and private manner, which should allow participants to answer honestly (data Program, n.d.). Additionally, there may have been unresearched or undocumented confounding variables that contribute to the HIV testing rates and HIV prevalence that will not be accounted for within this regression analysis. Finally, this research is cross-sectional, limiting the ability to determine causation from the analysis. Therefore, this research explores the data for any potential relationships within the variables.

Significance

This research is essential and could build on the current limited knowledge about how the age-of-consent policies relate to HIV testing and HIV prevalence within SSA adolescents. This topic has not been adequately researched, so this study should extend current applicable knowledge (Eba & Lim, 2017; McKinnon & Vandermorris, 2018). Presence or lack of relationship between these variables could be used to help direct updated age-of-consent policies and adolescent focused HIV prevention programs. This research study is significantly larger than previous studies on the topic, extending the scope and implications of the research outcomes. I sought to provide more extensive data and analysis that will be useful in ensuring that age-of-consent policies across SSA are ethical, sound, and evidence based.

Summary and Conclusions

Previous research has shown the significant health problem of HIV within the target population and has begun to examine age-of-consent policies as a potential contributor (McKinnon & Vandermorris, 2018). Researchers have identified age-of-consent policies as a barrier that may prevent some SSA adolescents from accessing testing and treatment (Tonen-Wolyec et al.; 2019, 2020). There are many individual, community, and external factors that contribute to this crisis, but there is limited research that relates to age-of-consent policies (Bodika et al., 2016; Rodriguez, 2017; Shanaube et al., 2017; Shayo & Kalomo, 2019; Tonen-Wolyec et al., 2019, 2020). In this research study, I attempted to add to this limited base of knowledge and determine if there is a relationship between age of consent and current HIV testing rates and prevalence. This research should provide guidance to increasing adolescent access to HIV testing with SSA.

In the second chapter, I will discuss the research design and data that will be used to answer the research questions and attempt to add to the existing body of knowledge surrounding HIV within the adolescent population in SSA. This will include an extensive explanation of the research methodology, population and sampling procedure, data analysis plan, threats to validity, and ethical procedures.

Section 2: Research Design and Data Collection

Introduction

Researchers have found many factors that contribute to the HIV crisis within the SSA adolescent population. Age of consent has recently been introduced as a potential barrier that may add to this public health crisis by impeding access to HIV testing. There is inadequate research that shows this relationship (McKinnon & Vandermorris, 2018). In this research project, I sought to determine if there was a relationship between a respondent's age of consent and HIV testing rates and HIV prevalence within the SSA adolescent population. Section 2 of this research project includes the design of the research and methods of data analysis, the target population included within the data, methods that were initially used to gather the data, the operationalization of the variables, the data analysis for this project, threats to validity, and ethical procedures within this study.

Research Design and Rationale

I planned to determine if there was a relationship between a respondent's age and the HIV testing rates and HIV prevalence within the SSA adolescent population. The independent variable was the respondents age in years. The first dependent variable was tested for HIV within the last 12 months. The second dependent variable was HIV prevalence, measured by HIV test results. The covariates included in this study were age of consent, gender, education level, and socioeconomic status, which is measured by wealth index.

To answer the research questions, I used quantitative, correlational research with a cross-sectional design. I conducted secondary data analysis utilizing the DHS from 32 SSA countries. Logistic regression was be used to determine any potential relationships between variables while controlling for the included covariates. This research design provided an appropriate method to examine existing data sets to add to the current understanding of HIV within the adolescent population (McKinnon & Vandermorris, 2018).

The DHS data set is a large and complex data set that requires an in-depth understanding of statistical analysis (Croft et al., 2018). This complexity increases the time necessary to perform statistical analyses. However, the use of the secondary data set reduced overall research time by eliminating the need to create a survey instrument and then collect primary data across the SSA region. The use of secondary data also provided the opportunity to increase the scope of this study to include all the countries in SSA that have HIV data.

This research design and the use of the DHS data set is typical of HIV-related research within SSA. The DHS data sets have been widely used due to the large scale of the available data and large scope of topics included within each survey (ICF, 2018). The DHS often includes HIV data and has data available from multiple time points for each country (Croft et al., 2018). The DHS data were used in the research by McKinnon and Vandermorris (2018) and have been used in several recent articles focusing on HIV within the SSA adolescent population.

Methodology

Population

In this research study, I targeted HIV within the SSA adolescent population. Therefore, the sample for this study was male and female respondents aged 18 or younger at the time of the survey. All participants with a valid data set who were not married and who had been sexually active were included within the sample. Exclusion criteria included missing or invalid data, respondents aged 19 or higher, those who were married, and those who had never been sexually active. For the second research question, the sample was further narrowed by only including the respondents who had an HIV test within the last 12 months. The inclusion of all qualifying respondents from these 32 countries should yield a sample of sufficient size to have a higher statistical power.

Sampling Procedures Used by the DHS

Sampling Strategy

The sample design used with the DHS is two-stage probability sampling drawn from existing sample frames, typically from the current census (ICF, 2018). Sampling is stratified to reduce sampling error. Each country is divided into different regions, or strata, called enumeration areas, based on location and population (rural and urban) and then samples are designed and selected independently from each enumeration area (ICF, 2018). This sampling design helps to reduce the population variance across a country by stratifying the population. Sampling is designed for the sample population to be representative at the national level, household level (rural versus urban), and regional level (Croft et al., 2018).

Data Generation

Each survey is a multistage process that typically takes up to 2.5 years to complete (ICF, 2018). The first stage includes the design of the survey and planning for data collection, which typically takes about 6 months (Croft et al., 2018). During this phase, the sample is determined, and the survey instrument will be developed. Stage 2 begins with training field staff on survey procedures and includes the process of collecting the data and lasts between 4 and 6 months (ICF, 2018). Stage 3 often lasts up to a year and includes data processing and editing. Stage 3 often begins as soon as the data collection starts, and stages 2 and 3 overlap (Croft et al., 208). Once all the data are obtained and the data are edited, then the final report is developed. Stage 4 is the final stage and includes dissemination and analysis of the data (ICF, 2018).

Inclusion and Exclusion Criteria

The population that is targeted by the DHS survey varies slightly based on the specific country's needs. The female respondents were typically aged 15-49 years, while male respondents were 15-49 years, 15-54 years, or 15-59 years (Croft et a., 2018). Each country sets the age perimeters based on the focus and goals of the survey. Each country performs the standard survey every 5 years and has a sample size typically between 5,000 and 30,000 respondents (ICF, 2018). Sample households are determined during the initial phases of data collection. Respondents within these predetermined households who meet the qualifying age and who live the household or slept in the household the night before meet inclusion criteria. Exclusion criteria would be persons in the home that do not meet the qualifying age, who do not reside in the home, or who did not stay at the residence the night before. Other exclusions include incapacitated persons who are not able to understand or answer the questionnaires, those who are not home and cannot be contacted after several attempts, and those who refuse to answer the questionnaire.

Data Access

The DHS provides data on over 90 countries about topics including population, wealth, HIV, health, and nutrition. The data are free to use, but each user must be granted access through a registration process. The rationale for registration and permission to use the data stems from the agreements between DHS and each participating country (ICF, 2018). Each country owns their respective data, and this process ensures that data access is only granted to people for research purposes. This process also allows for stringent permissions for access to HIV and GIS data (ICF, 2018). The registration process includes creating an account with DHS, which requires personal information including email, name, contact information, what data is being requested, and how the research will be used. The research topic, research questions, and institution should be included as well. The user can select specific countries as well as the type of data being requested, including the AIDS indicator survey (AIS), the malaria indicator survey, the service provision assessment, and GPS data. Once registration is completed, access is typically granted within 24 hours. The user may have to sign digital consents as well. The user agrees to not share the data or use the data for other purposes outside the listed project within the registration.

DHS Data Reputability

The DHS is the standard data set that is often used for quantitative research within Africa, Asia, and Latin America (Croft et al., 2018). The majority of the researchers cited within the literature review used the DHS data sets. The DHS uses a structured format to provide consistent data across these regions and allows small or developing countries to be able to collect data similar to other countries. McKinnon and Vandermorris (2018) used DHS data from 15 countries to explore age of consent laws within SSA. The DHS data has been widely used to research topics including HIV, contraception, infectious diseases like malaria, health care resources, wealth indicators, nutrition, maternal care, morbidity, and mortality (ICF, 2018). A literature search of peer reviewed articles including DHS data within SSA returned 2,520 articles within the EBSCO database that included articles on these significant topics.

Data Quality Relative to This Study

The DHS data set was the most appropriate data for this study. The consistency of the data across countries and the availability of data and HIV testing from 32 of the SSA countries provided a large sample size and variables that should be able to answer the research questions in this study. The large sampling size used within the DHS surveys also provided ample responses to analyze HIV testing rates and HIV prevalence across the 32 included countries. The DHS data sets provided the best opportunity to understand if a relationship exists between age of consent policies and HIV testing rates and HIV prevalence among adolescents within SSA countries.

Power Analysis

A power analysis provides information on what sample size is necessary to ensure the statistical analysis will accurately capture a statistically significant outcome (Kim & Seo, 2013). The power analysis can determine what sample size is needed to ensure that the outcome has the desired power based on the chosen necessary effect size. In a study utilizing primary data collection, the researcher would utilize a power analysis to ensure that they capture an adequate number of respondents but prevent spending unnecessary money and time obtaining too many respondents (Frankfort-Nachmias & Leon-Guerrero, 2015). A G*power priori analysis for logistic regression with a two-tailed alpha of 0.05, a power of 80%, an effect size of 0.2, and an odds ratio of 1.2 yielded a minimum sample size of 1496. The previous study on this topic used a relaxed alpha of 0.1 to explore this topic (McKinnon & Vandermorris, 2018). However, the alpha for this study is set to 0.05 as this is the scientific standard within research, and this study is no longer exploratory (Frankfort-Nachmias & Leon-Guerrero, 2015). I chose a power of 80% as this is the widely accepted standard for research (Kim & Seo, 2013). The effect size was set to 0.2 based on Cohen's method to capture a small statistical difference within the analysis (Kim & Seo, 2013). The power analysis determined that the minimum sample size should be 1496, but the sample used within this research will be significantly larger.

Instrumentation and Operationalization

The DHS was initially developed in 1984 by the United States Agency for International Development and has provided a consistent team that has gathered data in over 90 countries (Croft et al., 2018). The DHS has performed eight series of surveys that each span 5 years. These surveys have been based on the same survey instrument that has been adjusted and improved as needed over time to gather the data needed to address current health issues. The original instrument was the DHS-I, and the most current version is the DHS-8 (Croft et al., 2018). Each version of the survey has been updated to meet the changing needs of the population, and each country has been able to adapt the survey by adding specific sections or deleting questions that do not pertain to that location or population (IFC, 2018). As the survey has been modified and adapted, other instruments like the AIDS and MIS have been incorporated.

The DHS survey instrument was appropriate to this survey and provided variables related to age of consent and HIV within the adolescent population in SSA. The survey instrument collected information relevant to age, sex, location, previous HIV testing, and HIV status that provided the variables necessary to answer the current research questions (Croft et al., 2018). The previous study relating to age of consent used DHS data due to the high quality of the data (McKinnon & Vandermorris, 2018).

DHS data have been extensively used to research HIV within SSA. The scope, breadth, and recurrent nature of the data makes it a good fit for many research projects that target HIV with the SSA region. Worku et al. (2021) used DHS data from 11 countries in East Africa to better understand factors that are associated with HIV testing prenatally to reduce the risk of mother to child vertical transmission. Worku et al. noted that the use of the nationally representative data across SSA provides research that may be useful to inform updated policies and public health programs. The frequent use of the DHS data sets speaks to the reliability and validity of the data.

Operationalization

The dependent variables included HIV testing within the last 12 months and HIV prevalence, both of which were dichotomized. HIV testing within the last 12 months measured if a participant had an HIV test within 12 months, with 0 = not tested and 1 = has been tested. HIV prevalence measured if a respondent has ever had a positive HIV test, with 0 = HIV negative, and 1 = HIV positive. The independent variables included age, age of consent, gender, educational level, and wealth index based. Age is a continuous level variable that represents the respondents current age in years.

Age of consent, gender, educational level, and wealth index are included as covariates that have been shown to contribute to HIV testing rates and HIV prevalence. Age of consent, educational level, and wealth index are continuous level variables. Age of consent represented the respondent’s country current age of consent law applicable to HIV testing and will be a scale level variable. Gender is a dichotomous nominal variable that measured the respondent’s gender with 0 = male and 1 = female. Education level is a continuous variable that measured the respondent’s highest year of education completed in years. Wealth index is a continuous level variable that is a composite of variables including ownership of certain assets and housing materials, and types of sanitation within the home (Croft et al., 2018).

Table 1

Operationalization of Variables

Variable name/type	Categorization and operationalization	Level of measurement
HIV testing within last 12 months (dependent variable)	Tested for HIV within 12 months: 0 = not tested, 1 = tested	Nominal
HIV prevalence (dependent variable)	Results of HIV test: 0 = HIV negative, 1 = HIV positive	Nominal
Age (independent variable)	Respondents age in years	Ratio
Age of consent (covariate)	Respondent's countries current age of consent	Ratio
Gender (covariate)	Respondent's gender: 0 = male, 1 = female	Nominal
Educational level (covariate)	Respondent's highest year of completed education:	Ratio
Wealth index (covariate)	Wealth index ranks households according to factors that indicate socioeconomic status	Interval

Data Analysis Plan

Data analysis was completed using IBM SPSS version 27. Once the data was downloaded, it was screened and cleaned for completeness, accuracy, and consistency across the 32 data sets. The data was merged into a single data set utilizing the ID variables indicated in the data code book according to the data merging protocol (Croft et al., 2018). Participants with missing or invalid data were excluded from the study.

Research Questions

RQ1-Quantitative- Is there an association between respondents age and having been tested for HIV within last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index?

$H_0$1-There is no association between respondents' age and having been tested for HIV within the last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

H_a1-There is an association between respondents' age and having been tested for HIV within the last 12 months among adolescents in 32 countries in SSA, controlling for age of consent, gender, education level, and household wealth index.

RQ2-Quantitative- Is there an association between respondents age and HIV status among adolescents in 32 countries in SSA, controlling age of consent, gender, education level, and household wealth index?

$H_0$2-There is no association between respondents age and HIV status among adolescents in 32 countries in SSA, controlling age of consent, gender, education level, and household wealth index.

H_a2-There is an association between respondents age and HIV status among adolescents in 32 countries in SSA, controlling age of consent, gender, education level, and household wealth index.

Statistical Analysis

This research study used quantitative data analysis to answer the research questions. The initial analysis included descriptive statistics for the variables to describe and understand the sample population. Inferential statistics included bivariate analysis and binary logistic regression. Bivariate analysis was conducted to determine any association between the included variables. Binary logistic regression was employed to determine if the IV (age) had any predictive influence over the DVs (HIV testing within the last 12 months and HIV prevalence), while accounting for the included covariates (age of consent, gender, highest level of education, and wealth index).

Logistic regression does not have the usual assumptions of linearity, homoscedasticity, normal distribution, and a continuous DV. However, logistic regression does require a binary or dichotomous DV for binary logistic regression and an ordinal DV for ordinal logistic regression (Statistics Solutions, n.d.). Additionally, logistic regression requires independent observations that are not paired or repeated (Statistics Solutions, n.d.). Logistic regression assumes that none of the IV are highly correlated, preventing multicollinearity. Finally, this model must have a large sample size and the IVs should be linearly aligned with the log odds (Statistic Solutions, n.d.).

To ensure that the logistic regression assumptions have been met, I confirmed that the DVs are dichotomous, and the IVs are either categorical or continuous. The sample size within the study is large, meeting that assumption. The other assumptions were tested during analysis within SPSS. The Box-Tidwell test was used to determine that the IVs were aligned with the logit of the response variable (Statology, 2020). Multicollinearity was tested with the correlation matrix and Variance Inflation Factor (VIF; IBM, n.d.). If there is not linearity between the IVs and the log odds, then the test may not reject the null hypothesis despite the presence of a relationship (Statology, 2020). This was rectified by reclassifying the IV age of consent to a categorical variable (Statistics Solutions, n.d.). None of the IVs are too highly correlated. The Hosmer and

Lemeshow goodness of fit test will be used to ensure that the model is correctly fitted (Walden University Academic Skills Center, 2019a). Bonferroni correction will be applied to determine statistical significance due to the use of multiple independent variables.

HIV is a multifaceted public health crisis that has many layers of contributing factors. Therefore, I chose to use several covariates to ensure that any potential relationships between the IVs and DV exist when accounting for these covariates. The covariates that have been identified in previous research included age, gender, marital status, educational level, and wealth index (McKinnon & Vandermorris, 2018).

The inferential statistics were interpreted based on an alpha of 0.05, which is standard in social science (Statistic Solutions, n.d.). Therefore, if the p-value is above 0.05, the null hypothesis is retained. Confidence intervals (CI) will be set to 95% and used to ensure generalizability of the study outcomes (Frankfort-Nachmias & Leon-Guerrero, 2015). Odds ratios (OR) was be used to interpret the logistic regression output.

Threats to Validity

External Validity

External validity is the extent to which the research results can be generalized to other populations (Creswell, 2014). This study is a large-scale study that included 32 of the countries in SSA, making the study generalizable within the SSA adolescent population. However, the results would not be generalizable to other populations outside of Africa or countries that are not endemic with HIV.

I have included all the respondents that fit the study perimeters, which increased the sample size and power, making the results more generalizable among the SSA population. Additionally, external validity was addressed when drawing conclusions from the analysis to ensure that it is noted which outcomes may be specific to the study population versus the general population.

Internal Validity

Internal validity are any potential factors that could threaten the researcher's ability to interpret statistical results (Creswell, 2014). Internal validity is improved using a highly standardized, nationally representative survey instrument like the DHS. Selection bias was reduced by utilizing the entire sample population of the 32 SSA countries, and the DHS original sample design (Croft et al., 2018). Internal validity was also improved by the large sample size and high statistical power within the study (Frankfort-Nachmias & Leon-Guerrero, 2015). Additionally, all assumptions were tested and addressed during analysis (Creswell, 2014). While I made every effort to increase external and internal validity, there was still a risk for validity concerns, which was noted in the study's limitations.

Ethical Procedures

This research was completed in an ethically sound and responsible manner. DHS has received and maintained approval from the Inner-City Fund (ICF) International Review Board (IRB), along with each countries individual IRB if available (Croft et al., 2018). The data collected by DHS has no identifying responses, and care was taken in each survey to ensure data is not identifiable (ICF, 2018). There are stringent protocols in place to obtain informed consent and collect data with a series of codes based on location, household, and individual numbers (Croft et al., 2018). Further, geographical data is displaced by coordinate and direction (Croft et al., 2018). The coding system is randomized, and all interviews are completed anonymously and in private (Croft et al., 2018). When the data was downloaded, I took care to ensure that there was no identifying information, and that all data was kept confidential. The data is stored on my personal computer, which is security encrypted and locked with password protection. The data will be kept secured throughout the length of this research study, and then will be destroyed five years after project completion. This data will only be used for this research study, and the study was completed only after Walden IRB approval was granted. HIV among the adolescent population is a sensitive topic that requires the utmost care. As a secondary survey, however, there was no additional risk of psychological consequences from data gathering. There are no other ethical implications to report.

Summary

In the preceding chapter, I discussed the methodology of this research project, including the research design, analysis strategies, and ethical implications of the research. This study used binary logistic regression to answer the research questions. The sample population included all respondents aged 18 and younger who were not married and who had been sexually active from the data sets of the included 32 SSA countries. The IV was age, the DVs were tested for HIV within 12 months and HIV prevalence, and the included covariates are age of consent, gender, highest level of education, and wealth index based. I explained the operationalism of the included variables and the method I used to analyze the variables to answer the research questions. I discussed the logistic regression model and the associated assumptions, as well as how to proceed if any of the assumptions are broken. Finally, I discussed internal and external validity as well as ethical procedures for the study. In chapter 3, I will present the statistical analyses from this study along with my research findings, and chapter 4 will conclude with practical implications of this research.

Section 3: Presentation of the Results and Findings

Introduction

In this study, I used logistic regression to test if there was a relationship between age of consent and the HIV crisis among adolescents in SSA. I conducted binary logistic regression to determine if age was related to HIV testing rates and HIV prevalence while controlling for age of consent, years of education, marital status, gender, and wealth index. I used these analyses to answer the following research questions:

RQ1-Quantitative: Is there an association between respondents' age and having been tested for HIV among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index?

$H_0$1: There is no association between respondents' age and having been tested for HIV among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index.

H_a1: There is an association between respondents' age and having been tested for HIV among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index.

RQ2-Quantitative: Is there an association between respondents' age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index?

$H_0$2: There is no association between respondents' age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index.

H_a2: There is an association between respondents' age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index.

In Chapter 3, I will provide the results and findings of this study. This section will cover the data collection process for the study, including data collection time frames, recruitment and response, and descriptive analyses of the sample population. I will discuss discrepancies noted during statistical analyses that varied from the initial plan. This section will conclude with a discussion of the results of the quantitative analyses that were used to answer the research questions.

Accessing the Data Set for Secondary Analysis

Data Collection Time Frame and Response Rates

In this study, I used the most current available data set that included HIV biomarkers for each of the countries included. These data sets included phases DHS-V, DHS-VI, and DHS-VII and range from 2005 to 2019 (Table 2). The majority of included data sets showed results from the Standard DHS survey instrument, which was used to obtain data on demographics, health information, mortality, fertility, marital status, sexual practices, including contraception, nutrition, HIV, malaria, domestic violence, and childhood wellness (National Statistical Office/Malawi & ICF, 2017). Other countries used the AIS, which was used to better understand HIV and AIDS through serological testing and focused on obtaining data about current programs, HIV knowledge and attitudes, sexual behavior, and demographic information (Croft et al., 2018). Senegal used the Continuous DHS survey instrument, which collected data yearly (National

Agency for Statistics and Demography, 2018). Although the data sets varied on the collection time frame, there was no impact on the results of this study. This methodology was used in previous research by McKinnon and Vandermorris (2018) with successful results. The required variables for this study were present in each of the phases of the surveys. Additionally, these surveys represent cross-sectional data that provided information on any potential relationship between age of consent, HIV testing rates, and HIV prevalence.

The DHS data collection for each country collected nationally representative data that also accounts for regional differences and locality (rural and urban). In addition, the DHS used weighting to account for under and oversampling to ensure that the data is representative of the populations on all levels, including national, regional, and locality (Croft et al., 2018). The DHS instruments were used across all the included countries and the different phases of the survey, which provided consistent variables from Phase V through Phase VII (ICF, n.d.). Table 3 represents the response rates for each of the data sets used, including the percentage of chosen households, females, and males that responded to the survey and the number for each of these categories.

Table 2

Data Collection Information From the 32 SSA Countries With HIV Data

Country	Survey year	Phase	Survey type
Angola	October 2015- April 2016	VII	Standard DHS
Burkina Faso	2010	VI	Standard DHS
Burundi	October 2016- March 2017	VII	Standard DHS
Cameroon	2018-2019	VII	Standard DHS
Chad	2014-2015	VII	Standard DHS
Congo	2009	V	Standard AIS
Congo Dem. Republic	2014-2014	VI	Standard DHS
Cote d’Ivoire	2011-2012	VI	Standard DHS
Eswatini	2005	V	Standard DHS
Ethiopia	2016	VII	Standard DHS
Gabon	2012	VI	Standard DHS
Gambia	2013	VI	Standard DHS
Ghana	2014	VII	Standard DHS
Guinea	2018	VII	Standard DHS
Kenya	2008-2009	V	Standard DHS
Lesotho	September- December 2014	VII	Standard DHS
Liberia	2013	VI	Standard DHS
Malawi	2015-2016	VII	Standard DHS
Mali	2012-2013	VI	Standard DHS
Mozambique	May- December 2015	VII	Standard AIS
Namibia	2013	VI	Standard DHS
Niger	2012	VI	Standard DHS
Rwanda	2014-2015	VII	Standard DHS
Sao Tome & Principe	2008-2009	V	Standard DHS
Senegal	2017	VII	Continuous DHS
Sierra Leone	2019	VII	Standard DHS
South Africa	July- November 2016	VII	Standard DHS
Tanzania	December 2011-May 2012	VI	Standard AIS
Togo	2013-2014	VI	Standard DHS
Uganda	2011	VI	Standard AIS
Zambia	2018- January 2019	VII	Standard DHS
Zimbabwe	July- December 2015	VII	Standard DHS

Discrepancies From the Original Research Plan

During the study review and preliminary data analysis, I found some discrepancies in which the analyses varied from the original plan detailed in Chapter 2. These discrepancies included a variable change, reconsideration of one of the sample exclusions, and missing data across some of the descriptive variables.

The variable has been tested for HIV within the last 12 months was not present across all data sets. In addition, the earlier data sets did not measure when the last HIV test was performed. Therefore, the variable was updated to ever been tested for HIV. The covariates included in the regression model have been adjusted to better fit the model.

The second discrepancy challenged the initial planning of sample exclusions. In the original plan, the sample was limited by age, sexual activity, and marital status. Married respondents were originally to be excluded as marriage was thought to be a protective factor against HIV. However, upon accessing the data, I noted that the original three exclusions narrowed the sample size to 30,083 unmarried, sexually active teens. Therefore, I removed the exclusion of marriage, and the final sample size is 37,015 sexually active teen respondents. HIV testing is essential for this population; therefore, married teen respondents was included in the sample.

Some descriptive variables used had a higher frequency of missing values. Due to the personal and sensitive nature of the questions, some respondents refused to answer or may have answered inaccurately due to fear, stigma, or other negative connotations. Missing values were addressed via listwise deletion during regression but were left intact for the descriptive analyses. There were no other discrepancies noted from the documented plan from Chapter 2.

Table 3

Response Rates by Country

Country	Response rate			Interviews		
	Household	Female	Male	Household	Female	Male
Angola	99%	96%	94%	16,109	14,379	5,684
Burkina Faso	99%	98%	97%	14,424	17,087	7,307
Burundi	99%	98%	97%	15,977	17,269	7,552
Cameroon	99%	98%	98%	11,710	13,527	6,978
Chad	99%	96%	92%	17,233	17,719	5,248
Congo	99%	96%	95%	7,096	6,550	5,863
CDR	99%	99%	97%	18,171	18,827	8,656
Cote d'Ivoire	98%	93%	91%	9,686	10,060	5,135
Eswatini	95%	94%	89%	4,843	4,987	4,156
Ethiopia	98%	95%	86%	16,650	15,683	12,688
Gabon	99%	98%	96%	9,755	8,422	5,654
Gambia	95%	91%	82%	6,217	10,233	3,821
Ghana	99%	97%	95%	11,835	9,396	4,388
Guinea	99%	99%	99%	7,912	10,874	3,944
Kenya	98%	96%	89%	9,057	8,444	3,465
Lesotho	99%	97%	94%	9,402	6,621	2,931
Liberia	99%	98%	95%	9,333	9,239	4,118
Malawi	99%	98%	95%	26,361	24,562	7,478
Mali	98%	96%	93%	10,105	10,424	4,399
Mozambique	98%	95%	86%	7,169	7,749	5,283
Namibia	97%	92%	85%	9,849	9,176	4,481
Niger	98%	95%	88%	10,750	11,160	3,928
Rwanda	99%	99%	99%	12,699	13,497	6,217
Sao Tome & Principe	94%	90%	75%	3,536	2,615	2,296
Senegal	98%	96%	91%	8,380	16,787	6,977
Sierra Leone	99%	97%	99%	13,399	15,574	7,197
South Africa	83%	86%	73%	11,083	8,514	3,618
Tanzania	98%	97%	92%	12,563	13,266	3,514
Togo	99%	98%	95%	9,549	9,480	4,476
Uganda	99%	98%	96%	11,340	12,153	9,588
Zambia	99%	96%	92%	12,831	13,683	12,132
Zimbabwe	99%	96%	92%	10,534	9,955	8,396

Baseline Descriptive and Demographic Characteristics

The study sample included all respondents aged 18 and below (N=99,756) from the included 32 countries (Table 4). Respondents who were not sexually active were excluded from Research Question 1, which limited the sample size (N=37,015). For Research Question 2, the sample was further limited by the presence of HIV test results (N=25,107). The total sample included 9,420 males and 27,595 females, and the mean age of respondents from all countries was 17 (Table 5).

Table 4

Sample Size Exclusion

Total initial sample size	570,180	
Respondents aged 18 and younger	99,756	
Sexually active	37,015	
Respondents with HIV test results	25,107	
Final sample		N=37015

There was a significant difference between the sample size from each country, ranging from 341 respondents from Sao Tome & Principe and 2,563 respondents from Malawi. Although there was a difference between the number of respondents from each country, this appears similar to the spread of respondents in the original data set, prior to removing all respondents over 18 years of age and those not sexually active. This comparison can be found in Appendix A. Congo, Tanzania, and Uganda had no male respondents due to the use of the Standard AIS, which is only used to conduct individual interviews for the eligible females (Ministry of Health/Uganda and ICF International, 2012).

Table 5

Total Number of Respondents Based on Country

	Mean age	Male	Female	Total
Angola	17	762	1598	2360
Burkina Faso	17	175	943	1118
Burundi	17	194	345	539
Congo Democratic Republic	17	625	1592	2217
Congo	17	0	1198	1198
Cote d’Ivoire	17	281	919	1200
Cameroon	17	334	1120	1454
Ethiopia	17	218	673	891
Gabon	17	636	937	1573
Ghana	17	140	508	648
Gambia	17	110	442	552
Guinea	17	234	857	1091
Kenya	17	238	436	674
Liberia	17	263	1029	1292
Lesotho	17	318	491	809
Mali	17	114	840	954
Malawi	17	718	1845	2563
Mozambique	17	556	765	1321
Niger	17	29	834	863
Namibia	17	254	570	824
Rwanda	17	220	384	604
Sierra Leone	17	410	1345	1755
Senegal	17	243	785	1028
Sao Tome & Principe	17	152	189	341
Eswatini	17	168	356	524
Chad	17	178	1456	1634
Togo	17	163	581	744
Tanzania	17	0	1234	1234
Uganda	17	0	1332	1332
South Africa	17	241	420	661
Zambia	17	1035	1116	2151
Zimbabwe	17	411	455	866
Total	17	9420	27595	37015

I used descriptive statistics to better describe the sample population (Table 6). The majority of respondents were older adolescents (i.e., 17 or 18), with 11.8% of respondents aged 15, 19.3% aged 16, 27.2% aged 17, and 41.7% aged 18. The respondents were 74.6% female and 25.4% male, while 63.7% lived in rural settings and 36.3% in urban settings. As previously mentioned, 22.8% of respondents were married, 67.7% were unmarried, 7.0% lived with a partner, 0.1% were widowed, 0.7% were divorced, and 1.6% were separated. Respondents primarily had either primary (39.6%) or secondary (42%) education, but 18.1% had no education, and only 0.3% had higher education. More than half of respondents (54.5%) were literate and able to read a whole sentence, while 12.4% could read part of a sentence, and 32.6% could not read at all. The respondents were evenly distributed among the wealth index variable, with 20.7% poorest, 20.7% poorer, 21.2% middle, 19.7% richer, and 17.7% in the richest quintile. There was limited variability in health insurance, and 94.1% of respondents had no health insurance coverage.

Table 6

Characteristics of Respondents

Variable		Percentage
Age	15 years old	11.8%
	16 years old	19.3%
	17 years old	27.2%
	18 years old	41.7%
Gender	Male	25.4%
	Female	74.6%
Marital status	Never in union	67.7%
	Married	22.8%
	Living with partner	7.0%
	Widowed	0.1%
	Divorced	0.8%
	No longer living together	1.6%
Place of residence	Urban	36.3%
	Rural	63.7%
Educational level	No education	18.1%
	Primary	39.6%
	Secondary	42.0%
	Higher	0.3%
Literacy	Cannot read at all	32.6%
	Able to read only parts of sentence	12.4%
	Able to read whole sentence	54.5%
	No card with required language	0.5%
Wealth index	Poorest	20.7%
	Poorer	20.7%
	Middle	21.2%
	Richer	19.7%
	Richest	17.7%
Health insurance	No	94.1%
	Yes	5.9%

Sample Representativeness

The DHS survey is performed using two-stage stratified cluster sampling to provide representative samples at the national and regional level and across rural and urban locations (Statistics Sierra Leone & ICF, 2020). Probability-proportional-to-size sampling occurs in the first stage, and systematic probability sampling is used at the second stage to ensure that the sample represents the country (Statistics Sierra Leone & ICF, 2020). The DHS program used established sampling strategies that limited bias and ensured sample representativeness (Creswell, 2014). In addition, weights were provided for each data set to ensure that the data is representative regionally and across each enumeration area (Croft et al., 2018).

For this study, I used 32 data sets that were representative of each respective country. I merged the data sets and limited the data based on age (excluding all respondents over the age of 18), and then excluded all respondents that had never been sexually active based on the variable age at first sex. This data is representative of the 32 included countries and should limit the possibility of external validity errors.

Primary Univariate Analyses of Covariates

The covariates that have been identified in prior research as potentially contributing to HIV testing rates within the adolescent population in SSA include gender, age, age of consent, marital status, educational level, and wealth index. First, I performed univariate analyses to determine if the use of these covariates was justified within this study. Then, I used chi-square analyses to determine if the differences I discovered were significant. These analyses were used to examine each covariate as it relates to the dependent variable ever been tested for HIV.

Gender

Figure 2 shows that the majority of respondents (73.94% of males, 62.96% of females) had not previously been tested for HIV. Based on this analysis, only one quarter of male teens and one third of female teens had ever previously been tested for HIV. There was a significant difference in testing rates based on gender ($p<0.001$) with a small effect size ($\varphi=0.101$). (Table 8, Table 9). Females were more likely to have been tested for HIV previously (37% of females versus 26% of males).

Figure 2

Ever Been Tested for HIV by Gender

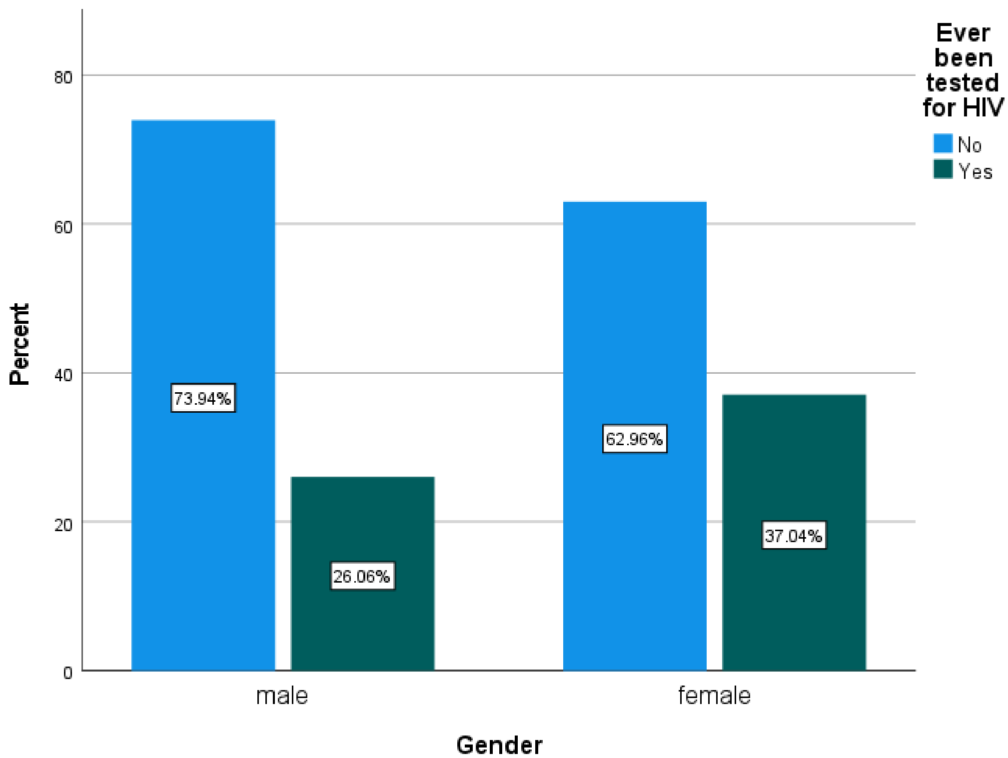


Table 7

Crosstabulation of Ever Been Tested for HIV by Gender

			Ever been tested for HIV		
			No	Yes	Total
Gender	male	Count	6962	2454	9416
	female	Count	17331	10198	27529
Total		Count	24293	12652	36945

Table 8

Chi-Square Analysis of Ever been tested for HIV by Gender

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	375.819[a]	1	.000
Continuity Correction[b]	375.331	1	.000
Likelihood Ratio	387.617	1	.000
Linear-by-Linear Association	375.809	1	.000
N of Valid Cases	36945		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 3224.56.
b. Computed only for a 2x2 table

Table 9

Effect Size

		Value	Approximate Significance
Nominal by Nominal	Phi	.101	.000
	Cramer's V	.101	.000
N of Valid Cases		36945	

Age

Figure 3 shows data on HIV testing by age. Older respondents were more likely to have been tested for HIV, with 22.15% of 15-year-old respondents, 28.18% of 16-year-old respondents, 34.4% of 17-year-old respondents, and 40.39% of 18-year-old respondents having previously been tested. There is a statistically significant difference between testing rates based on age ($p<0.001$), with a small effect size (Cramer's V=0.134; Table 11, Table 12).

Figure 3

HIV Testing by Age

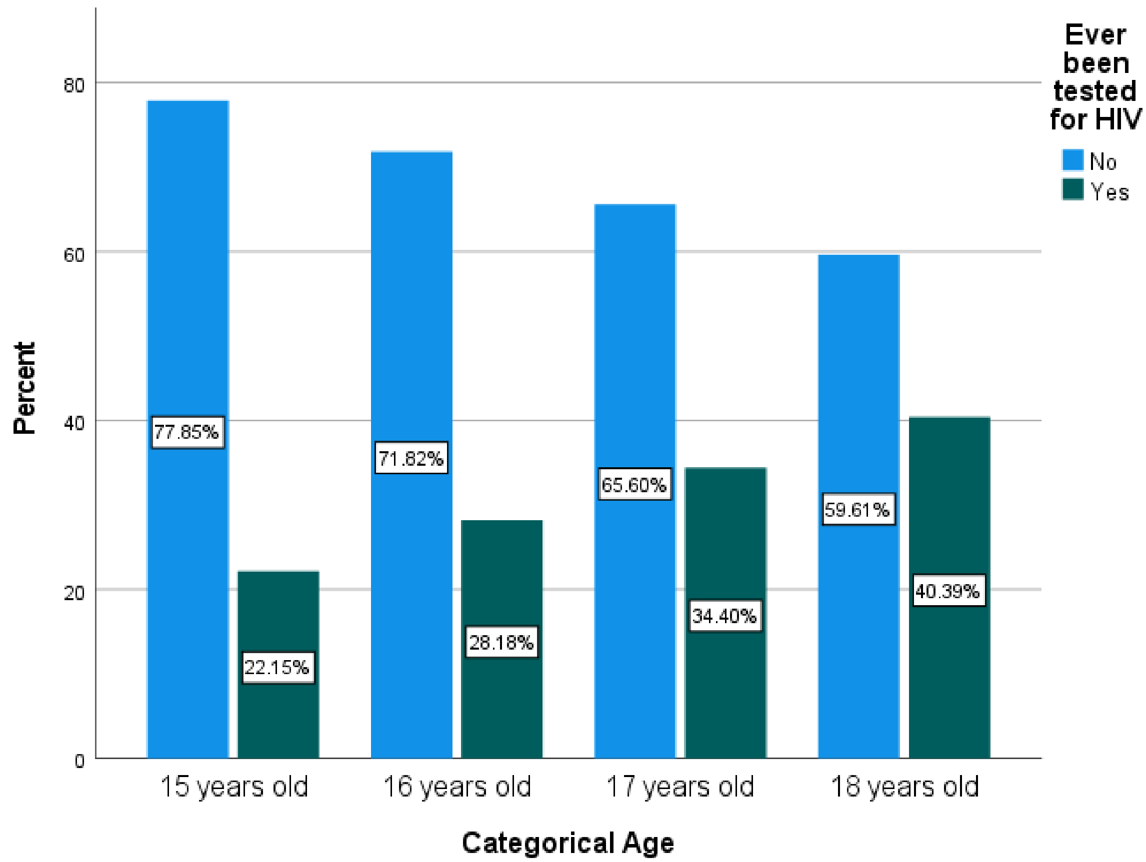


Table 10

Cross Tabulation of Ever Been Tested and Age

			Ever been tested for HIV		
			No	Yes	Total
Age	15 years old	Count	3403	968	4371
	16 years old	Count	5118	2008	7126
	17 years old	Count	6603	3463	10066
	18 years old	Count	9169	6213	15382
Total		Count	24293	12652	36945

Table 11

Chi-Square Analysis

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	658.790[a]	3	.000
Likelihood Ratio	677.657	3	.000
Linear-by-Linear Association	658.731	1	.000
N of Valid Cases	36945		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1496.87.

Table 12

Effect Size

		Value	Approximate Significance
Nominal by Nominal	Phi	.134	.000
	Cramer's V	.134	.000
N of Valid Cases		36945	

Wealth Index

The subsequent analysis (Figure 4) examines HIV testing by wealth index. This variable included five groups based on the wealth index factor score. These groups were poorest, poorer, middle, richer, and richest. There is a small statistical difference (p>0.001) between wealth index and testing rates (Cramer's V= 0.083). Respondents with a lower wealth index had a lower frequency of HIV testing, with only 28.34% of the poorest group previously tested, 32.43% of the poorer group having been tested, 34.24% of the middle group, 37.12% of the richer group, and 40.08% of the richest group previously tested for HIV (Table 14, Table 15).

Figure 4

HIV Testing Rates and Wealth Index

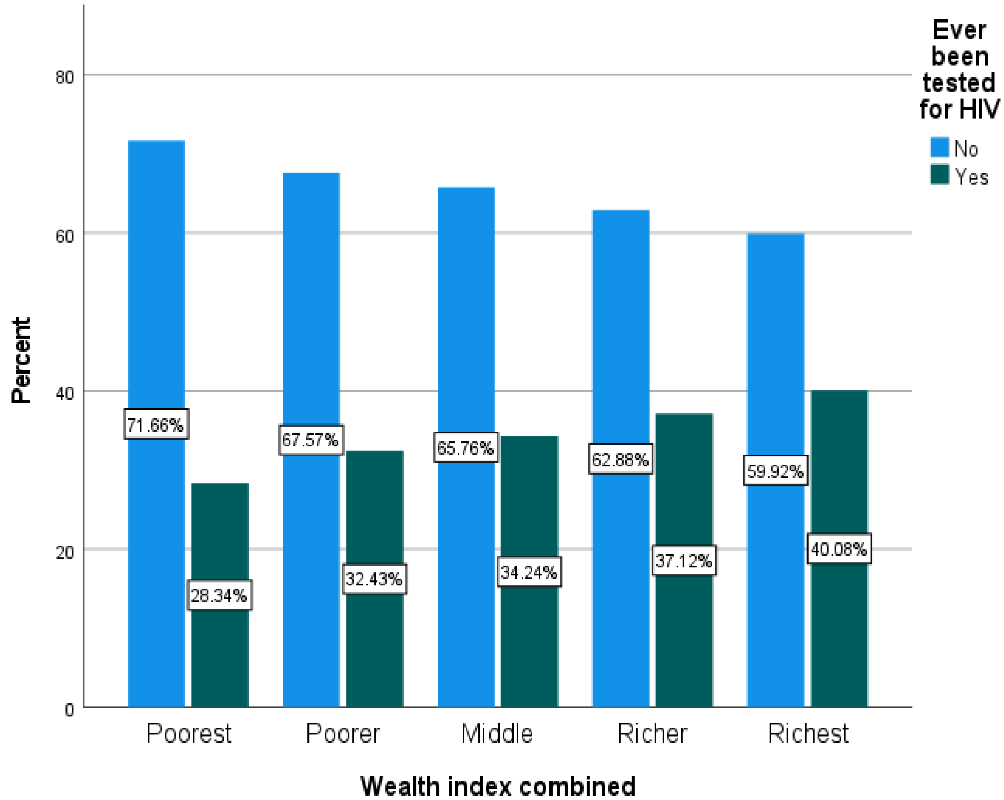


Table 13

Cross Tabulation of Ever Been Tested for HIV and Wealth Index

			Ever been tested for HIV		
			No	Yes	Total
Wealth index	Poorest	Count	5481	2168	7649
	Poorer	Count	5164	2478	7642
	Middle	Count	5159	2686	7845
	Richer	Count	4565	2695	7260
	Richest	Count	3924	2625	6549
Total		Count	24293	12652	36945

Table 14

Chi-Square Analysis

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	255.306[a]	4	.000
Likelihood Ratio	256.445	4	.000
Linear-by-Linear Association	252.183	1	.000
N of Valid Cases	36945		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 2242.74.

Table 15

Effect size

		Value	Approximate Significance
Nominal by Nominal	Phi	.083	.000
	Cramer's V	.083	.000
N of Valid Cases		36945	

Educational Level

As shown in the literature review, education level has been linked to HIV testing rates and prevalence. Figure 5 shows that for this sample, those with the highest levels of education have the highest testing rates (62.28%), while those with no education have the lowest rates (17.39%). Of respondents with secondary education, 42.31% had previously been tested for HIV, and those with primary education, 37.4% have been tested. Table 17 shows there was a statistically significant difference in testing rates based on educational level ($p<0.001$), with Table 18 showing a small effect size (Cramer's V=0.189).

Figure 5

HIV Testing Rates Based on Education Level

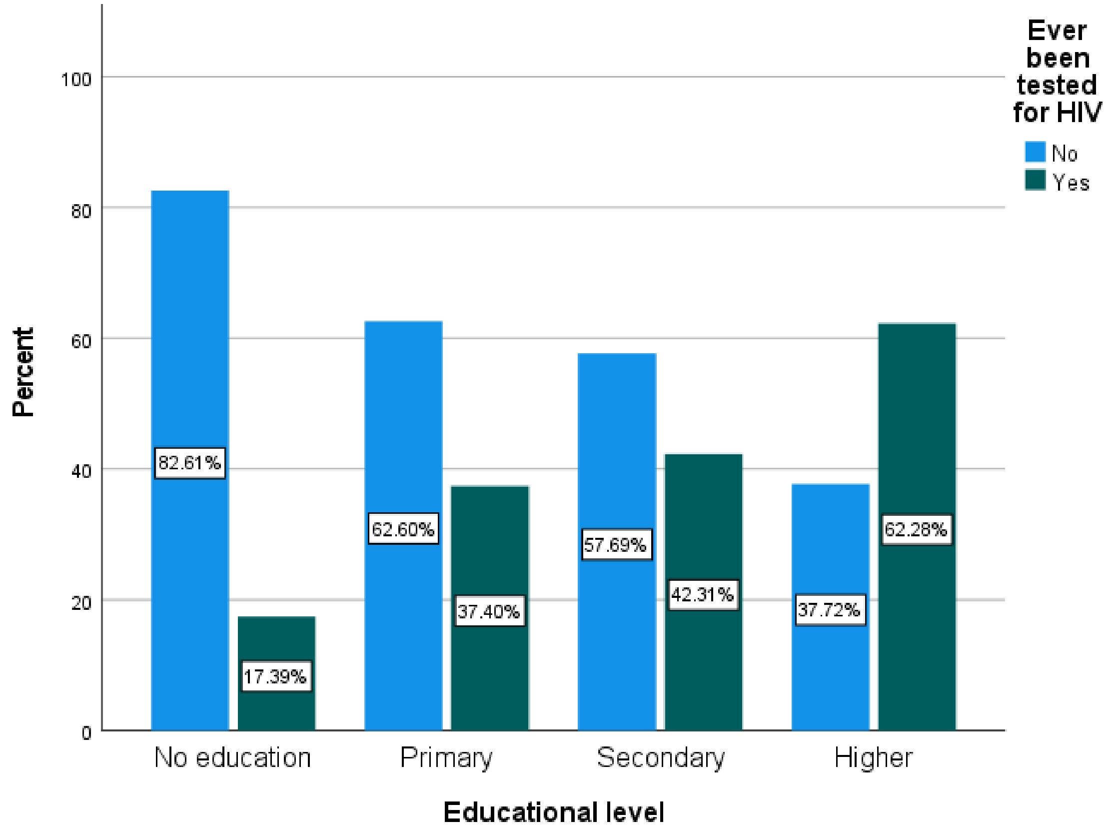


Table 16

Cross Tabulation of Ever Been Tested and Educational Level

			Ever been tested for HIV		
			No	Yes	Total
Educational level	No education	Count	5196	1094	6290
	Primary	Count	8597	5136	13733
	Secondary	Count	8421	6176	14597
	Higher	Count	43	71	114
Total		Count	22257	12477	34734

Table 17

Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1244.422[a]	3	.000
Likelihood Ratio	1351.085	3	.000
Linear-by-Linear Association	1051.299	1	.000
N of Valid Cases	34734		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 40.95.

Table 18

Effect Size

		Value	Approximate Significance
Nominal by Nominal	Phi	.189	.000
	Cramer's V	.189	.000
N of Valid Cases		34734	

Marital Status

Figure 6 represents HIV testing based on the respondent's marital status. There was a small but statistically significant variation noted in testing rates based on current relationship (Cramer's V=0.072; p<0.001; Tables 20, 21). Respondents that had never been in a union had the lowest testing rates (32.81%), and those who were no longer living together or who were separated had the highest testing rates (50.69%). Of the remaining respondents, the testing rates were as follows: married respondents (34.37%), respondents that lived with a partner (42.9%), widowed (40%), and divorced respondents (44.21%).

Figure 6

HIV Testing Based on Marital Status

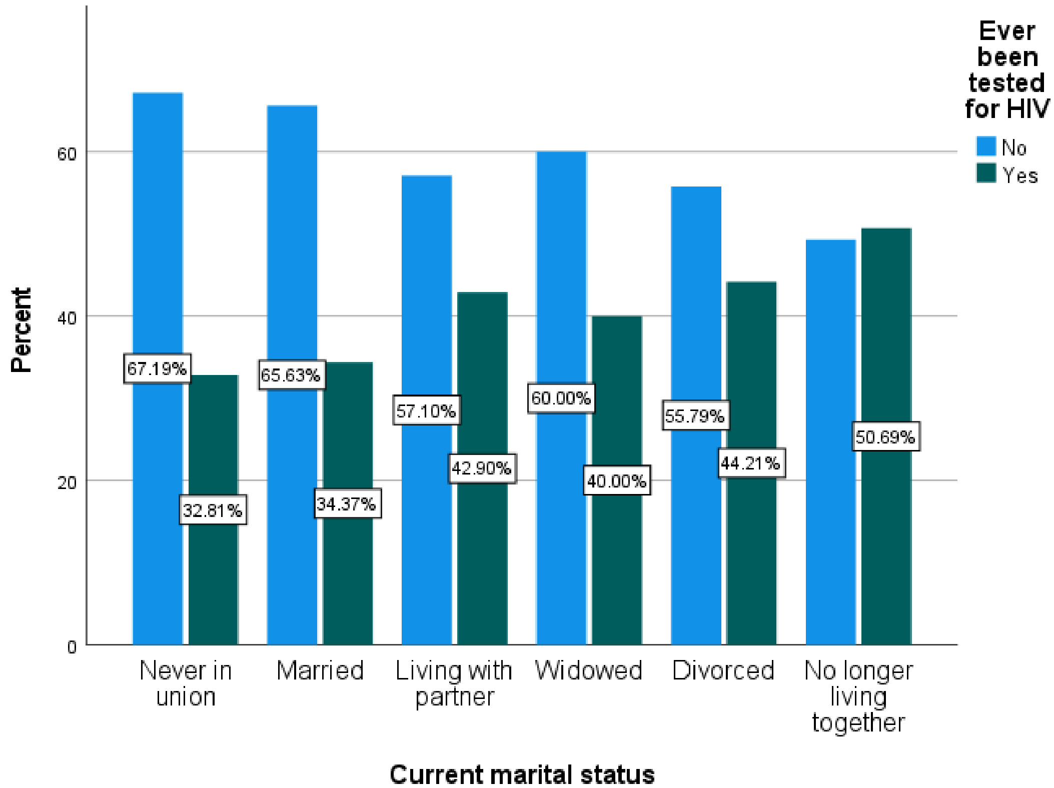


Table 19

Cross Tabulation of Ever Been Tested for HIV and Current Marital Status

			Ever been tested for HIV		
			No	Yes	Total
Current marital status	Never in union	Count	16829	8218	25047
	Married	Count	5521	2891	8412
	Living with partner	Count	1475	1108	2583
	Widowed	Count	24	16	40
	Divorced	Count	159	126	285
	No longer living together	Count	285	293	578
Total		Count	24293	12652	36945

Table 20

Chi-Square Analysis

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	191.388[a]	5	.000
Likelihood Ratio	184.554	5	.000
Linear-by-Linear Association	166.297	1	.000
N of Valid Cases	36945		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.70.

Table 21

Effect Size

		Value	Approximate Significance
Nominal by Nominal	Phi	.072	.000
	Cramer's V	.072	.000
N of Valid Cases		36945	

Age of Consent

The final univariate analysis was used to compare previous HIV testing rates based on the respondents' age of consent (Figure 7). There was a moderately sized (Cramer's V=0.279) difference between testing rates based on the respondent's country's age of consent ($p<0.001$; Table 23, Table 24). The lowest rates of testing were for participants that have an age of consent for HIV testing of 14 years (10.91%), 18 years (24.57%), and 15 years (32.58%). Those respondents who have an age of consent of 13 years (60.79%), 12 years (55.53%), 16 years (47.06%), and 11 years (40.08%) had higher rates of previous testing.

Figure 7

Ever Been Tested for HIV by Age of Consent

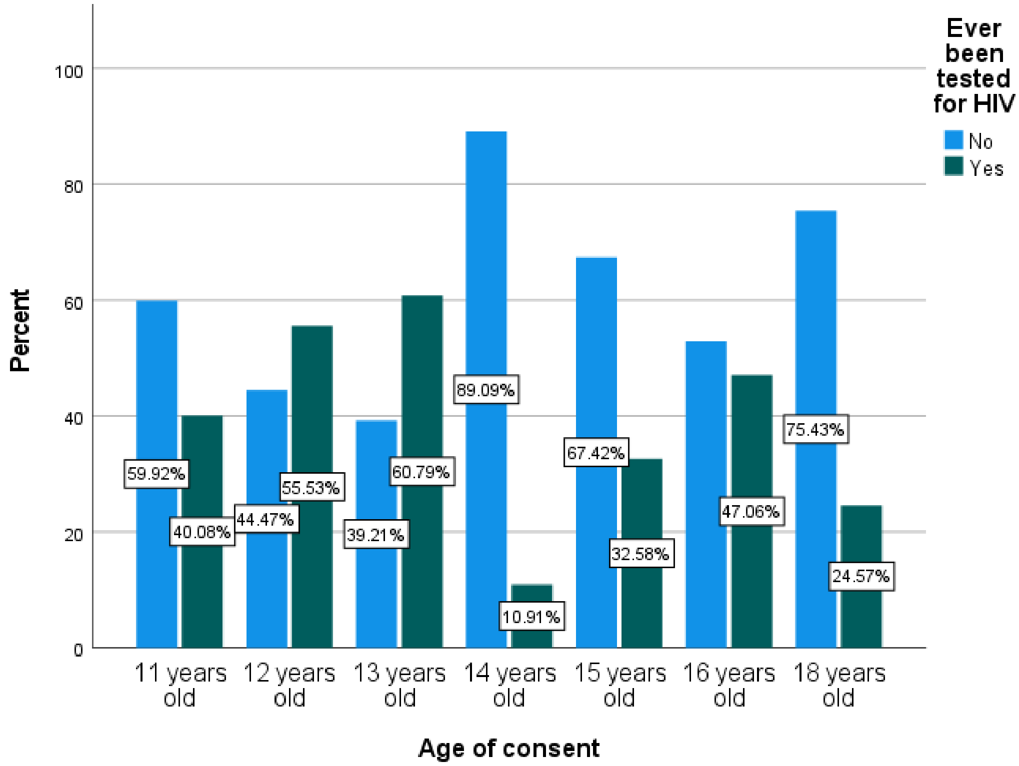


Table 22

Cross Tabulation of Ever Been Tested for HIV and Age of Consent

			Ever been tested for HIV		Total
			No	Yes	
Age of consent	11 years old	Count	791	529	1320
	12 years old	Count	1246	1556	2802
	13 years old	Count	1005	1558	2563
	14 years old	Count	972	119	1091
	15 years old	Count	2959	1430	4389
	16 years old	Count	3228	2870	6098
	18 years old	Count	14092	4590	18682
Total		Count	24293	12652	36945

Table 23

Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2876.746[a]	6	.000
Likelihood Ratio	2867.775	6	.000
Linear-by-Linear Association	1488.276	1	.000
N of Valid Cases	36945		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 373.62.

Table 24

Effect Size

		Value	Approximate Significance
Nominal by Nominal	Phi	.279	.000
	Cramer's V	.279	.000
N of Valid Cases		36945	

These univariate analyses and chi-square tests showed that each of the included covariates was justified for inclusion in this research. In addition, there was a statistically significant difference among previous HIV testing based on gender, age, wealth index, educational level, marital status, and age of consent.

Results

Descriptive Statistics

This sample included 37,015 respondents from the 32 included countries from SSA. Of these, 28,859 (75%) of the respondents were female, and 9,821 (25%) of the respondents were male (Table 4, Figure 8). Figure 9 shows that the sample was primarily older adolescents, with 41.67% being 18 years, 27.23% being 17 years, 19.28% being 16 years, and 11.82% being 15 years. The majority of respondents live in countries that have an age of consent of 18 years (50.59%), followed by 16 years (16.53%), 15 years (11.87%), 12 years (7.57%), 13 years (6.92%), 11 years (3.57%), and 14 years (2.95%; Figure 10).

Figure 8

Same Distribution by Gender

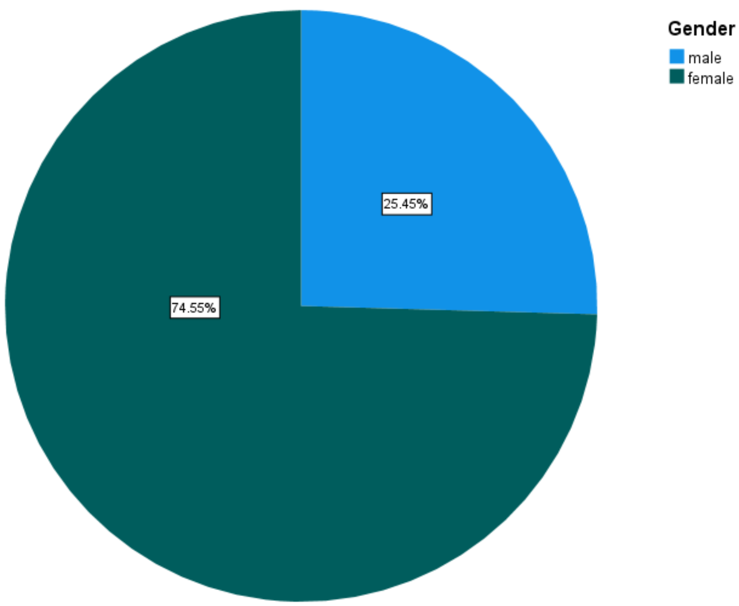


Figure 9

Sample Distribution by Age

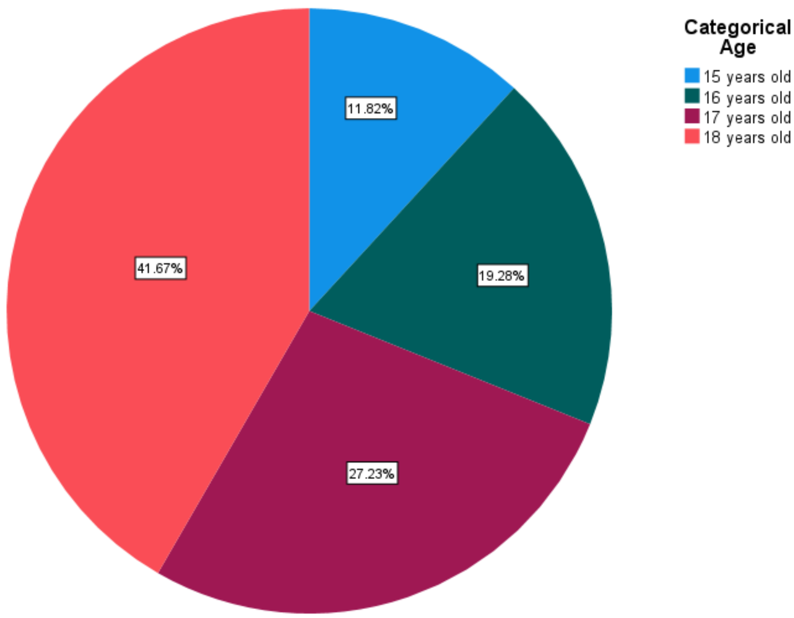
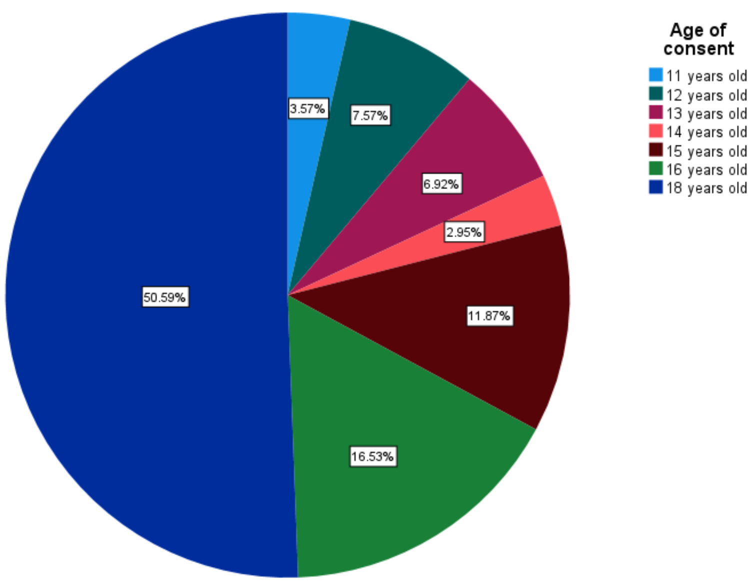


Figure 10

Sample Distribution by Age of Consent



The majority of the sample had some education, with 39.86% of males and 39.45% of females with primary education, 53.26% of males, and 38.18% of females with secondary education. However, only a very small percentage of the population had any higher education (0.36% males and 0.32% females). Respondents with no education included 6.52% of males and 22.06% of females (Figure 11). The sample was evenly spread across the wealth index, with 20.71% in the poorest quintile, 20.67% in the poorer quintile, 21.23% in the middle quintile, 19.67% in the richer quintile, and 17.71% in the richest quintile (Figure 12).

Figure 11

Sample Distribution by Education Level and Gender

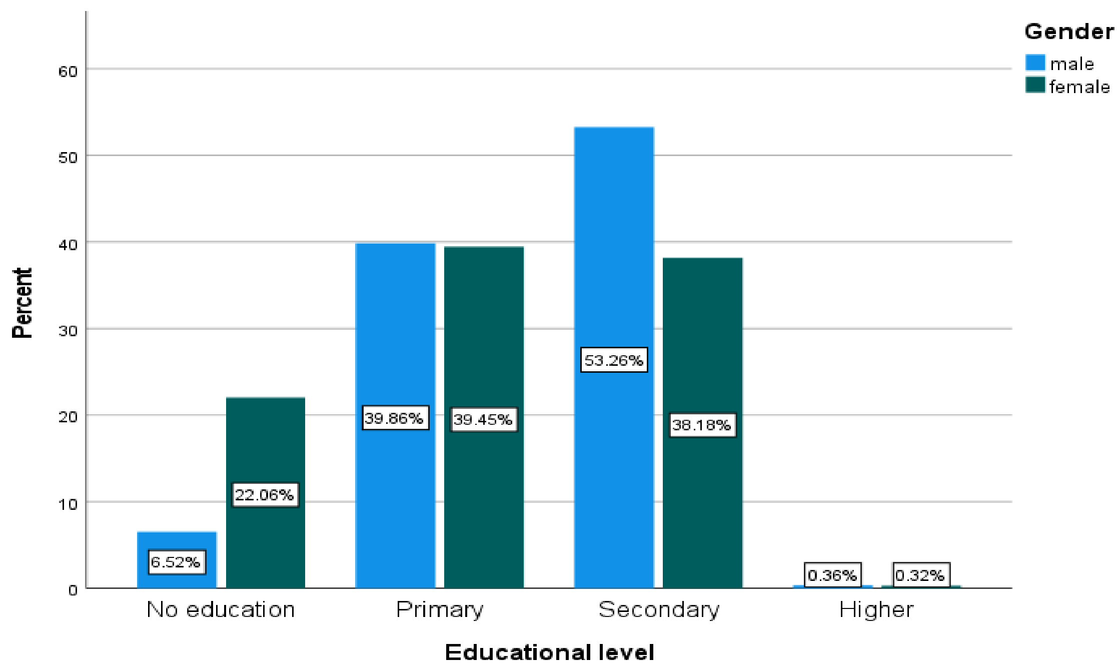


Figure 12

Sample Distribution by Wealth Index

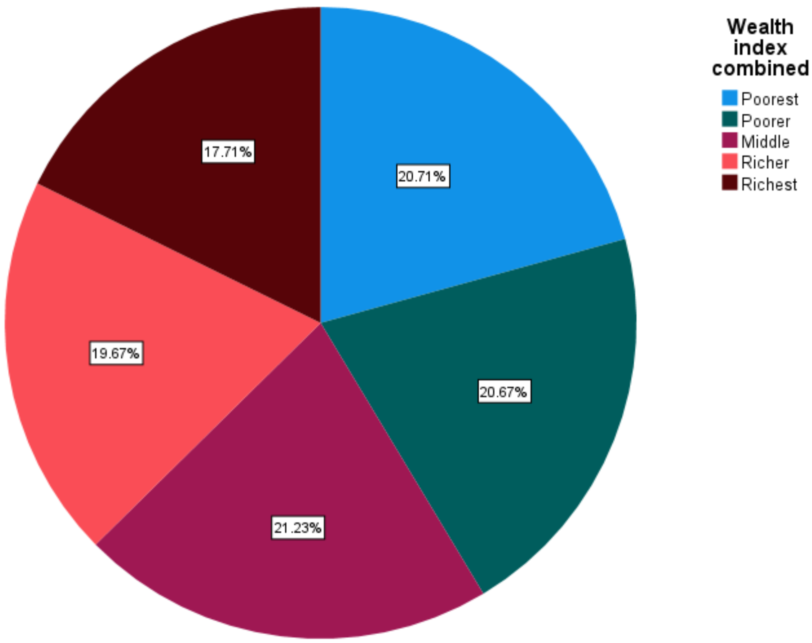


Figure 13 shows a histogram of respondents’ age of first sexual intercourse. The mean age was 14.88 years, with a minimum age of 5 years old. Figure 14 provides data on respondents’ total number of children, with 8,828 respondents with one child, 1,196 respondents with two children, 130 respondents with three children, and 16 respondents with more than three children.

Figure 13

Histogram of Age at First Sex

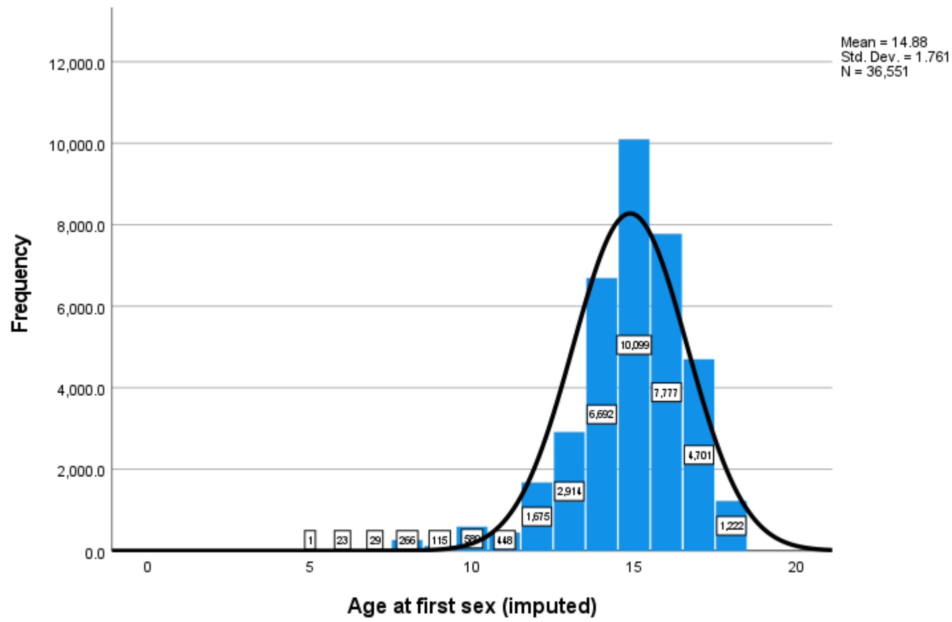
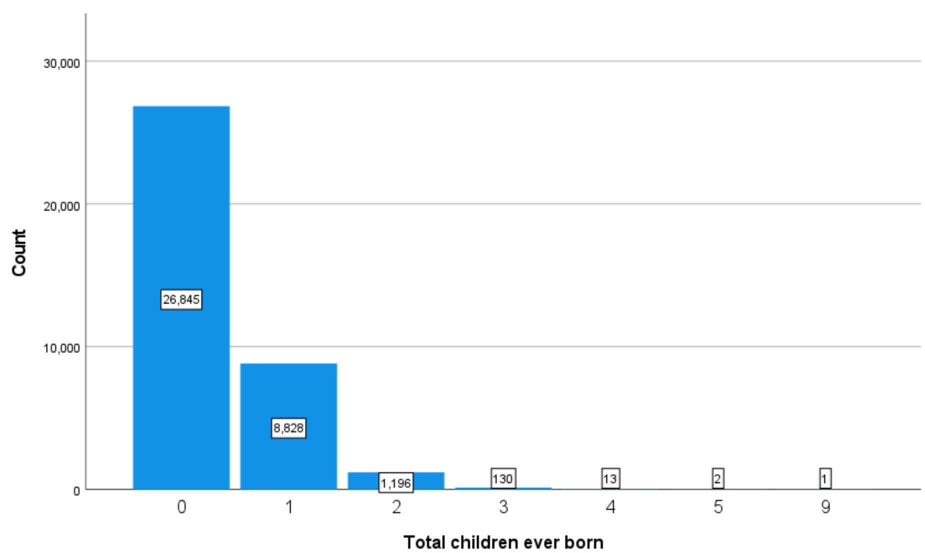


Figure 14

Sample Distribution of Total Number of Children Born



The variable country code and phase was recoded into a new variable to categorize respondents based on age of consent. The countries were grouped based on the policy and literature review by each countries current age of consent policy. Table 25 provides the grouping and references that were used to create the age of consent variable and Table 26 shows the coding used for the new variable age of consent. The age variable was used as a continuous variable (Table 27). Table 28 shows the frequency table for the variable ever been tested for HIV. Tables 29 and 30 show original and recoding for HIV results. Additionally, the variable marital status was recoded so that 0=not married and 1=currently married (Table 31, 32).

Table 25

Countries Divided by Age of Consent

Age of consent	
11 years	Mozambique[a]
12 years	Lesotho[c], Uganda[c], South Africa[d]
13 years	Malawi[c]
14 years	Guinea[a]
15 years	Congo[a], Ethiopia[c], Kenya[c], Rwanda[c], Senegal[a]
16 years	Cote d'Ivoire[a], Gambia[a], Namibia[c], Eswatini[b], Zambia[c], Zimbabwe[c]
18 years	Angola[a], Burkina Faso[a], Burundi[b], Congo Democratic Republic[c], Cameroon[c], Gabon[b], Ghana[b], Liberia[a], Mali[a], Niger[a], Sierra Leone[a], Sao Tome & Principe[b], Chad[b], Togo[a], Tanzania[c]

a. Eba & Lim, 2017
b. Fox et al., 2013
c. McKinnon & Vandermorris, 2018
d. Sam-Agudu et al., 2016

Table 26

Recoded Age of Consent Variable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11 years old	1321	3.6	3.6	3.6
	12 years old	2802	7.6	7.6	11.1
	13 years old	2563	6.9	6.9	18.1
	14 years old	1091	2.9	2.9	21.0
	15 years old	4395	11.9	11.9	32.9
	16 years old	6117	16.5	16.5	49.4
	18 years old	18726	50.6	50.6	100.0
	Total	37015	100.0	100.0	

Table 27

Age Variable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15 years old	4376	11.8	11.8	11.8
	16 years old	7136	19.3	19.3	31.1
	17 years old	10080	27.2	27.2	58.3
	18 years old	15423	41.7	41.7	100.0
	Total	37015	100.0	100.0	

Table 28

Ever Been Tested for HIV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	24293	65.6	65.8	65.8
	Yes	12652	34.2	34.2	100.0
	Total	36945	99.8	100.0	
Missing	9	63	.2		
	System	7	.0		
	Total	70	.2		
Total		37015	100.0		

Table 29

Initial Coding for Blood Test Result

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HIV negative	24657	66.6	98.0	98.0
	HIV positive	450	1.2	1.8	99.8
	Indeterminate	4	.0	.0	99.8
	Inconclusive	57	.2	.2	100.0
	Total	25168	68.0	100.0	
Missing	System	11847	32.0		
Total		37015	100.0		

Table 30

Recoded Variable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HIV positive	450	1.2	1.8	1.8
	HIV negative	24657	66.6	98.2	100.0
	Total	25107	67.8	100.0	
Missing	System	11908	32.2		
Total		37015	100.0		

Table 31

Original Marital Status Variable

	Frequency	Percent	Valid %	Cumulative %
Never in union	25077	67.7	67.7	67.7
Married	8444	22.8	22.8	90.6
Living with partner	2590	7.0	7.0	97.6
Widowed	40	.1	.1	97.7
Divorced	285	.8	.8	98.4
No longer living together/separated	579	1.6	1.6	100.0
Total	37015	100.0	100.0	

Table 32

Recoded Marital Status Variable

	Frequency	Percent	Valid %	Cumulative %
not married	28571	77.2	77.2	77.2
married	8444	22.8	22.8	100.0
Total	37015	100.0	100.0	

Evaluation of Statistical Assumptions

Before running the binary logistic regression, I ensured that the research variables and data fit the binary logistic regression and met the following assumptions: dichotomous dependent variable, independent variables that are continuous or nominal, independence of observations, large enough sample size, linearity between independent variables and logit of the dependent variable, and no multicollinearity (Laerd Statistics, 2017; Walden University Academic Skill Center, 2019b). In this section, I will provide information on how I assessed each assumption prior to running the regression analysis.

Dichotomous Dependent Variable

I confirmed that the dependent variables used both fit this assumption. The DV for RQ1 was ever tested for HIV, which is measured as 0=not tested, and 1=tested (Table 28). The DV for RQ2 was HIV prevalence, which is measured as 0=HIV negative, and 1=HIV positive (Table 30). Both DVs are dichotomous and met the assumption for the binary logistic regression.

Independent Variables are Continuous or Nominal Variables

Each independent variable included in the binary logistic regression must be nominal or continuous level of measurement. The independent variables included in both research questions include gender (nominal), age (continuous), marital status (nominal), education level (continuous), wealth index (continuous), and age of consent (nominal). This met the assumption and fit the chosen analysis.

Independence of Observations

This assumption requires that the included variables and observations are mutually exclusive and exhaustive (Laerd Statistics, 2017). Each of the included variables and all of their values are free from relationships. Those who have not been tested for HIV cannot be included in the group of previously tested for HIV. This holds true for each included IV and DV. Therefore, the assumption of independence of observations has been met.

Sample Size

There should be a reasonably large sample size for the effective use of binary logistic regression. According to Laerd Statistics, there should be between 15 to 50 respondents per IV (2017). This data set has six IVs, so the sample size should be between 90 to 300 at minimum. This data set includes 37,015 respondents and meets the assumption of sufficiently large sample size.

Linearity

RQ1. Binary logistic regression requires that all continuous level IVs are linearly related to of the logit of the DV. Linearity of the continuous variables with respect to the logit of the dependent variable (ever been tested for HIV) was assessed with the Box-Tidwell test (1962). A Bonferroni correction was applied using all eleven terms in the model resulting in statistical significance being accepted when $p < 0.00454$ (Tabachnick & Fidell, 2014). Based on this assessment, the continuous variables of age, wealth index, and total years of education were found to be linearly related to the logit of the dependent variable (Table 33). However, the continuous variable of age of consent was not linearly related to the logit of the dependent variable. Therefore, I transformed the variable into a categorical variable (Table 26).

Table 33

Box-Tidwell Procedure to Assess for Linearity to Logit of DV

	B	S.E.	Wald	df	Sig.	Exp(B)
Gender	-.639	.043	225.814	1	.000	.528
Marital status dichotomous	-.451	.068	44.460	1	.000	.637
Total number of years of education	.361	.101	12.689	1	.000	1.434
Current age	-1.674	2.634	.404	1	.525	.188
Wealth index factor score combined	.000	.000	.001	1	.976	1.000
Age of consent Continuous	1.750	.459	14.523	1	.000	5.753
Natural Log transformation of years of education by Total number of years of education	-.092	.034	7.441	1	.006	.912
Natural log Transformation of age by Current age	.508	.690	.543	1	.461	1.663
Natural Log transformation of wealth index by Wealth index factor score combined (5 decimals)	.000	.000	.003	1	.956	1.000
Age of consent Continuous by Natural log transformation of age of consent	-.513	.124	17.138	1	.000	.599
Constant	-2.300	11.676	.039	1	.844	.100

a. Variable(s) entered on step 1: Gender, Marital status dichotomous, Total number of years of education, Current age, Wealth index factor score combined (5 decimals), Age of consent Continuous, Natural Log transformation of years of education * Total number of years of education , Natural log Transformation of age * Current age , Natural Log transformation of wealth index * Wealth index factor score combined (5 decimals) , Age of consent Continuous * Natural log transformation of age of consent .

RQ2. Linearity of the continuous variables with respect to the logit of the dependent variable (HIV prevalence) was assessed with the Box-Tidwell test (1962). A Bonferroni correction was applied using all eleven terms in the model resulting in statistical significance being accepted when $p < 0.00454$ (Tabachnick & Fidell, 2014). Based on this assessment, all continuous IVs were found to be linearly related to the logit of the dependent variable (Table 34). The IV age of consent was used as a continuous level variable in RQ2.

Table 34

Box-Tidwell Procedure to Determine Linearity of Continuous IVs

	B	S.E.	Wald	df	Sig.	Exp(B)
Gender (1)	-1.017	.187	29.594	1	.000	.362
Marital status dichotomous (1)	.463	.289	2.570	1	.109	1.589
Current age	4.783	10.884	.193	1	.660	119.490
Total number of years of education	.576	.429	1.806	1	.179	1.779
Wealth index	.000	.000	.237	1	.626	1.000
Age of consent	1.002	1.619	.383	1	.536	2.725
Age of consent by natural log transformation of age of consent	-.333	.441	.572	1	.449	.717
natural log transformation of wealth index by Wealth index	.000	.000	.181	1	.670	1.000
natural log transformation of yrs of ed by Total number of years of education	-.226	.145	2.426	1	.119	.798
Natural log transformation of age by Current age	-1.197	2.851	.176	1	.675	.302
Constant	-29.939	48.209	.386	1	.535	.000

a. Variable(s) entered on step 1: Gender, Marital status dichotomous, Current age, Total number of years of education, Wealth index factor score combined (5 decimals), Age of consent Continuous, Age of consent Continuous * natural log transformation of age of consent, natural log transformation of wealth index * Wealth index factor score combined (5 decimals), natural log transformation of yrs of ed * Total number of years of education, Natural log transformation of age * Current age.

Multicollinearity

The assumption of multicollinearity tests to determine if any of the independent variables are highly correlated (Laerd Statistics, 2017). I tested for multicollinearity through linear regression with SPSS v 27. I included all the variables within the linear regression to determine there was no multicollinearity. Table 35 shows that the VIF 1.299

and the tolerance of 0.998 is below the threshold of 3; therefore, the assumption of multicollinearity has been met.

Table 35

Multicollinearity Coefficients

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	.017	.016		1.045	.296		
Gender	.016	.002	.054	7.963	.000	.897	1.115
Marital status dichotomous	-.007	.003	-.020	-2.763	.006	.770	1.299
education	.002	.001	.010	1.385	.166	.829	1.206
Current age	.003	.001	.020	3.105	.002	.974	1.026
Wealth index factor score combined	-5.032E-9	.000	-.009	-1.402	.161	.967	1.034
Age of consent Continuous	-.004	.000	-.074	-11.380	.000	.998	1.002

a. Dependent Variable: HIV prevalence

Statistical Findings

In this subsection, I include my statistical finding for each research question. This includes the exact statistics, associated probability values, confidence intervals, effect sizes, and associated statistical output.

Research Question 1

Binary logistic regression was used to determine what relationship, if any, existed between having ever been tested for HIV and age while controlling for confounders, including age of consent, marital status, education level, wealth index, and gender. I used

SPSS v 27 for this analysis and applied listwise deletion to address the missing values. This model has 81 missing cases, resulting in 36,934 valid cases included in this model (Table 36).

Table 36

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	36934	99.8
	Missing Cases	81	.2
	Total	37015	100.0
Unselected Cases		0	.0
Total		37015	100.0

a. If weight is in effect, see classification table for the total number of cases.

The data is appropriately fitted for the bivariate logistic regression. Table 37 presents the model fit data; the chi-square was 5408.945, degrees of freedom of 11, and $p < 0.001$. The full model was statistically significant ($p<0.05$) and had an increase in the overall ability to predict HIV testing history. The original prediction percentage was 65.7 based on the intercept, which increased to 70.5% based on this model. Based on this, the binary logistic regression was better able to predict HIV testing than the intercept only model. Of note, the Hosmer and Lemeshow goodness of fit test indicated a poorly fitted model (Table 38), but there has been evidence that this test may be invalid with large sample sizes (Wuensch, 2021). This sample was very large, with 37,015 respondents. Therefore, I proceeded to analyze the model results.

Table 37

Model Fit Information on HIV Testing and Covariates

	Chi-square	df	Sig.	% of correct fit
Intercept only				65.7
Model	5408.945	11	.000	70.5

Table 38

Hosmer and Lemeshow Goodness of Fit Test

Step	Chi-square	df	Sig.
1	50.374	8	.000

Table 39 explains the variance found in the model. Based on the Cox and Snell R^2, 13.6% of the variation in the HIV testing rates is explained by this model. Likewise, based on the Nagelkerke R^2, 18.8% of the variance is explained with this model (Laerd Statistics, 2017).

Table 39

Variance Based on Pseudo R-Square Cox and Snell and Nagelkerke Values

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	42064.664[a]	.136	.188

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 40 provides the coefficients of the model. All the predictor variables except richer wealth index (p = 0.548) were statistically significant. When controlling for the known confounders, being unmarried had 0.801 times lower odds of having previous HIV testing (p<0.001). Females were 2.197 times more likely to have had an HIV test (p<0.001). Respondents with more education are more likely to have been previously tested for HIV. For each unit increase in total number of years of education, the odds of having previously been tested increase by a factor of 1.141 (p < 0.001). When examining HIV testing based on age, The older respondents had higher rates of testing as well. For each unit increase in age, the odds of previous testing increase by a factor 1.304 (p < 0.001).

Finally, the respondents age of consent impacted previous HIV testing rates. When compared to respondents with an age of consent of 18 years, respondents with an age of consent of 16 years were 2.876 times more likely to have been tested (p<0.001), respondents with age of consent of 15 years were 1.451 times more like to have previous testing (p<0.001), those with an age of consent of 14 years had 0.437 times lower odds of HIV testing (p<0.001), respondents with an age of consent of 13 years had 4.916 times higher odds of having been tested (p<0.001), those with an age of consent of 12 years had 3.241 times greater odds of previous testing, and those with an age of consent of 11 years had 2.222 times greater odds of being tested (p<0.001).

Table 40

Contribution of IVs to Model

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	Upper
Age of consent 18yr			2320.331	6	.000			
Age of consent 11yr	.798	.062	167.933	1	.000	2.222	1.969	2.507
Age of consent 12yr	1.176	.044	729.630	1	.000	3.241	2.976	3.530
Age of consent 13yr	1.592	.046	1191.462	1	.000	4.916	4.491	5.381
Age of consent 14yr	-.827	.101	67.309	1	.000	.437	.359	.533
Age of consent 15yr	.372	.038	97.070	1	.000	1.451	1.347	1.562
Age of consent 16yr	1.056	.033	1039.845	1	.000	2.876	2.697	3.067
Gender (Male)	-.787	.030	690.658	1	.000	.455	.429	.483
Marital status (not married)	-.222	.032	46.694	1	.000	.801	.752	.854
Total number of years of education	.132	.004	1076.533	1	.000	1.141	1.132	1.150
Current age	.265	.012	483.002	1	.000	1.304	1.273	1.335
Wealth index factor	.000	.000	.361	1	.548	1.000	1.000	1.000
Constant	-6.067	.210	831.094	1	.000	.002		

a. Variable(s) entered on step 1: Age of consent, Gender, Marital status dichotomous, Total number of years of education, Current age, Wealth index factor score combined (5 decimals).

Based on these findings, I partially rejected the null hypothesis because there is a relationship between HIV testing and all included covariates except wealth index. I performed a binary logistic regression to determine the effects of gender, marital status, age, education, wealth index, and age of consent on the likelihood that participants had a previous HIV test. The logistic regression model was statistically significant, $\chi^2(11) = 5408.945$, $p<0.001$. The model explained 18.8% (Nagelkerke R^2) of the variance in HIV testing and correctly classified 70.5% of cases. Sensitivity was 36.6%, specificity was

88.2%, positive predictive value was 61.8% and native predictive value was 72.8%. Of the six predictor values, five were statistically significant, including age, gender, marital status, years of education, and age of consent (Table 40). Wealth index was found to have no statistically significant relationship to the DV. Being married, female, more years of education, higher age, and lower age of consent all increased the likelihood of having a previous HIV test.

Research Question 2

Binary logistic regression was used to determine what relationship, if any, existed between HIV prevalence and age, while controlling for confounders, including: age of consent, marital status, education level, wealth index, and gender. I used SPSS v 27 for this analysis and applied listwise deletion to address the missing values. This model has 9 missing cases, resulting in 25,098 valid cases included in this model (Table 41).

Table 41

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	25098	100.0
	Missing Cases	9	.0
	Total	25107	100.0
Unselected Cases		0	.0
Total		25107	100.0

a. If weight is in effect, see classification table for the total number of cases.

The data is appropriately fitted for the bivariate logistic regression. Table 42 presents the model fit data; the chi-square was 219.826, degrees of freedom of 6, and $p < 0.001$. The full model is statistically significant ($p < 0.05$) but did not have an increase in the overall ability to predict HIV testing history. The Hosmer and Lemeshow goodness of fit test indicated a poorly fitted model (Table 43), but there has been evidence that this test may be invalid with large sample sizes (Wuensch, 2021). This sample was very large, with 25,107 respondents. Therefore, I proceeded to analyze the model results.

Table 42

Model Fit Information on HIV Testing and Covariates

	Chi-square	df	Sig.	% of correct fit
Intercept only				98.2
Model	219.826	6	.000	98.2

Table 43

Hosmer and Lemeshow Goodness of Fit Test

Step	Chi-square	df	Sig.
1	17.165	8	.028

Table 44 shows the variance found in the model. Based on the Cox and Snell R^2, 0.9% of the variation in the HIV testing rates is explained by this model. Likewise, based on the Nagelkerke R^2, 5.3% of the variance is explained with this model (Laerd Statistics, 2017).

Table 44

Variance Based on Pseudo R-Square Cox and Snell and Nagelkerke Values

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	4291.223[a]	.009	.053

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Table 45 shows the results of the binary logistic regression. There was no statistically significant relationship between total number of years of education at HIV prevalence (p = 0.093) and wealth index (p = 0.044). The remaining IVs were statistically significant. Males have 0.377 times lower risk of being HIV positive versus females (p<0.001). The odds of being HIV positive was 1.435 times greater for unmarried respondents as opposed to married respondents (p=.009). For each unit increase in age, the odds of having HIV increase by a factor of 1.159 (p=.003). Finally, for each unit increase in age of consent, the odds of having HIV decreased by 0.804 (p<0.001). For each unit reduction in age of consent, the odds of having HIV increased by a factor of 1.24 (p<0.001).

Table 45

Contribution of IVs to Model

							95% C.I. for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Gender-Male	-.976	.126	59.619	1	.000	.377	.294	.483
Marital status-unmarried	.361	.137	6.899	1	.009	1.435	1.096	1.879
Current age	.148	.049	9.027	1	.003	1.159	1.053	1.277
Total number of years of education	.027	.016	2.827	1	.093	1.028	.996	1.061
Wealth index	.000	.000	4.065	1	.044	1.000	1.000	1.000
Age of consent	-.218	.019	129.621	1	.000	.804	.775	.835
Constant	-3.389	.900	14.164	1	.000	.034		

a. Variable(s) entered on step 1: Gender, Marital status dichotomous, Current age, Total number of years of education, Wealth index factor score combined (5 decimals), Age of consent Continuous.

Based on these findings, I partially rejected the null hypothesis because there is a statistically significant relationship between HIV prevalence and age, age of consent, marital status, and gender. I performed a binary logistic regression to determine the effects of gender, marital status, age, education, wealth index, and age of consent on the likelihood that participants had HIV. The logistic regression model was statistically significant, $\chi^2(6) = 219.826$, $p<0.001$. The model explained 5.3% (Nagelkerke R^2) of the variance in HIV prevalence and correctly classified 98.2% of cases. Sensitivity was 100%, specificity was 0%, positive predictive value was 98.1% and native predictive value was 0%. Of the six predictor variables, marital status, gender, age of consent, age, and wealth index were found to be statistically significant (Table 45).

Summary

Binary logistic regression was used to answer research question 1. The regression showed that there was a statistically significant relationship between previous HIV testing and age, gender, marital status, education level, and age of consent. There was no relationship between HIV testing rates and wealth index. Female gender, married respondents, higher levels of education, higher age, and lower age of consent all increase the odds of a respondent having previously been tested for HIV.

Binary logistic regression was also used to answer research question 2. The covariates total number of years of education and wealth index were not related to HIV prevalence. All other covariates were found to have statistically significant relationships to HIV prevalence. Male respondents were at significantly lower odds of having HIV. Respondents who were married had lower odds of being HIV positive. Older adolescents had a higher risk of having HIV. Finally, respondents who lived in countries with lower age of consent had higher odds of being HIV positive.

In the last chapter, I will discuss the results of these analyses, I will interpret the results into meaningful information, and I will relate these findings back to the data from the literature review. I will contextualize these findings and their meanings for public health professional practice, and I will translate these findings into potential social change implications.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

HIV remains a major burden to many populations, most notably developing countries and high-risk subgroups. The adolescent population within SSA is disproportionately affected by HIV, with over 80% of the global HIV infected adolescent population being from this region. To further contribute to this public health problem, there is a lack of participation in HIV testing by this population. Public health programs have been targeting HIV within the adolescent population, and research has been conducted to determine barriers that contribute to the lower testing rates among the SSA adolescent population. Age of consent policy has been identified as a barrier, but there has been limited research to create necessary change.

With this study, I aimed to add to the current literature and identify if current age of consent policies presented a significant barrier to this population. In this quantitative research study, I used secondary data to determine if there was a relationship between age of consent and HIV testing rates and HIV prevalence, while controlling for known covariates (age, gender, marital status, wealth index, and education level). This study was necessary to build on the previous research that named age of consent as a barrier that has hindered access to HIV testing among adolescents in SSA.

Summary of Key Findings

I used binary logistic regression to determine that age of consent was related to HIV testing rates and HIV prevalence when controlling for known factors including age, gender, marital status, education, and wealth index. The results indicated that respondents that live in countries with an age of consent set below 18 are more likely to have been previously tested for HIV. Similarly, respondents that live in a country with an age of consent below 18 have higher odds of being HIV positive.

Interpretation of the Findings

Research Question 1

Is there an association between respondents' age and having been tested for HIV among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index?

I performed binary logistic regression to answer Research Question 1. The results showed statistical significance between HIV testing rates and age of consent ($p<0.001$), gender ($p<0.001$), marital status ($p<0.001$), total number of years of education ($p<0.001$), and age ($p<0.001$). There was no statistical significance between HIV testing rates and wealth index ($p=0.548$). I used the Bonferroni Correction due to the number of covariates applied in the model, which resulted in statistical significance being accepted when $p<0.0045$. Therefore, I partially rejected the null hypothesis that there was no relationship between respondents' age and having been tested for HIV among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, educational level, and household wealth index.

I found that respondents with lower age of consent had higher rates of HIV testing when controlling for other confounders (age, gender, marital status, education level, and wealth index). The majority of respondents had an age of consent of 18 years old. When compared to testing rates of respondents with an age of consent of 18:

- Respondents with age of consent of 16 were almost three times more likely to have been tested, $p<0.001$, OR 2.876, 95% CI [2.697, 3.067]
- Respondents with age of consent of 15 were 1.5 times more likely to have been tested, $p<0.001$, OR 1.451, 95% CI [1.347, 1.562]
- Respondents with age of consent of 14 had 0.5 times lower odds of having been tested, $p<0.001$, OR 0.437, 95% CI [0.359, 0.533]
- Respondents with age of consent of 13 were five times more likely to have been tested, $p<0.001$, OR 4.916, 95% CI [4.491, 5.381]
- Respondents with age of consent of 12 were over three times more likely to have been tested, $p<0.001$, OR 3.241, 95% CI [2.976, 3.530]
- Respondents with age of consent of 11 were over two times more likely to have been tested, $p<0.001$, OR 2.222, 95% CI [1.969, 2.507]

Except for respondents who live in a country with an age of consent of 14 years, all other respondents with an age of consent less than 18 years had two to five times greater odds of having been tested.

Of note, there was only one country (Guinea) with an age of consent of 14 years. The lower prevalence of HIV testing in this country may have been an anomaly due to the current HIV situation in the country. The lower testing rates may have been due to the lower rate of HIV prevalence within Guinea (1.5%) as compared to other countries (Eswatini 27%, Lesotho 25%, and South Africa 19%; Roser & Richie., 2019). Another potential factor that has influenced HIV testing rates was the Ebola outbreak, which has impacted health care, public health, and ability to access routine care like HIV testing

(Ndawinz et al., 2015). The outbreak of 2014-2016 was a large and complex outbreak that had a bigger death and illness toll than all other Ebola outbreaks combined (World Health Organization, 2021). The lower rate of HIV infected population and the significant changes to the healthcare system and public health may have contributed to the lower testing rate in Guinea.

This research confirmed previous studies that gender, marital status, education level, and age are all related to HIV testing rates. For gender, females are more likely to have been tested, $p<0.001$, OR 0.455, 95% CI [0.429, 0.483]. For marital status, married respondents are more likely to have been tested, $p<0.001$, OR 0.801, 95% CI [0.752, 0.854]. For educational level, those with higher education are more likely to have been tested, $p<0.001$, OR 1.141, 95% CI [1.132, 1.150]. For age, the older the adolescent, the more likely they have been tested, $p<0.001$, OR 1.304, 95% CI [1.273, 1.335]. In this study, wealth index was not related to HIV testing rates.

These findings further the research by McKinnon and Vandermorris (2018). McKinnon and Vandermorris found that in 15 countries, respondents who have an age of consent below 16 years have increased rates of testing when compared to respondents who live in countries with age of consent set to 16 years or older. In this research project, I included 17 more countries and I examined respondents based on each age of consent group to determine if this relationship was still present or existed among the different age of consent groups. This research has added to the limited literature that indicates that respondents with age of consent set below 18 years of age have higher prevalence of being tested for HIV.

Research Question 2

Is there an association between respondents' age and HIV status among adolescents in 32 countries in SSA, controlling for age of consent, marital status, gender, education level, and household wealth index?

To answer Research Question 2, I performed binary logistic regression. I found that age of consent, gender, marital status, and age were related to HIV prevalence. However, there was no relationship found between HIV prevalence and total number of years of education ($p=0.093$) and wealth index ($p=0.044$). The Bonferroni correction was applied due to the use of multiple IVs, resulting in statistical significance being accepted when $p<0.00454$. Therefore, I partially rejected the null hypothesis for Research Question 2.

For Research Question 2, I found that there was an inverse relationship between HIV positivity and age of consent. The odds of being HIV positive decreased as age of consent increased. Additionally, gender, marital status, and age were related to HIV prevalence. Wealth index and education were not related. For gender, females were more likely to be HIV positive. For marital status, unmarried respondents were more likely to have HIV. The older adolescents were more likely to have HIV.

- For each year decrease in age of consent, the odds of being HIV positive increase by 1.244%, $p<0.001$, OR 0.0804, 95% CI [0.775, 0.835]
- The odds of being HIV positive decrease by 0.377% for males compared to females, $p<0.001$, OR 0.377, 95% CI [0.294, 0.483]

- Odds of being HIV positive increase by 1.5% for unmarried respondents, p=0.009, OR 1.435, 95% CI [1.096, 1.879]
- The odds of being HIV positive increase by 1.2% for each year increase in age, p=0.003, OR 1.159, 95% CI [1.053, 1.277]

There has not been any previous research about age of consent and HIV prevalence. I included this research question to potentially build on the current literature and to determine if age of consent potentially contributes to the HIV crisis among the adolescent population in SSA. The inverse relationship between age of consent and HIV prevalence could indicate that countries that have taken the initiative to reduce age of consent have done so in response the higher HIV prevalence within that country. Of the top 20 countries with the highest rates of HIV, 15 countries were included in this study, and 9 of the top 10 had age of consent set below 18 years (Table 46; Chepkomoi, 2019).

Table 46

Country Ranking by HIV Prevalence

Rank	Country	HIV	Age of consent
1	Eswatini	27.2%	16
2	Lesotho	25%	12
3	Botswana	21.9%	Not defined
4	South Africa	18.9%	12
5	Namibia	13.8%	16
6	Zimbabwe	13.5%	16
7	Zambia	12.4%	16
8	Mozambique	12.3%	11
9	Malawi	9.2%	13
10	Uganda	6.5%	12
11	Equatorial Guinea	3.2%	Not defined
12	Kenya	5.4%	15
13	Tanzania	4.7%	18
14	Central African Republic	4%	18
15	Cameroon	3.8%	18
16	Gabon	3.6%	18
17	Bahamas	3.3%	Unknown
18	Rwanda	3.1%	15
19	Democratic Republic of the Congo	3.1%	18
20	Guinea Bissau	3.1%	18

Note. Data from Chepkemoi, J. (2019). World Atlas

Interpretation of Findings in the Context of the Modified Social Ecological Model

The HIV crisis in SSA is a complicated and complex health crisis that is impacted by many layers of causative factors. For this reason, I chose to ground this research in a theory that utilizes a multidimensional strategy to address HIV comprehensively. I chose the MSEM for this study as the primary theoretical proposition is that no single level of the SEM can dictate the disease risk, but that we must also include the epidemiological stage to determine the adolescents' risk of disease (Baral et al., 2013). The IVs included in this study address several of the layers of the MSEM.

Age, gender, and education fit the individual level, marital status fits the individual and social and sexual network, wealth index fits the community level, age of consent policy fits the public policy level, and HIV prevalence fits the epidemic level. The results of this study fit the MSEM and show statistically significant relationships between age, gender, marital status, education, and the DVs. Wealth index was not significantly related to either DV of HIV testing or HIV prevalence. This study furthers the MSEM theory that no single variable or level can predict HIV outcomes, but that factors from each level must be accounted for to predict HIV testing or prevalence. Furthermore, in order to address HIV on an epidemic level, higher ranking levels including public policy must be addressed.

Limitations of the Study

There were several notable limitations to this study that should be acknowledged. This study only included the 32 countries in SSA that had HIV data available through the DHS program. Therefore, this study does not include all of the 49 countries in SSA (Fox et al., 2013). However, the majority of high prevalence countries were included in the study (Table 46). Additionally, data on age of consent policies were ascertained through electronic review only. This strategy may have missed updated documents that are only available through hard copy (Fox et al., 2013). This may not present a significant limitation as the data sets used were from 2019 and before. The updated policies from that time frame should be available electronically.

To increase the scope and generalizability of this study, I used the largest and most representative sample that was available. The results are generalizable to the endemic populations of SSA but would not be generalizable to countries that do not have a significant HIV population.

The use of secondary data presents another limitation. This relied on truthful reporting during data collection, which can be affected by recall or reporting bias (McKinnon & Vandermorris, 2018). The DHS utilizes several measures to limit untruthful reporting due to the private nature of the survey topics, including trained interviewers, private interviews, and confidentiality of the data collection (Croft et al., 2018). In order to reduce the risk of this limitation, I chose to use data from the DHS program, which is well established in its systems and processes.

Another limitation is the use of data that has been collected from 2005-2019. I chose to use the most recent data available for each country that had HIV testing data. This provided a broader range of data available for this study, but also created some potential for reliability limitations. More recent data from these countries would be desirable to reflect the most current situation, but this was not possible. This analysis is still relevant since HIV-related policies and the contributing factors are slow to change.

Recommendations

In this study, I aimed to build on the current literature surrounding how age of consent policies relate to HIV testing and HIV prevalence. There was a statistically significant relationship between age of consent policies and HIV testing rates and HIV prevalence. This research showed that there was an inverse relationship between age of consent policy and respondents HIV testing rates. This agrees with and builds upon previous research by McKinnon and Vandermorris (2018). This analysis also showed that there was an inverse relationship between age of consent and HIV positivity. To my knowledge, this has not been researched prior to this study. This study additionally showed that gender, age, marital status, and education are related to HIV testing rates and HIV prevalence. This further adds to the literature that has linked these factors to the HIV epidemic within SSA. Based on these outcomes, I recommend further research analyzing age of consent in more recent contexts, as well as potentially examining testing rates for countries that have recently reduced age of consent. This research could be used to analyze testing rates of a country with age of consent at 18 and then again at a lower age. I further recommend additional research to understand the relationship between age of consent policies and HIV positivity. This research may provide evidence of how age of consent policies affect HIV prevalence and if this relationship is due to HIV epidemic conditions or other potential factors. Further research may bring new factors to light that should be addressed in conjunction with age of consent to improve outcomes for the adolescent population in SSA.

Implications for Professional Practice and Social Change

This research has provided important data that is relevant to the HIV epidemic among adolescents in SSA. These outcomes are important to identifying the factors that could potentially reduce the epidemic. This section covers the potential implications borne from this study and how these outcomes impact social change.

Professional Practice

The findings of this study further add to the body of knowledge indicating that age of consent policies impact the adolescent’s ability to access HIV testing. Respondents from countries with an age of consent policy of 18 years have lower odds of being tested for HIV than respondents that have a lower age of consent. The literature review showed that many adolescents are not able to access HIV testing due to orphanhood, fear of parental reactions, and HIV-associated stigma. Based on this, I further recommend that policymakers, public health professionals, and national officials collaborate to address and update age of consent policies across SSA. This research has built on the limited previous research and existing recommendations to reduce HIV testing age of consent policies.

When taken in context of previous research and guidance from global organizations targeting HIV, this research has potential methodological and empirical implications. Methodological implications include improved training for HIV testing programs to ensure that all adolescents are able to access HIV testing when needed. As public health professionals gain awareness of this critical disparity, methods should begin to include advocating to provide them most ethically sound services. Empirical implications should include updated policies that better align with the needs of the adolescent population.

Positive Social Change

This research potentially provides positive social change on the societal and policy level. This study will help to shed light on the importance of access to HIV testing for this high-risk population. HIV is the leading cause of death of adolescents within this region, yet many adolescents are not able to access HIV testing (Tonen-Wolyec et al., 2019). This impacts the ability to access treatment for those who are HIV positive, significantly delaying access to necessary medications to improve health outcomes (Mark et al., 2018). By bringing these disparities to light, this research may assist public health professionals to lobby for policy change. Potential policy changes include lowering the age of consent to below age 18 to increase access to HIV testing to the highest risk populations.

Updated age of consent policies would increase adolescents' access to HIV testing (Eba & Lim, 2017; McKinnon & Vandermorris, 2018). This would also reduce delays in accessing HIV treatments and improve health outcomes for this population (Vollmer et al., 2017). Every adolescent should be able to access HIV testing, counselling, and treatment, but especially in this endemic environment where HIV is the leading cause of death. Updated and research-based policies would ensure that HIV testing is accessible to every adolescent, regardless of family situation, age, or other factors.

Conclusion

HIV in the SSA adolescent population must be a public health priority. This population remains disproportionately affected by HIV despite the global push to address this problem (Eba & Lim, 2017). Recently, age of consent has been identified as a potential barrier to accessing HIV testing among many adolescents in SSA (McKinnon & Vandermorris, 2018). In this research study, I determined that there is a significant relationship between age of consent and HIV testing as well as HIV prevalence when controlling for known covariates (age, gender, marital status, education, and wealth index). This research adds to the existing literature related to age of consent. Previous research, along with this new study, provides public health professionals with additional data that may be used to improve public health policies and ensure that HIV testing is available to all adolescents.

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Appendix A: Initial Dataset vs. Final Dataset

	Total sample	Final sample
Angola	3.5%	6.4%
Burkina Faso	4.3%	3.0%
Burundi	4.4%	1.5%
Congo Democratic Republic	4.8%	6.0%
Congo	2.2%	3.2%
Cote d’Ivoire	2.7%	3.2%
Cameroon	3.8%	3.9%
Ethiopia	5.0%	2.4%
Gabon	2.5%	4.2%
Ghana	2.4%	1.8%
Gambia	2.5%	1.5%
Guinea	2.6%	2.9%
Kenya	2.1%	1.8%
Liberia	2.3%	3.5%
Lesotho	1.7%	2.2%
Mali	2.6%	2.6%
Malawi	5.6%	6.9%
Mozambique	2.3%	3.6%
Niger	2.6%	2.3%
Namibia	2.5%	2.2%
Rwanda	3.5%	1.6%
Sierra Leone	4.0%	4.7%
Senegal	4.2%	2.8%
Sao Tome & Principe	0.9%	0.9%
Eswatini	1.6%	1.4%
Chad	4.0%	4.4%
Togo	2.4%	2.0%
Tanzania	3.4%	3.3%
Uganda	3.8%	3.6%
South Africa	2.1%	1.8%
Zambia	4.5%	5.8%
Zimbabwe	3.2%	2.3%
Total	100.0%	100.0%

Appendix B: IRB Approval

This email is to notify you that the Institutional Review Board (IRB) confirms that your doctoral capstone entitled, “Age-of-consent policies and HIV Among Adolescents in Sub-Sahara Africa,” meets Walden University’s ethical standards. Since this project will serve as a Walden doctoral capstone, the Walden IRB will oversee your capstone data analysis and results reporting. Your IRB approval number is 05-14-21-1013424, which expires when your student status ends.