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Understanding the Multidimensional Factors that Influence HIV Testing among Women in the Democratic Republic of Congo

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UNDERSTANDING THE MULTIDIMENSIONAL FACTORS
THAT INFLUENCE HIV TESTING AMONG
WOMEN IN THE DEMOCRATIC
REPUBLIC OF CONGO

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DEDICATION

This dissertation is dedicated to my three babies. Brandon, you are a wise leader, and you always know what is right. Collin, you bring joy to all and are victorious. Lyndon, you bring peace and love wherever you go. Boys, you are capable of more than your minds can fathom, and you each have unique gifts to help others. Brandon, Collin, and Lyndon, bring love where there is no love. Bring hope where there is no hope in this world. Boys, continue be a friend to the friendless and walk in kindness like you do so well. Always fight for those who cannot fight for themselves. Dream big, because you are world changers!

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REPUBLIC OF CONGO

by

DANIELLE A. WALKER, M.A., B.S.

DISSERTATION

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The University of Texas at El Paso
in Partial Fulfillment
of the Requirements
for the Degree of

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ABSTRACT

Approximately 37 million people worldwide are infected with the Human Immunodeficiency Virus (HIV), with the majority located in sub-Saharan Africa where women are more likely than men to become infected. Even though universal models such as the ‘HIV Continuum of Care’ and the ‘Bar Before the Bars’ exist that provide a context to identify barriers and tools to build the capacity for HIV testing and linkage to care, sub-Saharan Africa remains an HIV epicenter accounting for 72% of all worldwide HIV-related deaths in 2016. HIV testing rates vary significantly amongst many Central African countries; the DRC in particular has one of the lowest HIV testing rates in sub-Saharan Africa (21%) compared to neighboring countries Tanzania (67%) and Zambia (82%). However, why these testing discrepancies exist amongst countries that share tangible geographic borders is not well understood. The focus of this project was to identify which of the factors including HIV knowledge, cultural beliefs, stigma, and access to testing may directly contribute to the significantly lower HIV testing rates observed in women from the DRC. To evaluate this, a two-pronged approach was used. First, a retrospective cross-sectional explanatory study was designed using a dataset generated by the USAID Demographic and Health Survey Program containing data for 14,871 women between the ages of 18-49 who had been interviewed from 2013-2014. A series of variables addressing one of four primary areas including HIV knowledge, cultural beliefs, stigma, and access to testing were evaluated for their influence on the rate of HIV testing. Second, subjects were classified based on whether or not they had been HIV tested, then logistic regression was used to determine the capacity of the chosen variables to correctly predict a subject’s testing status. The prediction model generated using regression analysis based on the chosen variables was capable of identifying HIV-tested subjects with an accuracy of 81.8%. Women who were younger, of the poorest wealth index, those who lacked HIV knowledge, and those expressing behaviors associated with HIV-related stigma were substantially less likely to be HIV tested ($p < 0.001$). Location of residence, urban compared to rural, was the only statistically significant variable

pertaining to access to care that influenced HIV testing ($p < 0.001$). Cultural beliefs did not significantly impact HIV testing ($p = 0.751-0.965$). These gaps produced numerous limitations that prevented us from extrapolating the true impact of these factors on HIV testing in Congolese women. Future mixed method studies addressing considerations such as stigma and gender roles and conflict will be necessary to improve access to HIV testing and linkage to care for at-risk women in DRC.

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CHAPTER 1: INTRODUCTION

Overview

Human immunodeficiency virus (HIV) currently infects over 37 million people globally, with acquired immunodeficiency syndrome (AIDS) and secondary infections contributing to more than 34 million deaths since the epidemic began in the 1980s (World Health Organization [WHO], 2015; Gallo & Montagnier, 2003). Seventy percent of all individuals living with HIV/AIDS reside in Sub-Saharan Africa (SSA), which is the home of 11% of the global population (WHO, 2015; United States Census Bureau, 2015, Trading Economics, 2010). Treatment for HIV infection and AIDS remains the lowest in SSA, leading to the highest rates of HIV/AIDS-related deaths internationally (United Nations Programme on HIV/AIDS [UNAIDS], 2014). The risk of contracting HIV is substantially higher for women in most of the countries located within SSA. HIV testing rates also vary significantly throughout the region. This is particularly true in the southeast region of the Democratic Republic of the Congo (DRC) that borders the countries of Tanzania and Zambia. Strikingly, HIV testing rates vary substantially from 22.1% in the Democratic Republic of the Congo to 67.1% and 80.2% in neighboring Tanzania and Zambia, respectively (Demographic and Health Surveys [DHS], 2016).

A lack of data and exploration of factors influencing HIV testing has greatly hindered efforts to move toward development of a Continuum of Care for HIV in this region. Funding has been limited in the DRC due to conflict, and research has yet to explore the underlying cause of bordering prevalence rates that range from 1.5% to 18.2%, as observed in Figure 1 below. The need to obtain a better understanding of why these discrepancies exist and to propose methods to close the gaps is paramount. The proposed project discussed herein seeks to address what factors may influence a woman's decision to get tested for HIV in the DRC, where some of the lowest

testing rates exist. We believe that a better understanding of these factors can highlight the barriers that are experienced to improve the Continuum of Care and to propose strategies that would improve access to these services.

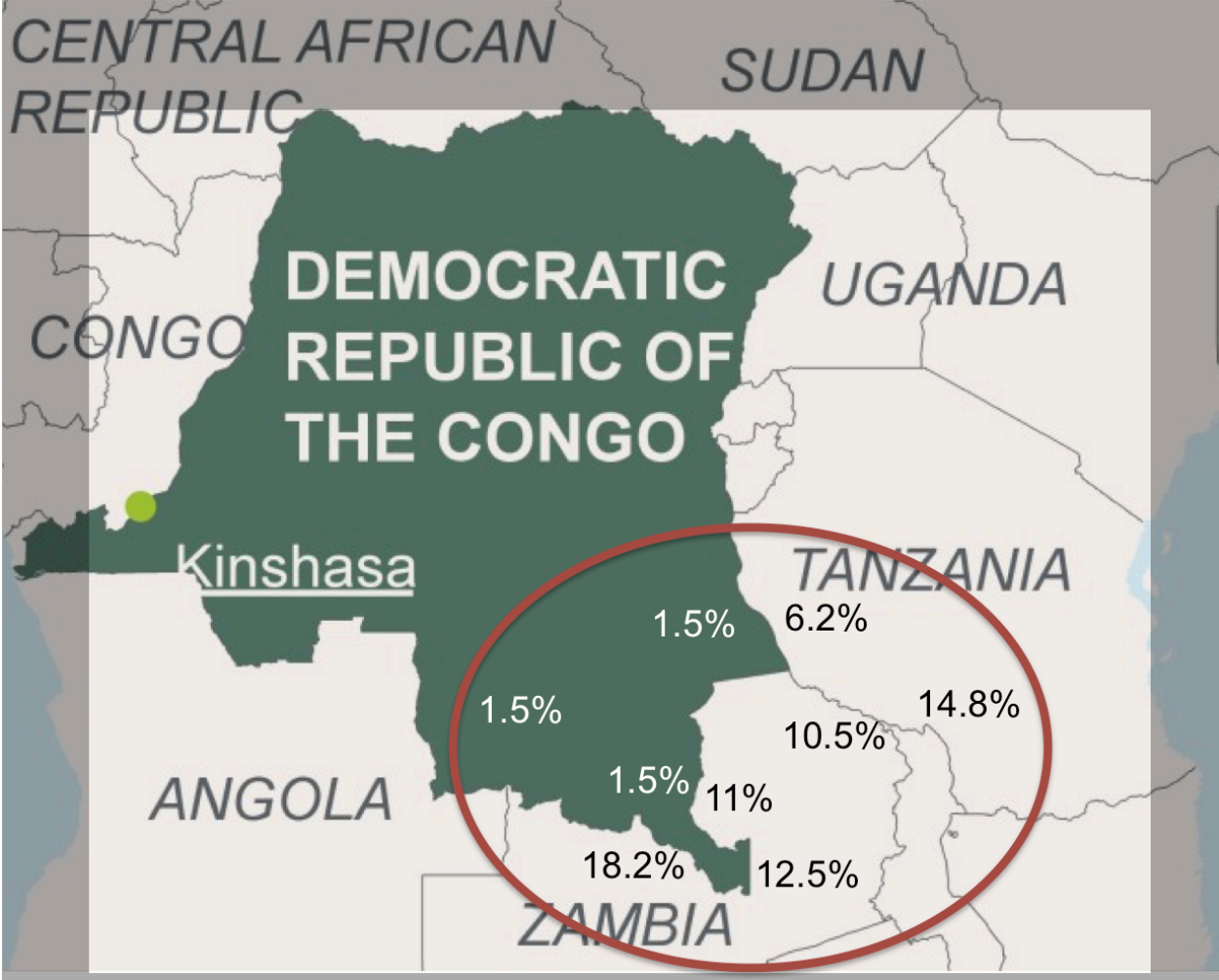


Figure 1. Regional HIV prevalence discrepancies. HIV prevalence rates are highlighted by province in the Democratic Republic of the Congo, Tanzania, and Zambia. The border region prevalence rates show extreme differences between bordering communities, ranging from 1.5% to 18.2%.

Specific Aims

The overarching goal of this study is to obtain a better understanding of the factors that influence HIV testing and treatment among women (18-49 years) in the Democratic Republic of the Congo, which has the lowest HIV testing rates in the region. To accomplish this, we will focus on three primary research aims:

1. To determine if knowledge of HIV infection and maternal health increase the odds of getting tested for HIV.
2. To examine if access to care and residence influence the odds of getting tested for HIV.
3. To explore how gender roles, cultural beliefs, and HIV-related stigma influence the odds of getting tested for HIV.

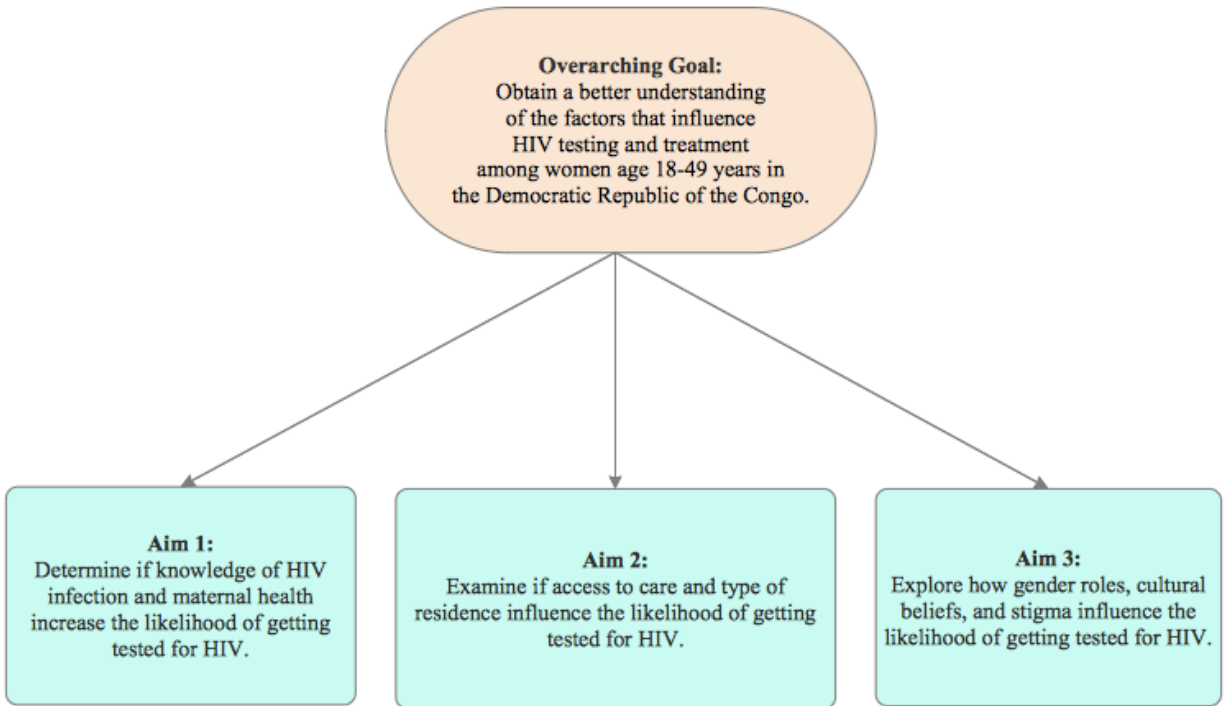


Figure 2. Research aims. Each aim focuses on a different factor that has been suggested by current literature to influence HIV testing. HIV knowledge, access to care, gender roles, cultural beliefs, and stigma were examined for association with HIV testing among women in the DRC.

Background and Significance

The DRC has suffered from a prolonged period of conflict, with experts estimating a death toll of approximately 6 million from civil war (Mukenge, 2013). This atmosphere of conflict led to fear, violence, and insecurity, placing women at the lowest status of society (Trenholm, 2016). From 1966-2001, an estimated 75% of women were victims of sexual violence linked to the conflict (Tenal, 2017). In July 2003, the DRC signed a Peace Agreement essentially ending the civil war. Since that point, the country has been through a transitional process to rebuild the government and the nation while concurrently dealing with the aftereffects of war.

Six different Ministers of Public Service were elected in the DRC between 2008-2013 (Gaynor, 2015). The high frequency of turnover caught the attention of the administration. In the midst of rebuilding the government, the need for change to specialize within the Ministry of Public Service was realized in 2012 and led to stratification into four different areas: Ministry of Health, Ministry of Education, Ministry of Development, and Ministry of Environment (Gaynor, 2015). This shift not only reduced the burden on the Minister of Public Health, but also provided a structure for the government to allow provincial leadership in each of these areas.

The promotion of peace and good governance has been a focus of Provincial leadership since the development of the Provincial Action Plan (PAP) in 2011. The PAP was specifically designed to address the needs of communities to be heard at the national level because of the lack of infrastructure at the national level (Gaynor, 2015). The predominance of the national PAP was designed to deal with issues related to peace and governance while leaving other issues such as poverty and HIV to non-government organizations (NGOs) to manage (Gaynor, 2015; Mukenge, 2013). In 2012, the United States President's Emergency Plan for AIDS Relief (PEPFAR) reported that only 22% of the DRC's legislatively authorized budget for health was released. The lack of appropriated funds left the rebuilding process with high medical operating costs, poor management and supervision, and impaired access to care because of underdeveloped roads and a lack of consistent electricity (PEPFAR, 2014).

DRC and the Global Spread of HIV. The DRC was politically controlled by Belgium from 1908-1960, and was known as the Belgian Congo (Belgian Congo, 2014). The Belgians used paternalism and forced labor to control the native Congolese population (Belgian Congo, 2014). In the early days, Belgian Congo was a land of wealth and resources as many European and American companies invested in the area during World Wars I and II. The land was rich in

resources that produced cotton, oil, and rubber, while mines were plentiful with gold, diamonds, and metals useful in providing raw materials and commerce for the war effort. The Belgians took advantage of this global interest and used forced labor to build roads, railroads, and buildings with electricity in Kinshasa in the early 1920's (Belgian Congo, 2014). Global trade began to increase at the same time HIV was first transmitted to humans, though the disease was not yet discovered (AVERT, 2017).

Researchers have identified that HIV originated in Kinshasa, DRC around the 1920's (Feria et al., 2014; Oxford University, 2014; AVERT, 2017). Earlier cases were believed to be an immunodeficiency virus that infected apes and chimpanzees (Feria et al., 2014; AVERT, 2017). HIV is a blood borne pathogen with transmission from contact with infected blood or bodily fluids carrying infected blood. Mutation from the animal to human immunodeficiency virus has been documented in at least thirteen cases from humans hunting, eating, and coming in contact with infected chimpanzee blood (AVERT, 2017). The earliest retrospective infected blood sample ever verified as HIV was from a man living in Kinshasa in 1959 (AVERT, 2017).

By 1937, HIV had spread west of Belgian Congo to Brazzaville. As trade continued to increase, the introduction of global populations into the region took place for the first time. Many Europeans and Americans migrated to Belgian Congo, and many Haitians also found work and relocated there through the 1960's. One of the key factors that contributed to the rapid spread of HIV was the development of the sex trade as migration and trade expanded (Faria et al., 2014). The Democratic Republic of Congo claimed its independence from Belgium in 1960. Most Haitians returned home once independence was declared, bringing with it the first reported case of HIV in Haiti (AVERT, 2017). The declaration of independence by the DRC led to the evolution of civil war over politics throughout the 1960's. By the 1970's, the newly appointed

leadership invited global trade back to DRC but their efforts were rejected. This caused the DRC to default on loans they had obtained from Belgium and the economy began to plummet (BBC, 2017). As soldiers and government workers went unpaid, rebel armies rallied in the 1980-90's in an attempt to take control of the government. Since the 1990's, the DRC has been engaged in internal and external conflicts that have significantly limited their ability to focus on economic growth, health care, and the spread of HIV. USAID and many other relief agencies have remained "flexible" with funding and programs due to the inherent instability of the region (USAID, 2018). In 2017 alone, estimates have suggested that 1.7 million Congolese people have fled their homes because of the ongoing violence (BBC, 2017).

Gender-Based Violence. Women in war zones often experience higher burdens to maintain the household simply for familial survival. The violence also puts them at substantially higher risk for experiencing sexual violence and rape because of militia activity and ongoing violence. Females account for just over half of the 78 million people who reside in the DRC, and nearly 75% of women were victims of sexual violence from the civil war (World Bank, 2015; Tenal, 2017). Congolese women who are victims of rape are commonly abandoned by their husbands and disowned by their families (Tenal, 2017). This relationship abandonment often happens out of fear because of three primary reasons: 1) the husband does not want to be exposed to STDs/HIV; 2) he doesn't want to have any involvement with unwanted pregnancies; and 3) he doesn't want to be associated with the stigma associated with rape (Tenal, 2017). Family members often share these same fears of association with the female victim.

Conflict and violence in the DRC have also caused a breakdown of family systems. With a national fertility rate of 6.1 births per woman, the burden of being a primary caregiver for children is high (World Bank, 2015). Women have often been left alone to survive and care for

children with no education or employment opportunities, and are left with no choice but to trade sex for food and money (Gaynor, 2015). Perpetuating this cycle, men in the DRC have reported accumulating mistresses for status. Polygamy, patriarchy, and forced female sex work has increased family conflict, mistrust, instability, and gender-based violence (Gaynor, 2015). Trenholm (2016) spent seven months in the DRC over a span of seven years to obtain a better understanding of the culture and interviewed 15 women about their roles and experiences. The common theme was that women are struggling to survive because of their low status and being overburdened. Women reported feelings of insecurity from uncertainty and instability in daily life, along with a constant lack of safety (Trenholm, Olsson, Blomqvist, & Ahlberg, 2016). Even though the war is over, the aftermath of sexual violence and patriarchy has left women in a voiceless state of survival. The DRC government and the United Nations signed a Joint Communiqué against sexual violence in 2013, but enforcement and evaluation has yet to be addressed (DRC Embassy, 2015).

HIV Policy. Psychological and serological data regarding HIV/AIDS in sub-Saharan Africa have led to the disease becoming known as a “feminized pandemic” (Mukenge, 2013). Women in sub-Saharan Africa have a higher HIV prevalence and risk compared to men due to the level of gender-specific violence that is occurring in the region (Mukenge, 2013; AVERT, 2014). No formal policy currently exists for HIV testing, treatment, or care in the DRC. The DRC National Multi-Sectorial Program for the Fight against AIDS (PNMLS) recommends voluntary testing, but there is no legislation or system of enforcement (PEPFAR, 2014; Rennie & Mupenda, 2008). Due to the lack of governmental capacity for health policy, studies have suggested collaborative NGO involvement to help improve HIV testing and reduce the burden of disease (Mukenge, 2013; Tenal, 2017). NGOs currently provide most health care services, but

more organizations are needed to scale up care, particularly for HIV testing (Mukenge, 2013). Inadequate monitoring and evaluation of HIV programs have become issues for programs that do exist. NGO collaboration and community mobilization from the ground up have been suggested as effective ways to improve HIV testing and reach rural areas (Mukenge, 2013). Mukenge (2013) also strongly suggests the need for legislative reform regarding HIV and proposes that the government address violence against women and women's rights.

HIV policy for testing and care needs to be implemented as gender-based violence is addressed. The DRC Ministry of Health has collaborated with the CDC on their Global HIV/TB Initiative. Even though HIV/AIDS is listed in the top ten causes of death in DRC, the new collaborative initiative is only focusing on the three most populated provinces: Kinshasa, Katanga, and Kasai-Oriental (CDC, 2015). PNMLS was established by the country in response to HIV/AIDS (PEPFAR, 2014). PNMLS was reported to have weak coordination, low coverage of interventions, limited data, and poor supply management systems (PEPFAR, 2014).

Study Contribution

The purpose of this study was to provide a basic foundation regarding factors that influence HIV testing for NGOs to implement aspects of the HIV Continuum of Care in the DRC. Little is known about barriers to testing and the Continuum of Care in the DRC primarily due to ongoing conflicts and the focus on maintaining peace by the DRC government. An understanding of those factors that influence HIV testing among women will provide information to guide NGOs and public health professionals in collecting future data and for the implementation of HIV/AIDS testing and care programs.

Theoretical and Conceptual Framework

This project sought to understand the multidimensional factors that can influence HIV testing among women in the DRC. The foundation for the project was grounded in improving HIV knowledge as a form of prevention to increase testing (Fisher & Fisher, 1992; Catina, Kegels, & Coates, 1990; Kalichman, 1998; Carey & Lewis, 1999; Carey & Schroder, 2002). The overarching theoretical construct of this study was centered in the HIV Continuum of Care from the Centers for Disease Control and Prevention (CDC), which provides a model of the ideal steps that should be taken to diagnose and treat a person living with HIV (National Alliance for State and Territorial AIDS Directors [NASTAD], 2015). The model includes five core pillars: HIV testing and diagnosis, linkage to care, retention in care, antiretroviral therapy, and viral suppression. Dynamics that can influence the core pillars were also addressed in the model and included but were not limited to stigma, discrimination, poverty, marginalization, and gender inequality. This project proposed to analyze the strengths and barriers to HIV testing in women of the DRC using a multidimensional approach. The goal of this project was to better understand the dynamics that influence the pillars of the Continuum based on the theoretical construct of HIV knowledge and education.

Bar before the bars. After the Continuum of Care was established as a universal model to provide a context for HIV within a target population, the National Alliance of State and Territorial AIDS Directors (NASTAD) recognized the need to identify the barriers that can influence all pillars. The organization reconstructed the Continuum of Care and added a bar before the bars to represent this recognition, which can be seen in Figure 3.

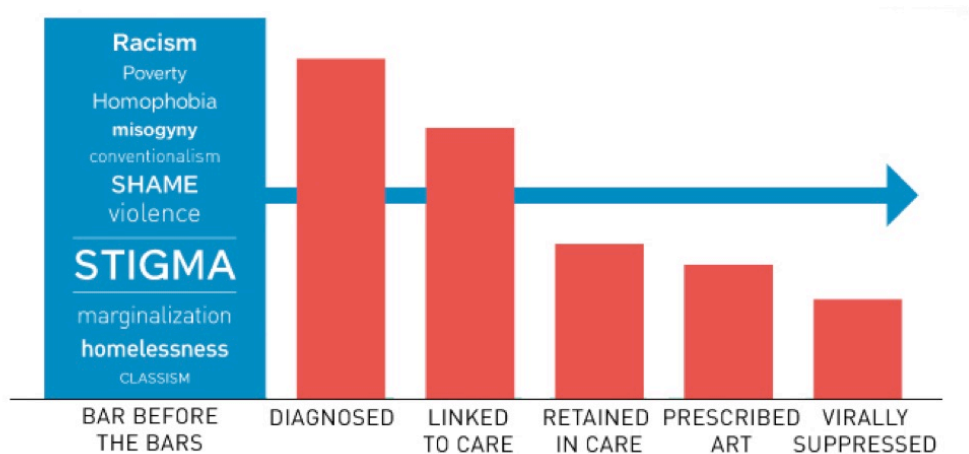


Figure 3. The Bar before the Bars. HIV Continuum of Care in red with social constructs and barriers to testing and treatment. The blue bar content can change based on the specific barriers a target population faces, but it highlights the need to identify them before the Continuum of Care is built (NASTAD, 2015).

The Bar before the Bars identifies social constructs that can be barriers to testing and care. By identifying the barriers within a target population, a foundation for the Continuum of Care can be built focusing on strategies to raise effectiveness of each aspect of bar. One of the limitations of this project is that the DRC does not currently have a Continuum of Care for HIV. However, we hope that this project will contribute knowledge that will lead to a better understanding of the multidimensional factors that influence HIV testing for the development of a Continuum of Care for the DRC in the future.

Data collection. This project has been developed based on data collected by the global Demographic Health Survey (DHS) program between 2013-2014 in the Democratic Republic of the Congo (n=18,827). Through a comprehensive literature review, seven key categories were identified that could have an influence on HIV testing amongst women: educational attainment,

poverty level, HIV knowledge, maternal factors, cultural influences, sexual risk behaviors, and access to care. Data was subset to females only, and then further filtered to include those aged 18-49 living in Democratic Republic of the Congo (n=14,871). Variables that had incomplete data were also eliminated from the analysis. Variables were selected for descriptive analysis based on the criteria that: 1) questions were answered completely, and 2) they pertained to one of the seven key categories. A descriptive analysis was then conducted on the selected variables to guide the analysis proposal.

Influential factors. Each of the variables that met the inclusion criteria and the literature justification will be listed below. In the descriptive statistics, the term “region” refers to collective data (n=39,421) meeting the inclusion criteria from DRC, Tanzania, and Zambia where drastically different HIV testing rates exist (Figure 1) to provide context for the DRC. Levels of categorical variables, recoding, and distribution of continuous variables will also be explained. See Appendix A for descriptive bar charts for each variable explained.

Educational attainment and poverty level. Studies have indicated that rates of HIV infection and socioeconomic status are negatively correlated. The level of education a person attains and their degree of poverty contributes to an individual’s risk of contracting HIV (Peters et al., 2008; Collins & Rau, 2000). According to the DHS datasets, educational attainment was categorized by the DHS datasets as having four levels: no education, primary, secondary, and higher. As a region (DRC, Tanzania, and Zambia), 90% of women surveyed possessed an incomplete secondary education or lower, while 36.6% experienced an incomplete primary education or no education. Differences were observed in the distribution of women who achieved only a primary education or no education in Democratic Republic of Congo (56.1%).

Educational attainment was a critical variable in our analysis as it pertains directly to HIV knowledge.

The degree of poverty experienced was collected and analyzed by the DHS program in the form of wealth index quintiles comprised of five levels of wealth defined by assets and cumulative living standards compared to the rest of the country and were termed: poorest, poor, middle, rich, and richest. The distribution of women surveyed was similar amongst the levels to control for socioeconomic status. Because wealth index was not determined using a standardized universal scale, interpretations were restricted to DRC only and were used to control for socioeconomic status.



Figure 4. The distribution of participants across the wealth index quintiles. Wealth index was used to control for socioeconomic status and ranged from 19.5-22.0% within each quintile.

HIV knowledge. Lack of HIV knowledge and disease misconceptions are often linked to poverty, stigma, and a higher burden of disease (Peters et al., 2008; Collins & Rau, 2000; Avert, 2014). Increased HIV knowledge and education have been shown to help reduce the spread of disease (Brewer, 2011; Kayeyi, Sandoy, & Fylkesnes, 2009; Ayiga et al., 2013; Ali, Bhatti, & Ushijima, 2004; Speizer, Tamashe, & Tegang, 2001). Studies in sub-Saharan Africa with a focus on increasing HIV knowledge and education have been limited but show the impact and importance of increasing knowledge (Brewer, 2011; Van der Borgh et al., 2010; Ayiga et al., 2013; Schirvel et al., 2009; Adeomi et al., 2014; Magnani et al., 2002; Mall et al., 2013; Scott-Sheldon et al., 2013). A better understanding of how to design and implement effective programs can be achieved by identifying the level of HIV knowledge and the misconceptions that exist in each culture (Adeomi et al., 2014; Cornish & Campbell, 2009).

Questions pertaining to HIV knowledge collected in the DHS datasets were identified and will be used as variables in statistical analysis and model building. Participants were asked the following questions: 1) Had they had ever heard of AIDS; 2) could they get HIV by sharing food with an infected person; and 3) could a healthy looking person have HIV. As a region, 17.8% of women sampled thought HIV could be transmitted by sharing food, and 16.6% did not think a person living with HIV could look healthy. In the DRC, almost eight percent of the total women originally sampled had never heard of AIDS, but after removing cases with missing data points from other questions, the eight percent was eliminated, suggesting that a knowledge gap may exist because the questionnaires were not fully completed. Out of women sampled in the DRC, 29.8% thought HIV could be transmitted by sharing food, and 27.1% thought a person living with HIV could not look healthy. All of the variables relating to HIV knowledge will be retained for the statistical analysis. Although each of the variables had initially been categorical

(yes/no/don't know), we collapsed them into the binary responses coded as 1 (yes) and 0 (no, including "don't know").

Maternal factors. Maternal-child transmission is a rare form of contracting HIV in countries with a higher socioeconomic status but remains an issue in many sub-Saharan African countries. Antiretroviral medications are available for pregnant women living with HIV and are one of the most effective ways to prevent the spread of disease. Unfortunately, when there is a lack of knowledge pertaining to disease transmission, prevention, and treatment, women are less likely to obtain the medications needed to protect themselves and their babies (UNAIDS, 2016; Schirvel et al., 2009).

The DHS program asked questions pertaining to the knowledge of maternal-child-transmission during pregnancy and through breastfeeding, and also asked women if they knew if medications were available to protect their children. Regional data showed that 30.6% of women sampled did not know HIV could be transmitted through pregnancy. In contrast, although more women (88.6%) knew it could be transmitted through breastfeeding, 31.5% did not know there was medication available to protect babies during pregnancy. Results in the DRC remained with those in the region, as 42.3% of women sampled did not know HIV could be transmitted through pregnancy. Knowledge on HIV transmission through breastfeeding was greater than transmission through pregnancy. The percentage of women unaware of HIV transmission by breastfeeding in DRC was 35.5%, along with almost 60% of women who did not know there were medications available to prevent maternal-child-transmission. All of the variables relating to maternal-child-transmission will be retained for the statistical analysis. Although each of the variables had initially been categorical (yes/no/don't know), we collapsed them into the binary responses coded as 1 (yes) and 0 (no, including "don't know").

Cultural influences and stigma. Culture is an expression of community and individuality and plays a major role in shaping personal behavior and practices. These cultural practices can directly impact not only where a person seeks out healthcare, but also the type of treatment that is obtained and through what mechanisms. Understanding community cultural influences can help researchers acquire more depth into the strengths and weaknesses that can impact health outcomes. Integrating cultural norms and practices into research can help build stronger and more sustainable programs (Carlos et al., 2015; MacIntyre et al., 2013; Hawkes et al., 2013; Maketa et al., 2013).

Research has found that individuals experiencing stigma are more than four times more likely to report poor access to health care (Sayles et al., 2009). Identifying cultural influences and HIV-related stigma is also needed to achieve program success (Ayiga et al., 2013; Avert, 2014; Mbonu, van den Borne, & De Vries, 2009). Dataset variables pertaining to cultural practices and stigma available for all three countries included asking if: 1) a subject would want HIV diagnosis in the family to remain secret; 2) female teachers with HIV should be allowed to teach when not sick; 3) children should be taught about condoms; 4) HIV can be contracted through witchcraft; and 5) they would buy vegetables from a vendor living with HIV. In the region, 64.2% of women sampled would want HIV in the family to remain a secret. In the DRC, almost three out of every four women (72.2%) would want HIV in the family to remain a secret. Regionally, almost 25% did not think a teacher with HIV should teach, over 24% thought HIV could be contracted through witchcraft, and 34.1% would not buy vegetables from a vendor living with HIV. All other variables in this category were much higher in DRC compared to the region. More than half (51.2%) of women surveyed in DRC did not think a female teacher with HIV should be allowed to teach. Close to 53% of women did not think children should be taught

about condoms. When asked if HIV could be contracted by witchcraft, over 42.6% of women in DRC answered yes/don't know, and over half (55.5%) of the women would not buy vegetables from a vendor with HIV.

All of the variables relating to cultural influence and stigma will be retained for the statistical analysis, except for the question pertaining to teaching children about condoms. The description of the term "children" was not defined in the DHS manual, so it is unclear whether the question relates to teaching high school, middle school, elementary school or younger aged children about condoms. The age a child begins primary education differs between countries, so lacking clear definition for that term allows for excess variability in responses and could be measuring different constructs depending on how each participant interpreted the meaning. Although each of the variables had initially been categorical (yes/no/don't know), we collapsed them into the binary responses coded as 1 (yes) and 0 (no, including "don't know").

Sexual risk behaviors and gender roles. A number of behaviors can place a person at greater risk for contracting HIV including but not limited to having multiple partners, not using condoms, men who have sex with men (MSM), injection drug users, partners of injection drug users, victims of sexual violence, victims of gender inequality and female sex workers (FSW) (UNAIDS, 2014, WHO, 2011). Due to the sensitive nature of these questions and the potential legal ramifications in some African countries, many of these questions were not asked in the DHS datasets. Four questions relating to sexual risk were asked, including: 1) whether a wife is justified to ask her husband to use a condom when infected with a sexually transmitted infection (STI); 2) the total lifetime number of sexual partners; and 3) can the respondent refuse sex or ask her partner to use a condom.

In the DRC, 30.4% of women who answered did not think a wife was justified in asking her husband to use a condom when infected with an STI. The average lifetime number of partners was 3.1 (SD=10.07) in DRC, with just over 34% of respondents saying they could not refuse sex. A high percentage of women stated they could not ask their partner to use a condom in DRC (63.2%). When asked if a husband was justified in beating his wife if she refused sex, almost half (48.4%) answered yes.

Importantly, close to half of the women in the original sample (n=11,895) did not respond to these questions, clearly demonstrating that issues surrounding sexual risk behavior and gender inequality should be further explored. Unfortunately, power analyses indicated that the sample size for these questions was too small to include these questions in the overall analysis without leading to inconclusive results. Two variables had sufficient responses to meet the inclusion criteria for the analysis. Survey questions asking if ‘a wife is justified in asking a husband with an STI to use a condom’, and if ‘a husband is justified in beating his wife if she refuses sex’ will be retained. Although the survey was confidential and anonymous, approximately 1 of 2 women did not feel comfortable answering these questions indicating that this is a key issue that should be explored by future research.

Access to care. Access to health care in sub-Saharan Africa is dependent upon a number of factors including residence location (urban versus rural), cost, availability of clinics and qualified medical personnel, knowledge of clinical services, and mode of transport to the clinics. The DHS dataset addressed this topic using only one variable by asking if a person ‘knew where to get tested for HIV’. Knowledge regarding whether testing locations are available and where they are located is crucial to understanding HIV testing rates in the DRC. If testing is available and individuals are actively choosing not to be tested, then the barriers preventing them from

getting tested need to be identified. Urban areas tend to have more hospitals and facilities that provide testing. In the dataset, 62.3% of participants indicated that they resided in rural rather than urban locations. Compared to 15.1% in the region who did not know a place to get an HIV test, an alarming 48.2% of Congolese women did not know where to get tested for HIV. These two variables will be retained and recoding is not needed as they are already in the binary form (urban/rural, y/n).

HIV Testing. Knowing where to get an HIV test is an important factor in maintaining the Continuum of Care, but the primary outcome variable of this analysis is whether or not the subjects obtained an HIV test. After quality control of the total sample set (n=18,827) and the elimination of missing data, the final total sample size was n=14,871. Data was then stratified into those not being tested (78.4%; no=11,655) and those receiving an HIV test (21.6%; yes=3,216). Selected descriptive statistics have been highlighted below in Figure 5, with each color representing a sub-category of data identified within the literature that could influence HIV testing amongst women.

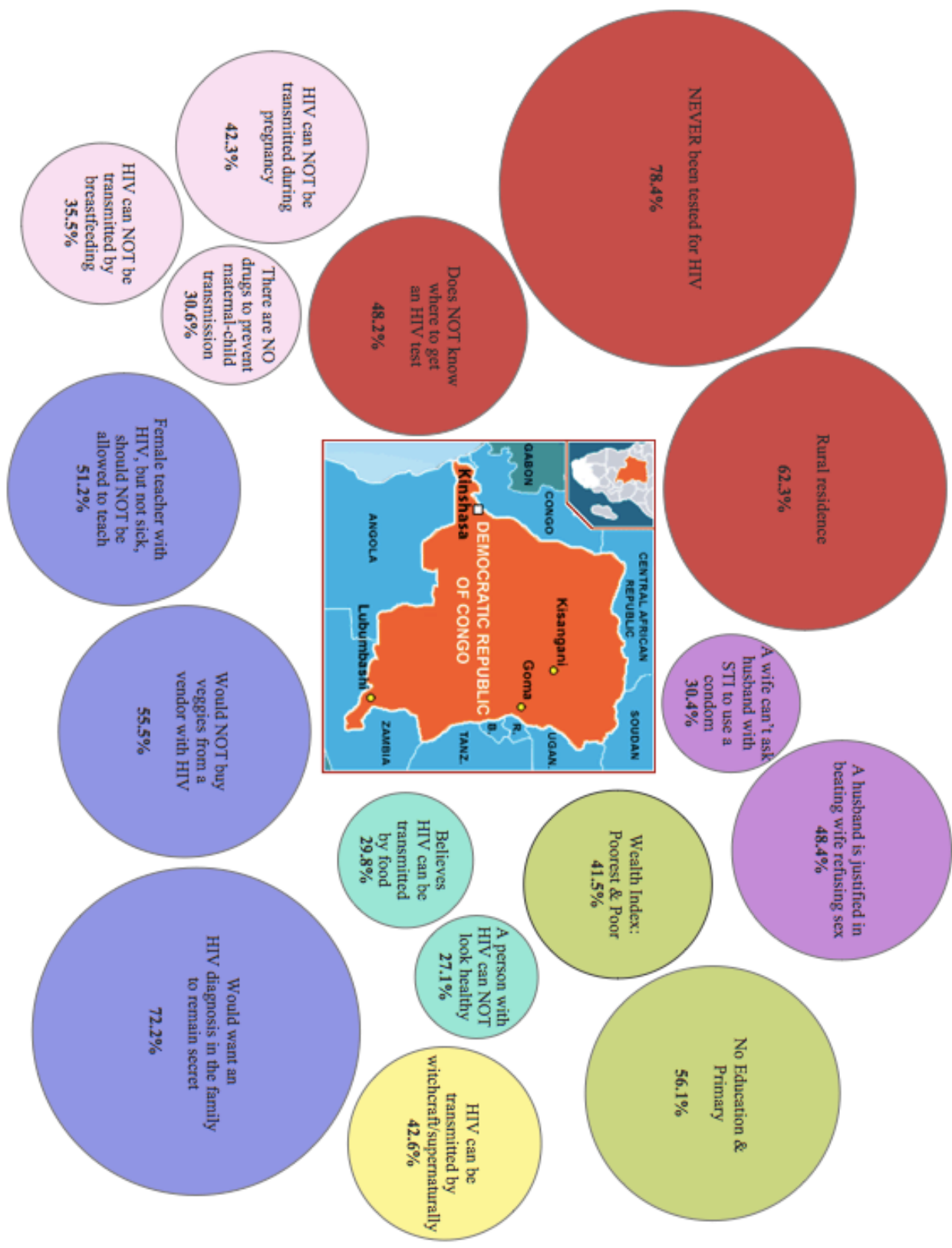


Figure 5. Key variables that may influence HIV testing in Congolese women. Variable circles are framed to reflect the response with the corresponding percentage, with the assumption that the opposing response accounts for the remaining percentage up to one hundred (N=14,871 women). Each color represents a different category identified in current literature including access to HIV testing (red), gender roles (purple), socioeconomic status (green), cultural beliefs (yellow), HIV knowledge (aqua), stigma (blue), and maternal HIV knowledge (pink).

Following univariate analysis of each variable, a bivariate analysis was completed for each independent variable in relation to the outcome variable. A correlation matrix was evaluated for collinearity amongst the variables and a logistic regression model was built to identify factors contributing to HIV testing among Congolese women. The dataset analyzed for this study was extant data extracted from a larger dataset collected by the USAID for the global DHS program. Extant data, particularly with large sample sizes, can be very useful in studies where little research has been done and to obtain a better understanding of how a disease impacts a community. Although a logistic regression model was utilized for this study, we must emphasize that the results obtained herein are limited in scope and cannot imply cause since we did not design the data collection or have the ability to control external factors as the collection took place. Interpretation of the analysis must consider the source of the data, identify statistical significance, and incorporate how the findings can inspire and direct further research. Other limitations of this study include a lack of information on access to care, TB data, and other comorbidities. The variable of access to care was limited to one question, whether or not a person knows where to get an HIV test or not. Future studies will include questions pertaining to the distance to clinics, cost of care, and other barriers that influence access to care need to be

analyzed. TB is a known comorbidity with HIV, and the point of contact for a TB diagnosis can be an opportunity for an HIV test. Questions around risk behaviors, TB, and other sensitive topics are not asked in countries where they are not culturally appropriate to discuss. As such, we were not able to address the impact of TB on HIV testing in this study, but may be able to address this issue in future work.

CHAPTER 2: REVIEW OF LITERATURE

Over 37 million people globally have been infected by HIV (WHO, 2015). Sub-Saharan Africa alone accounted for more than 65% of new infections diagnosed in 2015 (UNAIDS, 2016). When considering the demographics of HIV infected individuals, women are more likely to become infected with HIV than men, with females accounting for almost 60% of the disease distribution throughout SSA. In particular, young women aged 15-24 years old residing in SSA are twice as likely than young men of equal age to be living with HIV/AIDS (UNAIDS, 2014). Although multiple factors play a role in the spread of HIV, gender-based violence that primarily affects women has contributed to the disproportionate spread of HIV in females throughout SSA, including sexual abuse and rape (UNAIDS, 2014). In addition, educational deficiencies, inadequate access to health care, and a lack of social protection also contribute (UNAIDS, 2014).

According to reports by UNAIDS (2014), fifteen countries account for 75% of the global burden of HIV/AIDS worldwide. Tanzania and Zambia, two of the countries included on this list with HIV rates of 5.3% and 13.3%, respectively, are located within the heart of sub-Saharan Africa and share a border on the southeastern edge of the Democratic Republic of Congo. Having an HIV prevalence ranging from 0.7-1.1%, the DRC has a reported HIV rate similar to many countries with excellent access to care, prevention, and treatment programs, such as the United States. Little to no data exists explaining how three countries can exist so closely to one another geographically and have fluid travel throughout the region, yet have HIV rates that so drastically differ from each other (See Figure 1). A literature review was performed to better understand sociocultural factors and access to HIV education and testing in the DRC.

The literature review provided a greater level of insight to potential factors influencing HIV testing amongst women. Lack of HIV knowledge, fear of discrimination, and stigma were

found to be potential barriers to testing. Access to care, cultural practices and beliefs suggest the need for culturally competent models for HIV testing and care.

Democratic Republic of the Congo

The DRC is located in the core of sub-Saharan Africa and consistently scores toward the bottom of Human Development Index scale (ranking 186 out of 187 countries in 2014), an indicator of socioeconomic development and potential (United Nations Development Programme [UNDP], 2014). Of the 79 million individuals residing in the DRC, more than 77% live below the international poverty line (\$1.9 PPP or less a day) with only 46% having adequate access to basic health care services (UNAIDS, 2014; UNDP, 2014; World Bank, 2012; International Federation of Red Cross and Red Crescent Societies, 2011). An average individual in the DRC has an education level of 3.1 years, suggesting that educational facilities are not a likely source for HIV education within these communities (UNDP, 2014). Although Congolese women are at a higher risk for contracting the disease than men because they are more likely to be victims of sexual crimes, estimates indicate that only 12.3% are knowledgeable of HIV transmission and prevention (United Nations International Children's Emergency Fund [UNICEF], 2013; AVERT, 2014; USAID, 2008). The DRC is among the top 30 countries with the lowest antiretroviral therapy (ART) coverage, as less than 25% of people living with HIV/AIDS (PLWHA) have access to ART. These data demonstrate the need for both effective education programs to prevent HIV transmission and improved access to treatment (UNIADS, 2014).

Studies by Brewer (2011) and others have shown that the incidence of HIV infection can be reduced through activities that heighten awareness, improve communication and reduce stigma about the disease (Kayeyi, 2009; Van der Borgh et al., 2010). We sought to learn what types of community- and home-based HIV education programs have been implemented in the DRC and

surrounding countries to mitigate the risk of new infections and to detect and treat those already infected (Brewer, 2011; WHO, 2014). Furthermore, recommendations for improving HIV education through culturally competent models within the rural community and through local health care providers and community leaders in the DRC were proposed.

Methods. The focus of this section was to evaluate HIV education programs employed in rural communities within sub-Saharan Africa, particularly the DRC. The literature review was completed between September and October of 2015, and updated January 2018, using comprehensive searches conducted in multiple databases including the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Academic Search Complete and the U.S. National Library of Medicine through the National Institutes of Health (Medline/PubMed). Because of the limited quantity of published manuscripts regarding HIV education programs in this region of Africa, no date limitations were set for the starting period. The terms of interest, specific key words and combinations used in each of the databases are summarized in table 1.

Table 1. Keyword search conducted in identified search engines.

Terms Required	Democratic of the Congo	Republic	Human Immunodeficiency Virus	Education
Key words and combinations	"Democratic" OR "Central" "Africa" AND	AND AND AND	"HIV" AND	"Education" OR "Program"
Location	Text		Text	Text

Search criteria revealed a total of 174 peer-reviewed articles, of which 28 were duplicates identified in multiple search engines. Of the 146 remaining articles, those containing information specific to HIV prevention programs, community education, HIV pre-test counseling and adult populations in the respective regions identified were included for further review. Those articles containing information and/or terms relating to HIV management, ART for HIV prevention, articles pertaining specifically to children and those not available in English were excluded from review. Supplemental data sources for financial and demographic data were also obtained from a review of articles satisfying the search criteria on the inclusion list, including data from the World Health Organization, United Nations Programme on HIV/AIDS, UNDP, Department for International Development, Global Fund, and the International Federation of the Red Cross and

Red Crescent Societies. A total of 36 articles and data sources were identified that met criteria for inclusion in the review.

Results. A total of 22 studies were synthesized and categorized by topic for this review. The authors and main points extrapolated from each of the studies are explained in Table 2.

Table 2. Key Points of Article Review Search Results

Misconceptions and Barriers to HIV Education, Care and Management	
Peters et al., 2008	Poverty and access to healthcare in developing countries.
Collins & Rau, 2000	Poverty and HIV link.
AVERTing HIV and AIDS, 2014	Education and approaches to reduce stigma related to HIV on a global scale.
Ayiga, Namboozee, Nalugo, Kaye, & Katamba, 2013	Stigma reduces HIV testing/services. As education increases, stigma is reduced.
Carlos et al., 2015	Misconceptions: lack of knowledge, what HIV looks like, incorrect ways to contract the disease.
Maketa et al., 2013	Lack of trust in health care workers, lack of information, negative rumors are all causes for not getting health care services.
Misconceptions, Cultural Beliefs, and Lack of HIV Knowledge	
Carlos et al., 2015	Misconceptions: lack of knowledge, what HIV looks like, incorrect ways to contract the disease.
AVERTing HIV and AIDS, 2014	Education and approaches to reduce stigma related to HIV on a global scale.
Hawkes et al., 2013	Religious beliefs in the DRC impacting HIV. Cross-sectional study, 97% Christian and 7.4% tested positive. Higher rates among Catholic Christian subcategory, and decreased condom use with higher church attendance rates.
UNICEF, 2013	DRC gender inequality and women having higher rates of HIV.
Van der Borghet et al., 2010	VCT; "Uptake of HIV testing can be actively influenced by educational or promotional activities."
Dimbuene, 2014	Relationship between parents' and adolescents' knowledge of HIV/AIDS transmission routes and prevention. Gender, communication, education gaps.
Mechanisms to Improve HIV Education, Diagnosis and Treatment	
Ayiga, Namboozee, Nalugo, Kaye, & Katamba, 2013	Stigma reduces HIV testing/services. As education increases, stigma is reduced.
AVERTing HIV and AIDS, 2014	Education and approaches to reduce stigma related to HIV on a global scale
MacIntyre et al., 2013	Keys to understanding communities and building trust between NGOs and African communities to reduce rates of HIV/AIDS
Schirvel et al., 2009	2 midwives provided community HIV education. Increased testing, return for care, and partner testing. Greatest impact seen in partner testing increase from 1% to 21%. HIV education can increase HIV testing.
Maketa et al., 2013	Lack of trust in health care workers, lack of information, negative rumors are all causes for not getting health care services.
Kayeyi, Sandoy, & Fylkesnes, 2009	"HIV prevalence decreased substantially by increasing level of neighbourhood education."
Van der Borghet et al., 2010	VCT; "Uptake of HIV testing can be actively influenced by educational or promotional activities."
Brewer, 2011	"These findings suggest that knowledge of blood-borne HIV risk protects against HIV infection and that public education campaigns are important for spreading that knowledge."
Improving HIV education and Testing while Reducing Stigma through Community and Clinical Programs	
Vanden-Driessche, Sabue, Dufour, Behets, & Van Rie, 2009	Health care provider education around HIV correlated with HIV testing: Important issues regarding HIV epidemiology and PEP remained poorly understood post-training. Mean post-training scores of clinic's HCWs were significantly correlated with the centre's HIV testing acceptance rates.
Mbonu, van den Borne, & De Vries, 2009	Stigma hindering HIV testing.
Vaz et al., 2011	Health care provider roles and support to help parents with HIV disclose and educate their children
Parker et al., 2013a	Implementing a US-based prevention program in a low-resource community (DRC).

Misconceptions and barriers to HIV education, care, and management. A positive HIV diagnosis can negatively impact a multitude of personal and public aspects of an individual's life even under the best of circumstances. When substantial barriers to HIV education, care and management exist, the impact can be even more devastating. Disease misconceptions and barriers to HIV care are often linked to poverty and stigma (Peters et al., 2008; Collins & Rau, 2000; AVERT, 2014). The level of poverty a person experiences can determine whether the individual has sufficient financial support to travel to a local clinic, cover the costs of care and continue treatment (Peters et al., 2008; Collins & Rau, 2000). Psychosocial aspects such as isolation, discrimination, and fear also play critical roles in HIV education, care and management and can serve as barriers to care. This section explores some common misconceptions and barriers to HIV transmission currently experienced in sub-Saharan Africa.

The effect of HIV education on individuals' perceptions of HIV infection. HIV education is known to help prevent the spread of HIV (Brewer, 2011; Kayeyi, Sandoy, & Fylkesnes, 2009; Ayiga et al., 2013). Individuals in rural African regions are confronted with a number of socioeconomic factors that influence their decisions to be tested and obtain treatment for HIV (Peters et al., 2008; Collins & Rau, 2000; AVERT, 2014; Ayiga et al., 2013; Maketa et al., 2013). These issues may include access to appropriate health care, the cost of obtaining testing and treatment, and stigma and fear surrounding the disease that often stems from ignorance about HIV (Ayiga et al., 2013; Maketa et al., 2013; Hawkes et al., 2013; Parker et al., 2013). Individuals are less likely to be tested and learn their HIV status in regions where there is a lack of HIV education and stigma is high regarding the disease (AVERT, 2014; Ayiga et al., 2013; Schrivel et al., 2009). Throughout sub-Saharan Africa, culturally-sensitive education and treatment programs designed to disseminate and implement widespread HIV education and

screening are limited, allowing the perpetuation of fear, secrecy and stigma regarding HIV (Brewer, 2011; Van der Borgh et al., 2010; Ayiga et al., 2013; Schrivel et al., 2009). Perceptions toward HIV infection in rural community environments and cultural belief systems may also directly impact self-efficacy leading to stigma. Education programs seeking to improve awareness and understanding regarding the disease, and the mechanisms by which individuals can protect themselves and others, can reduce the degree of stigma that exists within communities (Brewer, 2011; Van der Borgh et al., 2010; Ayiga et al., 2013; Schrivel et al., 2009). Knowledge of the effects and impact of HIV is often the first step toward empowering an individual to get testing and treatment to mitigate the odds of transmitting the infection to others. Those with a positive disease diagnosis who are linked to a care team can be advised how they can protect others from contracting the disease and about the efficacy of ART to reduce viral load which further reduces the risk of transmission. HIV education can also assist PLWHA with more effectively managing the disease (Cohen et al., 2011; Vanden et al., 2009).

Stigma and fear in HIV testing and treatment. Stigma and fear of discrimination may directly influence a person's decision to seek health care for HIV testing and treatment (AVERT, 2014). In rural communities where the levels of HIV education are low, stigma is increased (AVERT, 2014; Ayiga et al., 2013). A person experiencing a higher degree of stigma is less likely to be tested for HIV. General educational levels are positively correlated to rates of HIV testing and negatively correlated to the degree of stigma experienced by individuals (Ayiga et al., 2013). Lack of trust in health care workers and discrimination linked to stigma have been suggested as common fears among individuals, and that can contribute to reduced success of testing and treatment programs (Maketa et al., 2013).

Cultural beliefs and lack of HIV knowledge. Cultural beliefs and religious views can cause misconceptions about HIV (AVERT, 2014; Carlos et al., 2015). Carlos, et al. (2015) observed that among individuals studied in the DRC, a lack of HIV knowledge led to misconceptions about the physiologic presentation of HIV infection and modes of transmission. Further studies in the DRC conducted by Hawkes, et al. (2013) identified that 97% of the participants who were tested for HIV identified themselves as Christians. Of those, approximately 44% identified themselves as Catholic, with the remaining classifying themselves as non-Catholic Christian (Hawkes et al., 2013). These Christian groups reported an increased frequency of church attendance and reduced rates of condom use, consistent with religious guidelines dissuading individuals from utilizing artificial methods of birth control (Hawkes et al., 2013). HIV was detected in approximately 8% of Christians within these two groups, with Catholics more likely than non-Catholic Christians to test positive, indicating that religious practices can have a direct impact on HIV disease transmission and risk management (Hawkes et al., 2013).

Educational attainment and family roles in HIV education. Family and community are highly valued in many African cultures and the roles of men and women remain well-delineated in daily life (UNICEF, 2013; AVERT, 2014). In sub-Saharan Africa, HIV incidence and prevalence are statistically higher in women than in men primarily due to gender inequality, sexual crimes and domestic violence (UNICEF, 2013; AVERT, 2014; USAID, 2008). Educational levels were found to be significantly lower in Congolese women residing in rural communities, with only 12.3% demonstrating knowledge regarding HIV transmission and prevention (UNICEF, 2013). Dimbuene (2015) states that the level of communication regarding HIV transmission between adults and children in this region remains low; however, if such

communication could be improved, particularly with children of sexual age, the risk of HIV transmission would likely decrease. Thus, educating women regarding HIV could empower families to reduce the incidence of new HIV infections.

The financial burden of HIV testing and treatment. Although many international HIV programs exist through governmental and private agencies such as CDC, NIH, WHO, UNAIDS and others to provide both financial and professional support to combat the spread of HIV in sub-Saharan Africa, significant complications remain regarding how to effectively screen large numbers of at-risk individuals. These often include a lack of clinical laboratory resources, an inadequate quantity of testing instruments and reagents and insufficient numbers of qualified personnel for testing and counseling of PLWHA, particularly in rural regions (Vanden et al., 2009). Also, as the incidence of HIV is reduced in other regions of Africa, the number of dollars committed by these programs to combat HIV spread likewise decreases (Global Fund, 2015).

The financial burden of HIV testing and medical care can be exceptionally prohibitive to individuals residing in rural sub-Saharan Africa where the average annual incomes are extremely low. Severe poverty can also contribute to low levels of self-efficacy and access to transportation for services, making efforts to educate individuals about HIV transmission more difficult (Peters et al., 2008; Collins & Rau, 2000; Dimbuene, 2015). Many government health agencies throughout Africa have medication programs that provide PLWHA with antiretroviral medication at little to no cost following the initial diagnosis, but the financial burden of obtaining the diagnosis and treatment is often borne by the individual and can have a significant impact on decisions to get tested and follow through with treatment (AVERT, 2014; Maketa et al., 2013; Global Fund, 2015; U.S. Department of State, 2015). This financial burden can also directly impact families and communities because of the need for screening additional family members

residing with the infected individual. These effects are compounded if the HIV-positive individual is a primary source of financial support for the family or within the community.

Mechanisms to improve HIV education, diagnosis and treatment. Regardless of socioeconomic status or poverty level, improving HIV knowledge through education will enable communities to promote the use of appropriate methods to prevent the spread of HIV and to decrease stigma regarding the disease (AVERT, 2014; Ayiga et al., 2013). We explored how HIV education and community engagement can facilitate reductions in HIV incidence and prevalence in rural areas of sub-Saharan Africa.

Facilitating of community trust and enhancing HIV education. Before HIV-targeted education programs can be successfully implemented, an environment of trust and security must be established by service groups that often can be facilitated through community and religious leaders. To accomplish this, cultural respect and community identity must be demonstrated, so that the common goals existing among organizations and communities can be clearly identified and promoted once trust is established (MacIntyre et al., 2013). Because many African communities remain male-dominated, organizations having key leaders who were male initiate conversations regarding HIV education programs and facilitating trust-building were found to be more effective than those led by females (MacIntyre et al., 2013). Interestingly, the efficacy of HIV education and the degree of trust were higher in communities where females were trained to disseminate HIV information (MacIntyre et al., 2013). This was reinforced in a study by Schirvel et al. (2009) demonstrating that positive correlations existed between improved HIV education from sessions held by community midwives to discuss HIV, improved rates of testing and the frequency of return appointments. Most importantly, these educational programs led to a statistically significant increase in male partner testing from 1% to 21% in these Congolese

communities, demonstrating that this is an effective model to reduce HIV transmission (Schirvel et al., 2009).

HIV education with community and government involvement to reduce HIV rates. Community educational programs and campaigns are important ways to spread knowledge, particularly in increasing knowledge of HIV (Brewer, 2011). To better understand HIV perceptions regarding the quality of health care services and community-oriented interventions, eight focus groups were established in 2013 within the DRC. The focus groups expressed concern about the level of knowledge regarding HIV management at the community and government levels, indicating that key community leaders needed to be more involved and engaged in the health information being distributed to community members (Maketa et al., 2013). This was mirrored by other findings confirming that as HIV education levels and programs amongst communities rose, testing and knowledge increased, culminating in a decrease in HIV incidence and prevalence (Kayeyi Sandoy, & Fylkesnes, 2009; Van der Borghet et al., 2010).

Healthcare approaches to HIV testing and education. Community-based HIV education programs are an effective way to improve HIV knowledge, promote disease prevention and reduce the risk of disease transmission. Health care provider education and training about HIV were positively correlated with HIV testing acceptance in clinics in the DRC (Vanden et al., 2009). By adding the support of hospitals and clinics involved in HIV testing and treatment, efforts toward disease management and prevention could be strengthened using a comprehensive and supportive approach on both an individual and community level. The roles of health care providers in clinical settings can provide support for patients through educating, testing and providing encouragement when disclosing their status (Vaz et al., 2011). The use of train-the-

trainer models could help empower clinic employees to provide more effective education to patients to increase prevention efforts and HIV testing (Vaz et al., 2011).

Another resource health care providers could utilize is a framework developed by the CDC to implement successful HIV programs in resource-limited rural communities. Parker et al. (2013) explored an effective design to translate HIV educational material for resource-limited regions. The framework established five key steps for health care workers, including community assessment, selection of specific resources, then preparation, piloting and implementing the program (Parker et al., 2013). Utilizing these steps, providers were able to assess what was culturally important to the population, to determine the level of HIV education in the patient population and how to choose and implement appropriate curricula from those available to achieve the maximum benefit.

Reducing stigma through community and clinical programs to improve HIV education and testing. The goal of improving HIV education within a community is to reduce fear and stigma so as to increase HIV screening and disease management. Stigma hinders HIV testing and education by placing a burden of emotional shame onto individuals based on religious and sexual beliefs that can lead to isolation, secrecy and denial (Mbonu, van den Borne, & De Vries, 2009). Discovering ways to recognize the types and root causes of stigma can assist in reducing or eliminating barriers to HIV testing and treatment in sub-populations where stigma exists, such as women living in communities infiltrated with gender inequality or men who have sex with men.

Discrimination, which is often present with stigma, has been associated with HIV testing and diagnosis. Discrimination experienced from family and/or community members, religious organizations, or even one's place of employment can hinder HIV education and testing within a community (Maketa et al., 2013; Mbonu, van den Borne, & De Vries, 2009). Functional

assessment of current community practices, in addition to identifying the degrees of stigma and discrimination that exist within a community, can help clarify a path for improvement of HIV education to reduce levels of stigma and to improve HIV screening and management programs (Kayeyi Sandoy, & Fylkesnes, 2009; Van der Borgh et al., 2010; Vaz et al., 2011). Improvement of HIV educational programs requires identification and critical evaluation of existing HIV testing and/or outreach programs, evaluation of screening criteria and requirements, and mapping out the linkage to and retention in medical care, such as models outlined in Figure 20 (AVERT, 2014; Van der Borgh et al., 2010).

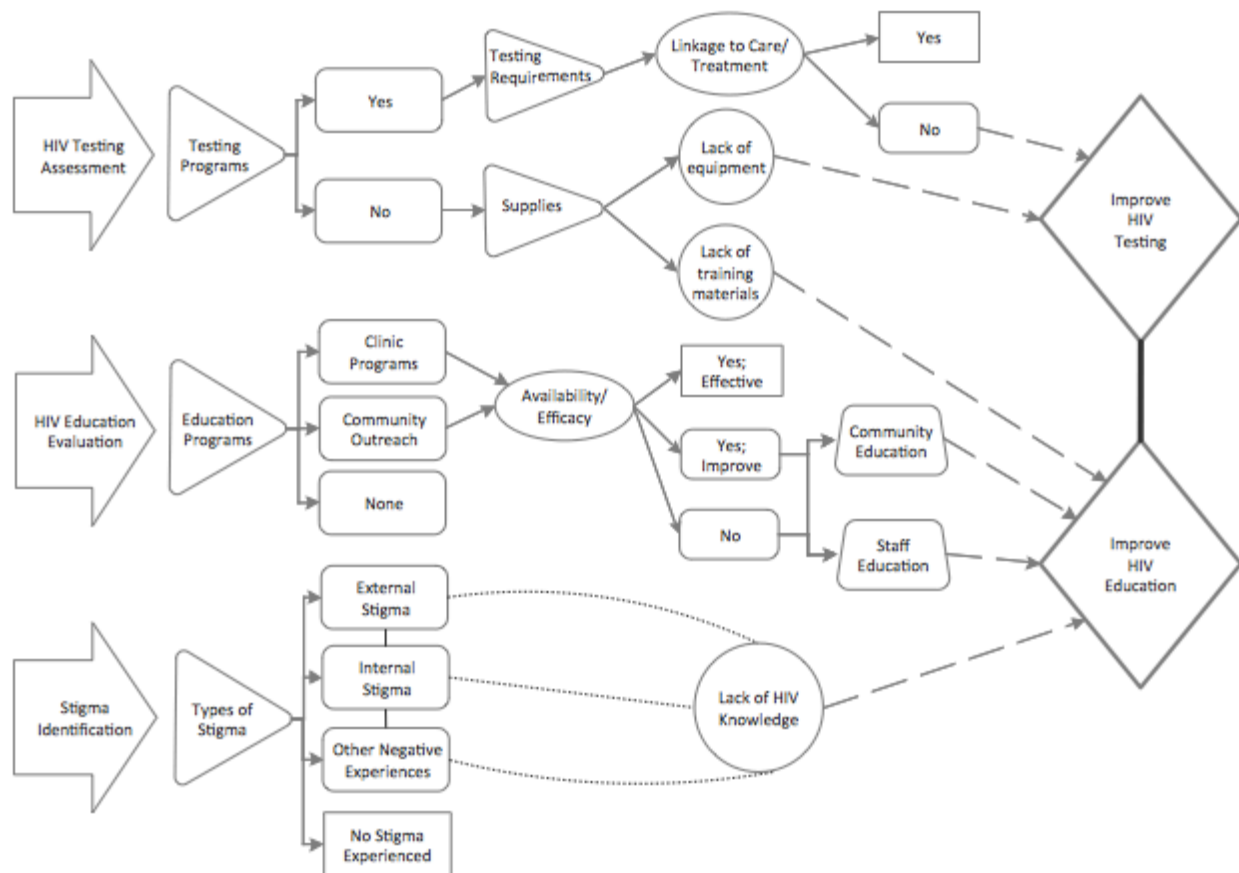


Figure 6. HIV Community Evaluation: Improving HIV education and testing through community and clinical programs, along with stigma reduction. Although the interrelationships that exist between HIV testing, education, and stigma are complex, models

such as this one can be used with needs assessments to determine efficacy of community-based HIV programs for reducing HIV incidence and prevalence.

Needs assessments can further identify gaps in service for present programs and identify pathways toward implementation of services where none currently exist. Two specific areas that can be targeted for potential improvement are ongoing training sessions for staff delivering the educational programs and activity-driven community-based programs. Models such as “Train-the-Trainer” that promote exponential spread of information within communities can be adopted on multiple levels to improve teaching strategies and educational attainment among participants (AVERT, 2014; Van der Borgh et al., 2010; Vanden et al., 2009; Vaz et al., 2011).

Conclusion. Reductions of new HIV infections have been observed in more affluent regions throughout the world; however, the gap continues to widen in poverty-stricken regions. The DRC has poor health care options and suffer from high death rates. Socioeconomic factors and lack of access to adequate health care and treatment contribute significantly to the incidence and prevalence of Human Immunodeficiency Virus (HIV) in these regions. There is a demonstrative need for programs facilitating community and individual HIV education, prevention and treatment in an effort to reduce stigma and reduce the spread of HIV. One of the hardest hit nations in sub-Saharan Africa is the DRC, whose critically low socioeconomic status and education rate have led to drastically high HIV rates. Other factors such as lack of trust in the health care workers and stigma-related discrimination also contribute to the upsurge in HIV incidence.

Through this review, we have sought means to identify possible alternatives for modulation and/or reduction of HIV incidence and prevalence in DRC. Data are clear that

increasing knowledge regarding HIV testing and treatment decreases misconceptions about the disease and improves disease outcomes (Brewer, 2011; Kayeyi Sandoy, & Fylkesnes, 2009; Van der Borgh et al., 2010). Based on studies done evaluating programs to combat HIV infection in regions with similar socioeconomic status to DRC, we propose that programs designed to heighten individual and community awareness and that improve overall communication about the disease and reduce stigma may be effective in improving the continuum of care in this region. Because of the role of family and tribal affiliations in rural African communities, cultural considerations are vital when creating and implementing HIV education and infection management programs. Partnerships encouraging active program participation and support from community-based spiritual leaders to implement HIV educational programs are also a key mechanism to reach communities and individuals. Empowerment and education of families about the importance of HIV testing and care could be an impactful way to engage community support. These efforts would be further strengthened with the added support of hospitals and clinics in rural areas to facilitate access to HIV testing and care for positive patients. Health care providers in clinical settings need to provide a network of continued support and education for HIV-positive patients not only when disclosing a patient's status, but throughout the course of treatment. Models such as "train-the-trainer" can be an effective tool for educating rural communities about HIV education because of the cultural sensitivity and familiarity participants have with those providing the information.

Educational programs and community engagement that facilitate understanding of the role of individuals and community in reducing HIV incidence and prevalence can strongly impact an individual's decision to become educated about HIV, be screened and, if positive,

obtain treatment. HIV education can empower individuals and communities while providing assistance in protecting themselves and others.

CHAPTER 3: METHODS

Inconsistent HIV testing rates along the border of DRC and neighboring countries led us question what factors influence HIV testing among women in the DRC. Current literature analysis regarding HIV in the DRC highlighted seven variable categories for analysis including HIV knowledge, access to care, socioeconomic status, maternal health, gender roles, cultural beliefs and stigma. HIV testing has been specified as the dependent variable for this analysis.

Participants

All participants in this study were from the DRC and took part in the surveys from the Demographic Health and Survey Program in 2013-2014. The USAID successfully collected data from 18,827 women (age 15-49) and 8,656 men (age 15-59) from 2013-2014, making the raw data available for research purposes in 2015. The comprehensive survey consisted of hundreds of questions pertaining to health with hundreds of subcategories for most questions, creating the possibility of having over 4,000 variables within a complete country dataset. Data collection was performed anonymously and had no key identifiers. Each USAID interviewer underwent extensive training to insure consistency in survey data collection and accuracy. Informed consent was obtained from each participant, which was documented by the USAID interviewer. This study was also approved by the UTEP College of Health Sciences Institutional Review Board.

Sampling Procedures

Random selection. The DHS Program started sampling subjects using a random selection of households within each province of the DRC. The total sample set used for this study was reduced from 27,483 men and women to 16,451 women aged 18-49. After quality

control of the data to include complete survey data for each DRC subject only, 14,871 women meeting the criteria were retained for analysis.

Power and sample size. Analysis of power and sample size was used to confirm that the sample population was sufficient for the logistic regression analysis based on the number of variables selected. G*Power software (Heinrich-Heine-Universität Düsseldorf) was used to calculate sample size with a power of 0.95 for regression modeling. G*Power analysis indicated that a minimum sample size of 10,868 participants was required based on the number of variables being selected from the dataset (Field, 2013). Therefore, we concluded that a sample size of 14,871 women was sufficient for analysis of the 22 variables selected for analysis, of which 12 were retained in the final model. Table 3 outlines the factors influencing HIV testing identified in the literature, the corresponding variables identified in the dataset, the analysis steps taken, and whether variables were retained or rejected in each portion of the analysis.

A goodness-of-fit test and a covariance matrix were used to determine whether the logistic regression model was acceptable to explain the relationship between variables with the outcome and whether each of the variables were measuring independent factors (Field, 2013; Cohen 1988). The goodness-of-fit test was determined using statistical significance (Field, 2013) and a covariance matrix with a value of 0.90 as a cutoff to eliminate coliniarity among variables (Cohen, 1988).

Instrumentation

USAID conducts over 300 surveys in more than 90 different countries. The health, population, HIV, and nutrition data is used for monitoring the efficacy of programs and secondary analysis. Comprehensive surveys have been collected by USAID from 1986 to the present. The most recent survey for the DRC was collected in 2013-2014 and was used for this

analysis. Each interviewer for the DHS program goes through extensive training to ensure accuracy and consistency of data collection and confidentiality. Surveys are given in the native language of the participant. The length of the interview along with the individuals present in the room at the time of the interview are documented. Two members of the same sex were required to be present for each interview with the subject.

Psychometric evaluations were conducted as part of the DHS survey program and by other researchers. Reliability coefficients were established based on surveys from other sub-Saharan African countries including Kenya, Namibia, and Senegal and ranged from 0.71-0.90 (Wang, Do, Hembling, & Ametepi, 2014). The DHS program strives to have high reliability and evidence of validity with Cronbach's alpha used for internal reliability among sample countries in sub-Saharan Africa (0.58-0.90) and high percentages of valid retest results (MacQuarrie, Winter, & Kishor, 2013; USAID, 2012; USAID, 2014). More recent studies used median agreement (83.26%) and a median kappa statistic (0.79) when assessing reliability of the survey (Chakraborty, Fry, Behl, & Longfield, 2016). That same study also evaluated evidence for validity and regarded the Demographic and Health Survey the “gold standard” compared to similar survey tools with data collection for wealth, equity, malaria, and HIV/AIDS (Chakraborty, Fry, Behl, & Longfield, 2016).

Data Collection

Data collection within this study was informed by current literature on HIV in sub-Saharan Africa and facilitated the identification of the overlapping variables available in the extant dataset. Seven categories were highlighted in the literature. A total of 21 independent variables from the DHS dataset were originally identified within the literature-based categories. Table 3 explains the progression of categories, variables identified, and each step of the analysis

that determined if variables remained as influencing factors or were removed. Eleven of the 21 variables were retained for final analysis using logistic regression analysis.

Table 3. Progression of identifying variables to retain within the statistical model based on current literature and available survey data from the DHS program.

Factors influencing HIV testing based on literature	DHS dataset variables aligning with factors from literature	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Reason for rejection	Variable retained in final model
Outcome Variable	Ever tested for HIV	A; retain	n/a	n/a	n/a	n/a	n/a	n/a	Retained as outcome
SES: Age, education level and poverty level	Age	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained
	Ed level	A; retain	retain	retain	retain	retain	Retain	n/a	Final retained
	Wealth index	A; retain	retain	retain	retain	retain	Retain	n/a	Final retained
HIV knowledge	Heard of HIV	A; retain	reject	n/a	n/a	n/a	n/a	Variable lost 'no' answers when missing cases were deleted	n/a
	HIV transmit by food	A; retain	retain	retain	retain	retain	Retain	n/a	Final retained
	HIV can look healthy	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained
Maternal health	Meds available to prevent maternal-child-trans.	B; retain	reject	n/a	n/a	n/a	n/a	Sample size; not enough women answered after data filter	n/a

	HIV transmit by breast-feeding	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained
	HIV transmit by pregnancy	B; retain	reject	n/a	n/a	n/a	n/a	Not a stat sig. factor	n/a
	Would keep HIV diagnosis a secret	B; retain	retain	retain	retain	reject	n/a	Not a stat sig. factor	n/a
	Female teacher with HIV should teach	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained
Culture and stigma	Children taught about condoms	B; reject	n/a	n/a	n/a	n/a	n/a	Un-defined def of children among countries	n/a
	HIV transmit by supernatural means	B; retain	reject	n/a	n/a	n/a	n/a	Not a stat sig. factor	n/a
	Would buy veggies from vendor with HIV	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained
Gender roles and sexual risk	Wife justified asking husband with STI to use condom	B; retain	retain	retain	retain	retain	Retain	n/a	Final retained

	Beating wife justified when refused sex	B; retain	retain	retain	retain	reject	n/a	Not stat sig.	n/a
	Lifetime number of sexual partners	A; reject	n/a	n/a	n/a	n/a	n/a	Sample size; not enough women	n/a
	Can refuse sex	B; reject	n/a	n/a	n/a	n/a	n/a	Sample size; not enough women	n/a
	Can ask partner to use condom	B; reject	n/a	n/a	n/a	n/a	n/a	Sample size; not enough women	n/a
Access to care	Know where to get HIV test	B; retain	retain	retain	retain	reject	n/a	Not a stat sig. factor	n/a
	Type of res.	B; retain	retain	retain	retain	retain	Retain n	n/a	Final retained

Note: In Step 1, A = continuous variable and B = categorical variable.

Step 1: Descriptive statistics (continuous/categorical; retain/reject)

Step 2: Data filtered and missing cases deleted (retain/reject)

Step 3: Bivariate analysis (statistically significant retain/reject)

Step 4: Covariance matrix (retain/reject covariance)

Step 5: Logistic regression model 1 (retain/reject)

Step 6: Logistic regression model adjusted 2 (retain/reject)

Procedures for analysis

After identifying the variables from the DHS dataset that met inclusion criteria of the literature categories, a univariate analysis was completed to understand the characteristics and distribution of the available data. This analysis provided the necessary information to choose further discrimination of the variables and their influence on HIV testing among women in the

DRC. Figure 21 illustrates the process utilized to identify the appropriate analysis needed for model building based on the univariate analysis of each of the variables described below.

Outcome. The dependent variable assessed in this study was a binary variable ‘Have been tested for HIV’, which was answered as yes or no.

Independent variables. The original 21 variables determined that the two or more independent variable selection would be chosen. Out of 21 variables, two were continuous and 19 had multiple levels making them categorical. The combination of continuous and categorical variables led to the answer “both”. The outcome variable placed participants in two different groups by either answering “yes” to being tested or “no,” indicating the presence of different groups for comparison. Thus leading to the determination that logistic regression would be the most appropriate statistical test to analyze the data.

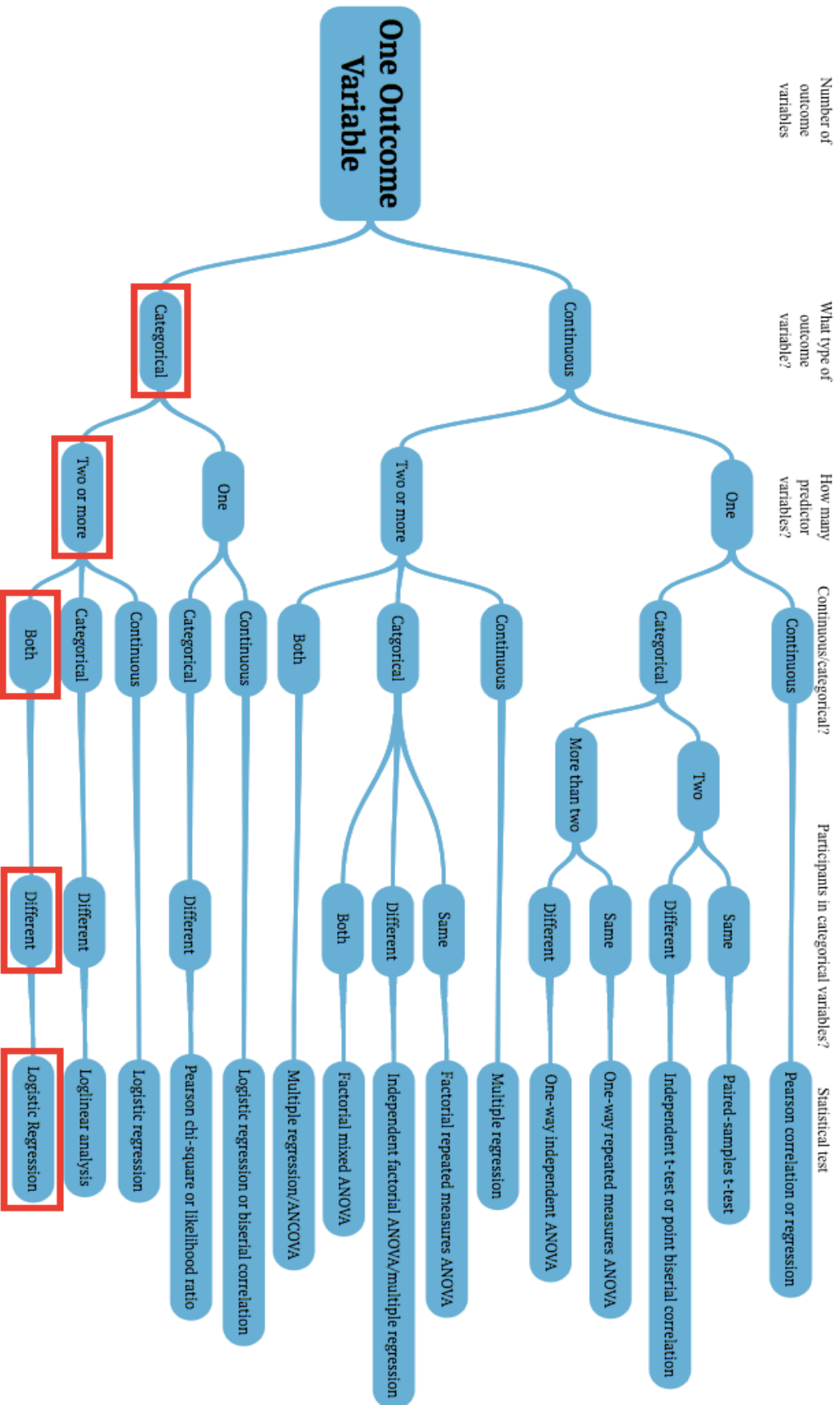


Figure 7. Steps to identify the appropriate statistical analysis for one outcome. The outcome variable of HIV testing is categorical (y/n). The independent variables selected for analysis include continuous and categorical. Participants in the given categorical variables are in different groups and not compared to their own group. These responses led to logistic regression being the appropriate statistical test to use to explore the relationship between the outcome and independent variables.

Description of final variables and distribution. Variable characteristics are important to identify appropriate statistical tests, but understanding the distribution is necessary to determine which test is appropriate to compare each independent variable to the outcome variable. The statistical bar charts for each descriptive variable can be found in Appendix A.

Outcome. This binary categorical variable was originally coded with only two levels, asking if participants had ever been tested for HIV (y/n). Over 78% of participants answered no to this question and had never been tested for HIV (N=14,871). The comparison groups of “yes” and “no” do not need to be equal as in most statistical tests because SPSS logistic regression analysis has a built-in technique that automatically weighs the differences appropriately and equal proportions are not needed to achieve accuracy. This outcome variable will remain unchanged for the statistical analysis.

Continuous. Age was the only continuous independent variable retained for the logistic regression model. The dataset was filtered to include only women age 18-49, and was the limiting range of this variable. The mean age of the population subset was 30.1 years of age with a standard deviation of 8.736 years (N=14,871), which was not normally distributed.

Categorical. The majority of the independent variables retained for the regression model were categorical. The type of residence, which was originally reported as a binary variable (urban/rural), remained coded as such. Out of the 14,871 women surveyed, 62.3% live in rural areas in contrast to urban areas.

Seven of the variables retained for the final regression analysis were categorical and contained three levels (y/n/don't know). Variables containing one of those three responses were recoded to binary variables representing "don't know" with the incorrect answer to the question asked (y/n+dk or n/y+dk). Pertaining to HIV knowledge, participants were asked if HIV could be transmitted by sharing food (y/n/dk). Because HIV cannot be transmitted by sharing food, the answer "yes" and "don't know" were grouped together as being incorrect (n/y+dk). Almost 30% of participants thought HIV could be transmitted by food or were not sure (N=14,871). Participants were also asked if a person living with HIV can physically look healthy (y/n/dk). Since a person diagnosed with HIV can look healthy, the responses of "no" and "don't know" were considered incorrect and were recoded together. Responses indicated that 27.1% of participants do not think a person with HIV can appear healthy (N=14,871).

Only one question regarding maternal health was retained which pertained to whether subjects believed if HIV could be transmitted by breastfeeding. Because HIV can be transmitted by breastfeeding, "no" and "don't know" were considered incorrect and recoded as a binary response. More than one third of participants (35.3%) did not know HIV could be transmitted by breastfeeding (N=14,871).

Participants were asked questions regarding stigma and treatment of people with HIV. One of the retained variables asked participants if a female teacher with HIV (healthy) should be allowed to continue teaching. Answers were coded as either "yes", a teacher who is healthy but

living with HIV should be allowed to teach at a school, or “no” and “don’t know” that were combined and recoded for a binary response. One in two women surveyed did not think a female teacher should be allowed to teach if she has HIV (51.2%) even if she is healthy (N=14,871). Another question that addressed stigma and attitudes toward people with HIV asked participants whether they would buy vegetables from a market vendor who had HIV. Answers of “yes” or “no” and “don’t know” were recoded and combined. More than half of the women surveyed for this question (55.5%) would not buy vegetables from a vendor with an HIV diagnosis (N=14,871).

Two variables relating to gender roles and violence had enough responses to remain within the statistical model. Most questions that inquired about sexual partners, abuse, and risk behaviors were left unanswered by more than half of those surveyed. When asked if a wife is justified in asking her husband to wear a condom if he has an STI, 30.4% of women answered “no” or “don’t know” (N=14,871). When asked if a husband is justified in beating his wife if she refuses sex, almost half of women surveyed (48.8%) agreed or did not know (N=14,871).

Two categorical variables retained for final logistical regression analysis had four or more levels, requiring dummy variables to be created for each level. The level of poverty experienced by subjects was collected and analyzed by the DHS program in the form of wealth index quintiles, and was comprised of five levels of wealth defined by assets and cumulative living standards compared to the rest of the country. They were termed: poorest, poorer, middle, richer, and richest. The levels of wealth index were fairly similar amongst each quintile, ranging from 18.2-22%. The lowest percentage occurred within the rich category and the poorest accounted for the highest percentage (N=14,871). The other categorical variable that contained multiple levels was educational attainment. The levels ranged from no education (17.5%),

primary (38.6%), secondary (40.2%), and higher than secondary (3.7%) (N=14,871). This distribution suggests that the majority of women sampled had some form of education, but very few had a higher level and more than 1 in 6 women had no form of education at all.

Table 4. Variable descriptive statistics.

	Variable responses	Total (N=14,871) Mean (SD) or %
Age (range 18-49 years old)	18-49	30.10 (8.74)
Congolese	Congolese	100.0
Gender	Female	100.0
Residence	Rural	62.3
	Urban	37.7
Educational level	No education	17.5
	Primary	38.6
	Secondary	40.2
	Higher	3.7
Wealth index	Poorest	22.0
	Poor	19.5
	Middle	19.5
	Rich	18.2
	Richest	20.8
HIV transmission by food	Yes/DK	29.8
	No	70.2

Person with HIV can look healthy	No/DK	27.1
	Yes	72.9
HIV transmission by breastfeeding	No/DK	35.5
	Yes	64.5
HIV transmission by pregnancy	No/DK	42.3
	Yes	57.7
Would keep HIV diagnosis a secret	Yes/DK	72.2
	No	27.8
Female teacher with HIV should teach	No/DK	51.2
	Yes	48.8
HIV contracted through supernatural means	Yes/DK	42.6
	No	57.4
Would buy vegetables from vendor with HIV	No/DK	55.5
	Yes	44.5
Wife justified asking husband with STI to use condom	No/DK	30.4
	Yes	69.6
Beating wife justified when refused sex	Yes/DK	48.4
	No	51.6

Response key: DK=don't know

Research design

This study used a Retrospective Cross-Sectional Explanatory design that examined the influence of factors on HIV testing for women in the DRC using data collected by the

Demographic Health and Survey Program through USAID. The design was based on a regression analysis model using one outcome variable (HIV test vs. no HIV test) with simultaneous analysis of contributing variables.

The first set of analyses was designed to examine the relationship of each factor to the outcome of HIV testing. Appropriate bivariate statistical tests were used based on the distribution of each factor individually. A covariance matrix was used to eliminate colinearity among variables, followed by a Goodness-of-Fit test for the statistical model. Logistic regression in SPSS was used to assess the relationship of the variables to the outcome. The model was further adjusted based on statistical significance of the factors.

CHAPTER 4: RESULTS

Binary analysis was completed leading to a logistic regression model to analyze the factors influencing HIV testing after exploring variables identified within the DHS datasets that aligned with current literature.

Variables of interest

Outcome variable. The primary binary outcome variable was HIV testing (y/n).

Independent variables. Each independent variable matching a category from the literature is listed below. The table explains the category, variable, distribution, and the appropriate bivariate test based on variable characteristics and the binary outcome.

Table 5. Variable description, distribution, and bivariate test.

Factors influencing HIV testing based on literature	Independent variables from DHS dataset that match factors identified in the literature	Categorical/ Continuous	Levels/ Distribution	Bivariate Test with Binary Outcome
Socioeconomic status: Educational attainment and poverty level	Age	Continuous	Not normal	Mann-Whitney U-Test
	Educational level	Categorical	4	Pearson Chi-Square
	Wealth index	Categorical	5	Pearson Chi-Square
HIV knowledge	Heard of HIV	Categorical	2	Pearson Chi-Square
	HIV transmission by food	Categorical	2	Pearson Chi-Square
	HIV can look health	Categorical	2	Pearson Chi-Square
Maternal health	Medication available to prevent maternal-child-transmission	Categorical	2	Pearson Chi-Square
	HIV transmission by breastfeeding	Categorical	2	Pearson Chi-Square

	HIV transmission by pregnancy	Categorical	2	Pearson Chi-Square
Culture and stigma	Would keep HIV diagnosis a secret	Categorical	2	Pearson Chi-Square
	Female teacher with HIV should teach	Categorical	2	Pearson Chi-Square
	Children taught about condoms	Categorical	2	Pearson Chi-Square
	HIV contracted through supernatural means	Categorical	2	Pearson Chi-Square
	Would buy vegetables from vendor with HIV	Categorical	2	Pearson Chi-Square
Gender roles and sexual risk	Wife justified asking husband with STI to use condom	Categorical	2	Pearson Chi-Square
	Beating wife justified when refused sex	Categorical	2	Pearson Chi-Square
	Lifetime number of sexual partners	Continuous	Not normal	Mann-Whitney U-Test
	Can refuse sex	Categorical	2	Pearson Chi-Square
	Can ask partner to use condom	Categorical	2	Pearson Chi-Square
Access to care	Know where to get HIV test	Categorical	2	Pearson Chi-Square
	Type of residence	Categorical	2	Pearson Chi-Square

Sample characteristics

Only females age 18-49 years of Congolese descent were used within the study design. Table 6 below describes the sample demographic characteristics, the descriptive statistics for those variables meeting the inclusion criteria to complete a bivariate analysis, and the bivariate analysis descriptions by group with overall statistical significance.

Table 6. Demographic characteristics and variables by group.

	Total (N=14,871) Mean (SD) or %	Group 1: HIV Test (no) (N=11,655) Mean (SD) or %	Group 2: HIV Test (yes) (N=3,216) Mean (SD) or %	Bivariate Analysis (p value)
Age (range 18-49 years old)	30.10 (8.74)	30.02 (8.93)	30.38 (7.99)	<0.001*
Congolese	100.0	100.0	100.0	-
Gender Female	100.0	100.0	100.0	-
Residence				
Rural	62.3	71.8	28.0	<0.001*
Urban	37.7	28.2	72.0	
Educational level				
No education	17.5	20.0	8.5	<0.001*
Primary	38.6	43.0	22.4	
Secondary	40.2	35.3	57.8	
Higher	3.7	1.6	11.3	
Wealth index				
Poorest	22.0	26.2	6.6	<0.001*
Poor	19.5	22.8	7.8	
Middle	19.5	22.1	10.1	
Rich	18.2	17.3	21.5	
Richest	20.8	11.6	54.0	
HIV transmission by food				
Yes/DK	29.8	33.8	15.4	<0.001*
No	70.2	66.2	84.6	
Person with HIV can look health				
No/DK	27.1	31.6	10.8	<0.001*
Yes	72.9	68.4	89.2	
HIV transmission by breastfeeding				
No/DK	35.5	37.5	28.2	<0.001*
Yes	64.5	62.5	71.8	

HIV transmission by pregnancy				
No/DK	42.3	42.7	41.0	0.079
Yes	57.7	57.3	59.0	
Would keep HIV diagnosis a secret				
Yes/DK	72.2	70.1	79.9	<0.001*
No	27.8	29.9	20.1	
Female teacher with HIV should teach				
No/DK	51.2	55.5	35.7	<0.001*
Yes	48.8	44.5	64.3	
HIV contracted through supernatural means				
Yes/DK	42.6	42.9	41.4	0.136
No	57.4	57.1	58.6	
Would buy vegetables from vendor with HIV				
No/DK	55.5	61.3	34.5	<0.001*
Yes	44.5	38.7	65.5	
Wife justified asking husband with STI to use condom				
No/DK	30.4	33.7	18.4	<0.001*
Yes	69.6	66.3	81.6	
Beating wife justified when refused sex				
Yes/DK	48.4	52.1	38.0	<0.001*
No	51.6	48.8	62.0	

***p value** statistical significance indicated ($p \leq 0.05$)

Response key: DK=don't know

Bivariate Analysis

Variables retained after data cleaning and univariate analysis were individually compared to the primary outcome, followed by logistic regression analysis to identify which variables demonstrated significant influences on HIV testing in Congolese women between 18-45 years of

age.

Continuous. Age was the only continuous independent variable retained for the logistic regression model. Because this continuous variable was not normally distributed, the appropriate bivariate test was the Mann-Whitney U Test. The bivariate analysis showed a mean age of 30.02 (SD=8.93) for those not tested for HIV (n=11,655), and a mean age of 30.38 (SD=7.99) for women who were tested for HIV (n=3,216). The mean difference differed slightly between groups and demonstrated statistical significance ($p<0.001$).

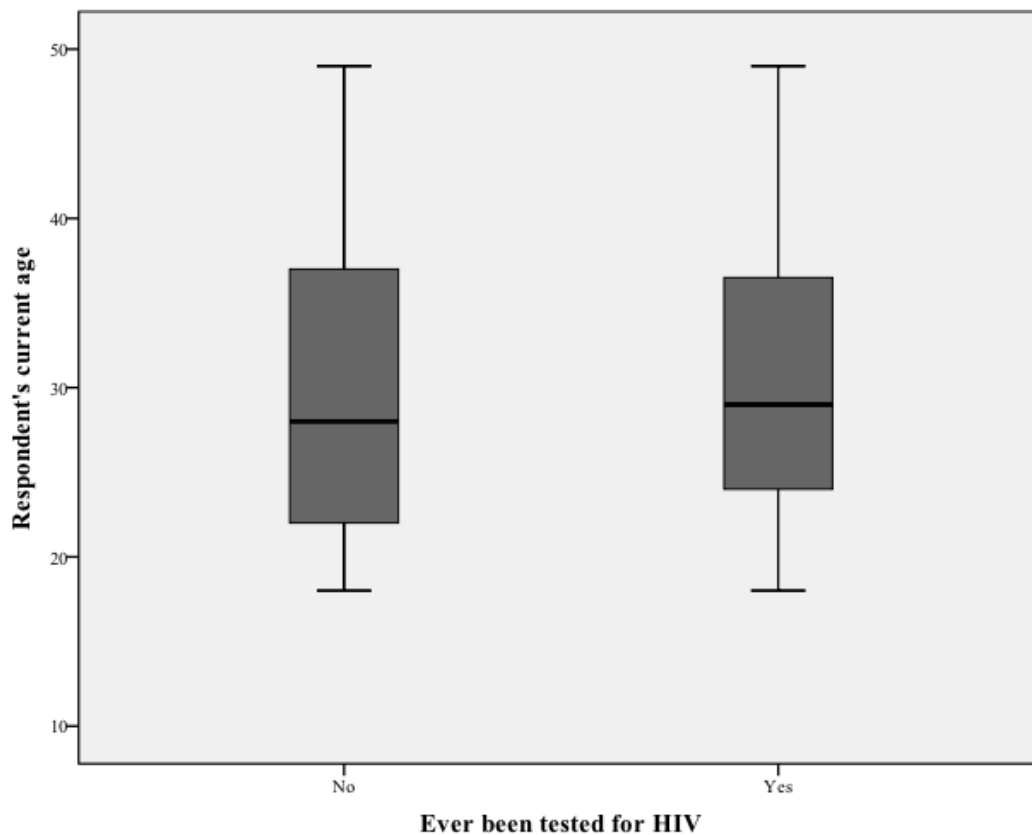


Figure 8. Age distribution by HIV testing status (no/yes). The mean age appears to be similar between groups (n=14,871), but is statistically significant ($p<0.001$).

Categorical. The majority of the independent variables retained for the regression model were categorical and Pearson’s Chi-Square was used to compare each variable to the binary outcome. Women who lived in rural areas were significantly less likely to be tested (71.8% not tested) compared to women who resided in urban regions who were significantly likely to be tested (72% were tested; Fig 35) because they are less likely to have access to locations for testing and are less likely to have information regarding HIV and the testing process ($p < 0.001$).

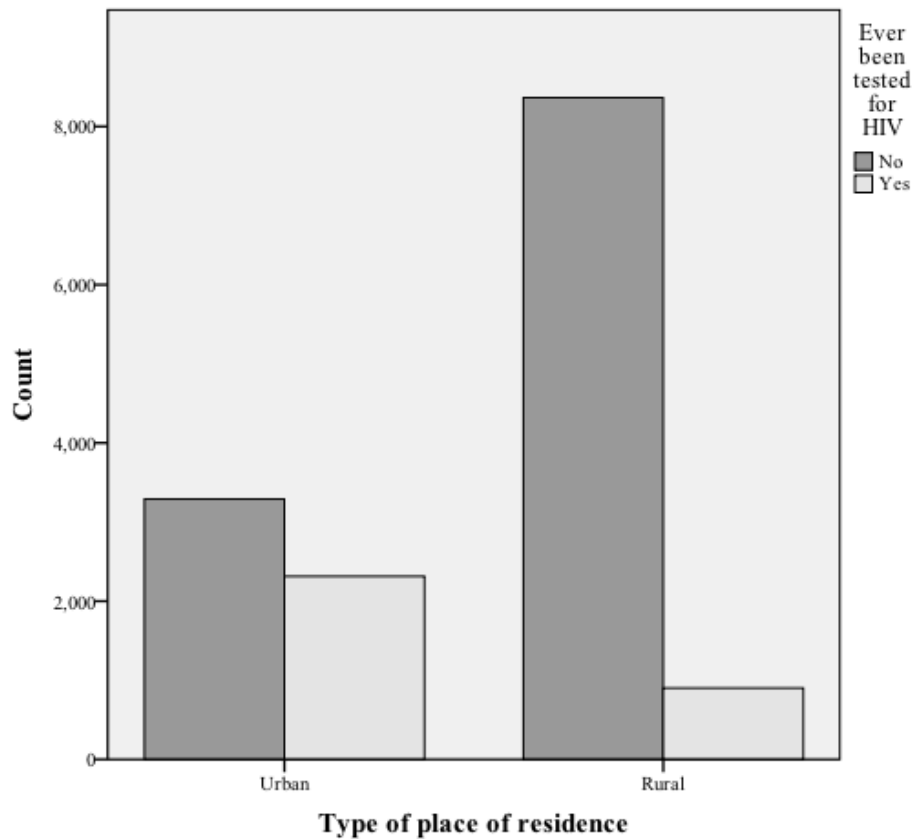


Figure 9. Type of residence (urban/rural) by HIV testing (no/yes). Women in rural regions accounted for more women not tested for HIV and a much lower percentage of women tested.

A lack of knowledge about HIV and the mechanisms of transmission may contribute to beliefs that sharing inanimate objects such as food could be a source of contracting the virus.

When we studied this question, approximately 33.8% (n=11,655) of subjects not tested for HIV believed that HIV could be spread by sharing food with someone who had HIV compared to only 15.4% (n=3,216) of those who had been tested, suggesting that this belief may be a contributing factor to stigma towards HIV patients. This variable achieved statistical significance and retained for further analysis ($p < 0.001$).

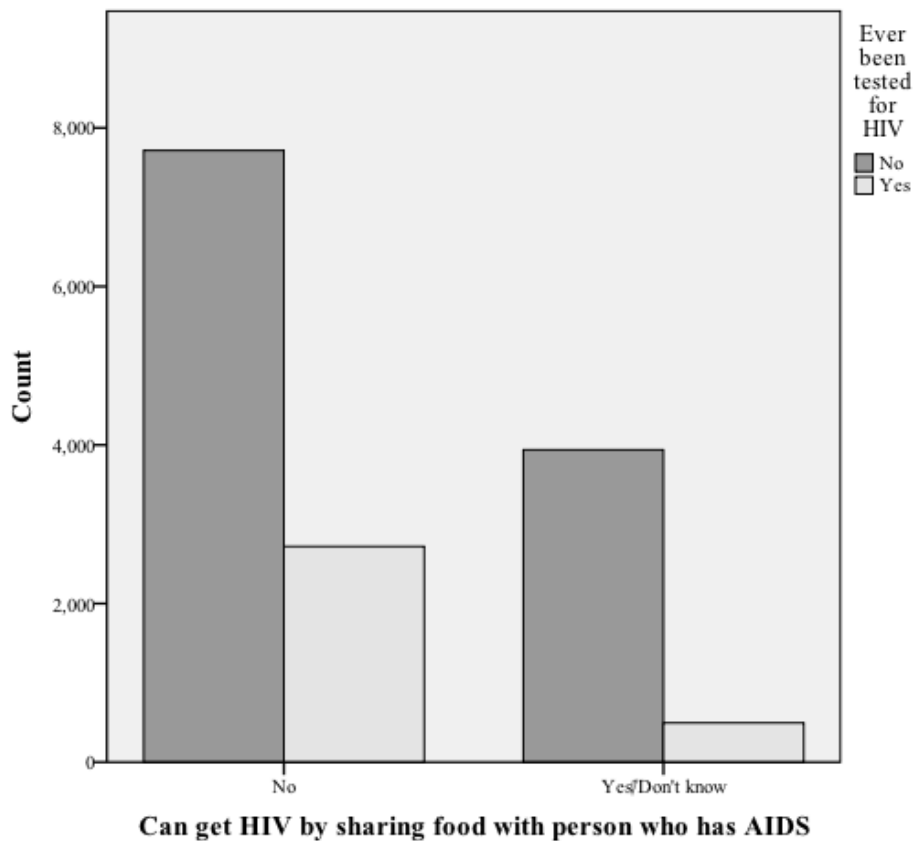


Figure 10. Can get HIV by sharing food by HIV testing (no/yes). Over one third of women not tested for HIV believed HIV could be transmitted through sharing food. This misconception was found to be statistically significant and influence HIV testing ($p < 0.001$).

Individuals with AIDS often experience complicated secondary diseases that affect their personal appearance and make them look unhealthy (Pang et al., 2018). A lack of understanding regarding the progression of HIV infection to full-blown AIDS could contribute to the belief that a person with HIV could not look healthy. When we evaluated the system of belief around this question, close to one third of women (31.6%) who had not been tested for HIV believed that a person with HIV could not appear to be healthy. When asking women who had been tested for HIV, this figure dropped significantly to 10.8%. This suggests that knowledge of HIV and disease characteristics could influence whether or not a person obtains an HIV test ($p < 0.001$).

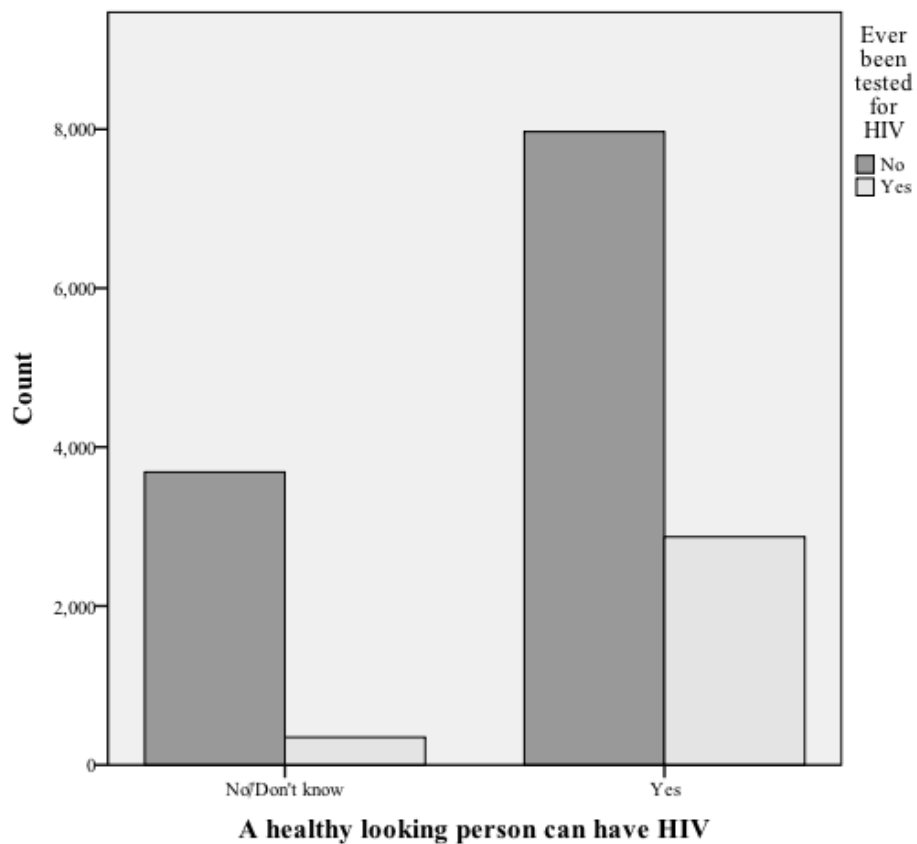


Figure 11. A person with HIV can look healthy (no/yes). Women who had been tested for HIV had a higher rate of correct answers pertaining to physical characteristics of HIV disease

progression compared to women who had not been tested ($p < 0.001$).

If a female has tested positive for HIV and is pregnant, knowing that HIV can be transmitted to the fetus through pregnancy and breastfeeding can be a motivator to start antiretroviral therapy to protect the unborn child. Knowledge regarding transmission of HIV between mother and child in utero was similar between tested (41%) and non-tested (42%) cohorts, where less than half did not know that HIV could be transmitted in this manner ($p = 0.079$). This variable was found to not be statistically significant and was not retained for the final analysis.

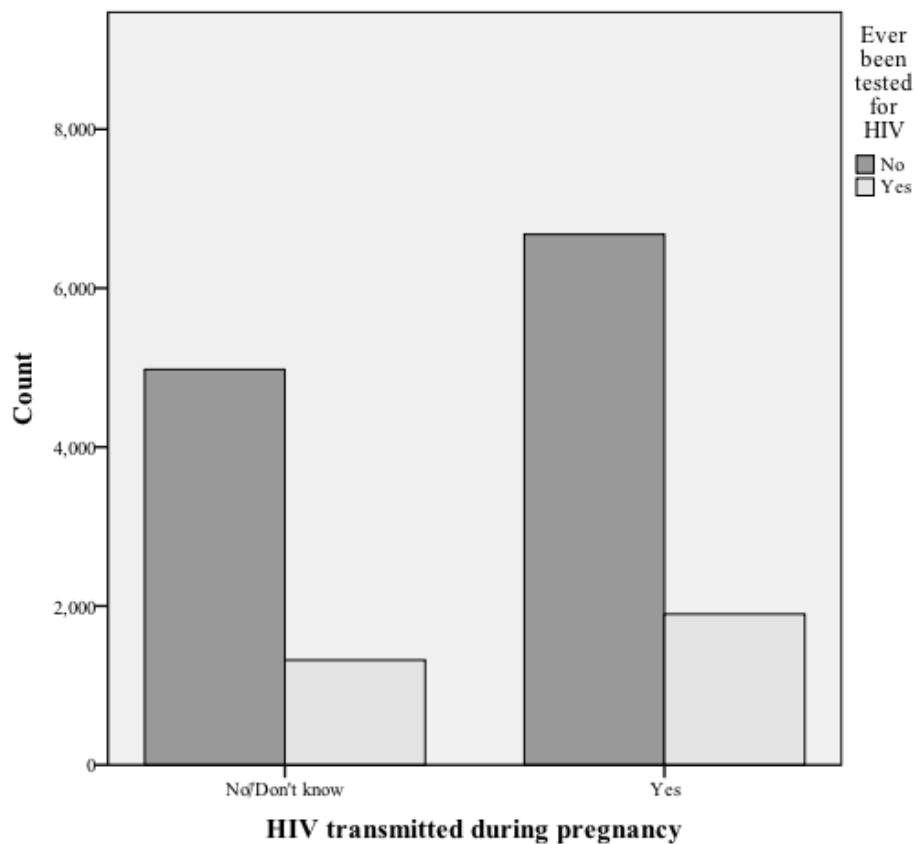


Figure 12. HIV can be transmitted during pregnancy by HIV testing (no/yes). Responses to HIV knowledge pertaining to pregnancy transmission were similar between groups (tested/not

tested) and were not statistically significant ($p=0.079$).

When the questions pertaining to maternal health were evaluated, only the question that specifically addressed whether HIV could be transmitted by breastfeeding could be included because of sample size concerns. Questions that were removed from the analysis pertained to whether the subject knew if medications were available to prevent maternal-child-transmission of HIV. Of those women not tested for HIV ($n=11,655$), over one-third (37.5%) were not aware that HIV could be transmitted by breastfeeding ($p<0.001$).

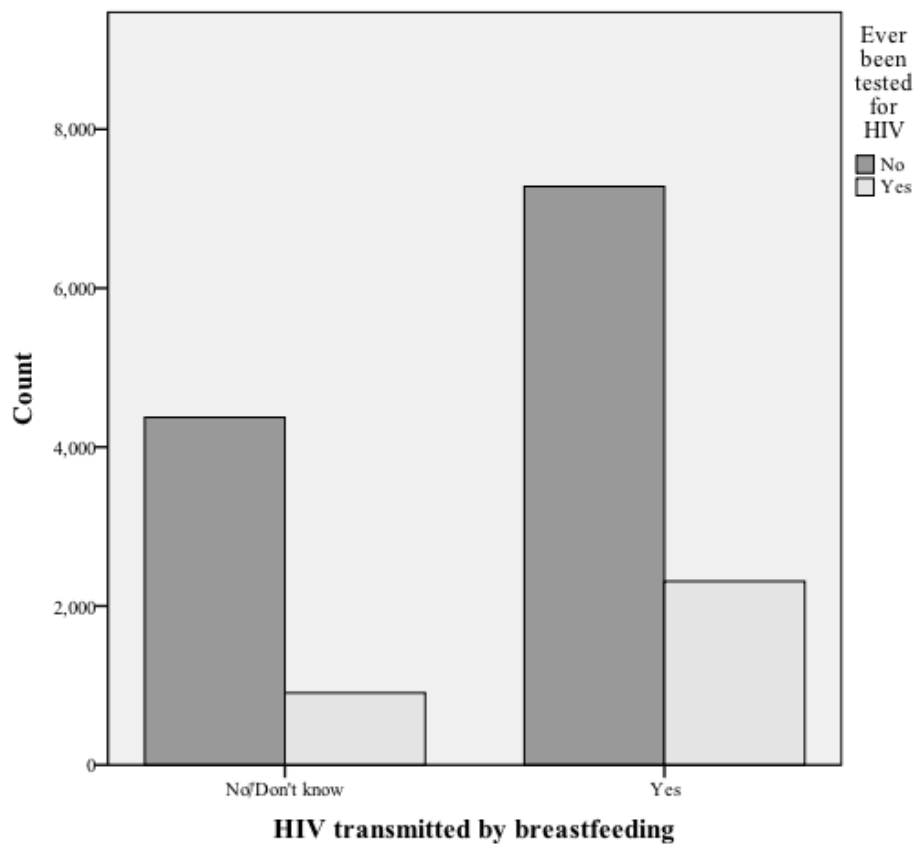


Figure 13. HIV can be transmitted through breastfeeding by HIV testing (no/yes). More than one in three women (37.5%) who had not been tested for HIV were unaware that HIV could be transmitted by breastfeeding. These results were statistically significant ($p<0.001$).

Stigma is a major concern that can carry with it significant life changes for individuals diagnosed with HIV (Sayles et al., 2009). In an attempt to try to understand some of the behaviors that may be linked to stigma in subjects testing positive for HIV, we evaluated some questions included in the questionnaire that addressed cultural and community-based relationships. The first question we evaluated asked whether female teachers with HIV that were healthy should be allowed to continue teaching. More than half of subjects not tested for HIV (55.5%) thought teachers should not be allowed to teach with a positive HIV diagnosis. This figure demonstrates that women with a positive HIV diagnosis are significantly more likely to experience stigma and loss of gainful employment should they reveal their status to the community. This figure decreased to over one-third (35.7%) of women who had been tested for HIV, confirming that even with increased education about the virus, the perception of risk for transmitting the disease and stigmatizing behaviors remain high ($p < 0.001$).

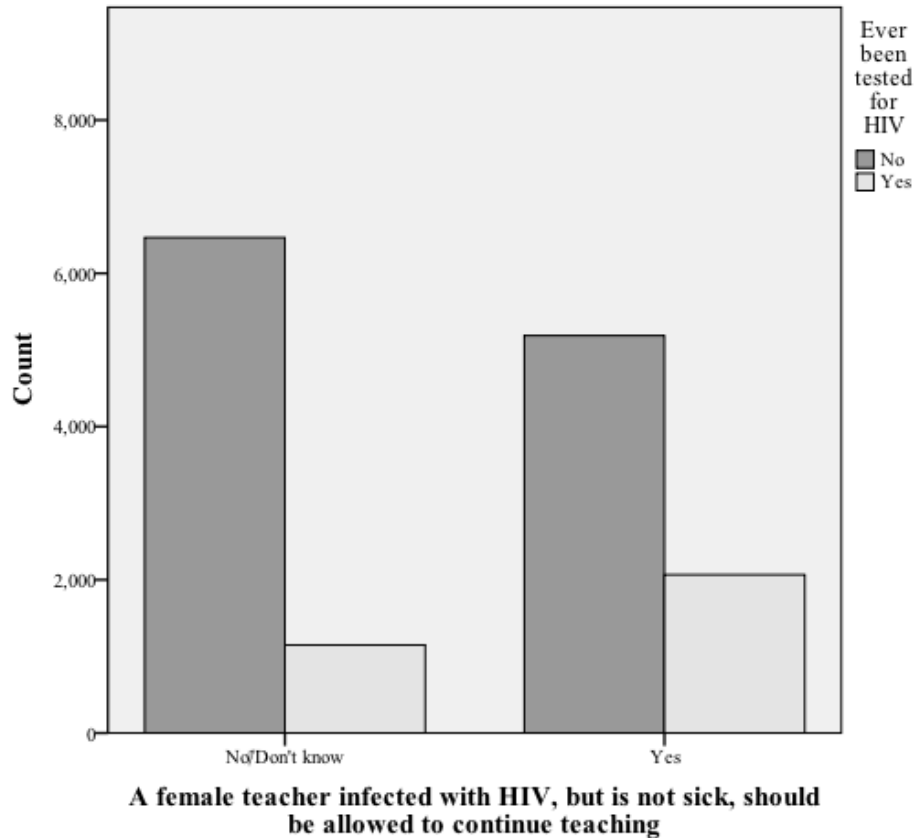


Figure 14. A female teacher with HIV should be allowed to teach by HIV testing (no/yes).

More than one in two women (55.5%) not tested for HIV did not think a female teacher with HIV should continue teaching ($p < 0.001$).

We also wanted to determine subjects' perceptions of their beliefs whether transmission of the virus could occur through innocuous means such as the sharing of inanimate objects like food. This type of belief could affect the livelihood of a person living with HIV since many individuals in SSA make their livelihood from selling items in markets. Beliefs that HIV could be transmitted through objects such as this could contribute to fear and stigma toward someone with an HIV diagnosis. An alarming 61.3% of women who had not been HIV tested answered that they would not buy vegetables from a vendor with a positive HIV diagnosis. Importantly,

knowledge and obtaining an HIV test reversed this trend, with 65.5% of subjects answering that they would buy vegetables from a vendor with a positive HIV diagnosis ($p < 0.001$). These results demonstrate that basic knowledge about HIV transmission can substantially reduce the effects of some factors that can contribute to stigma associated with a positive HIV diagnosis.

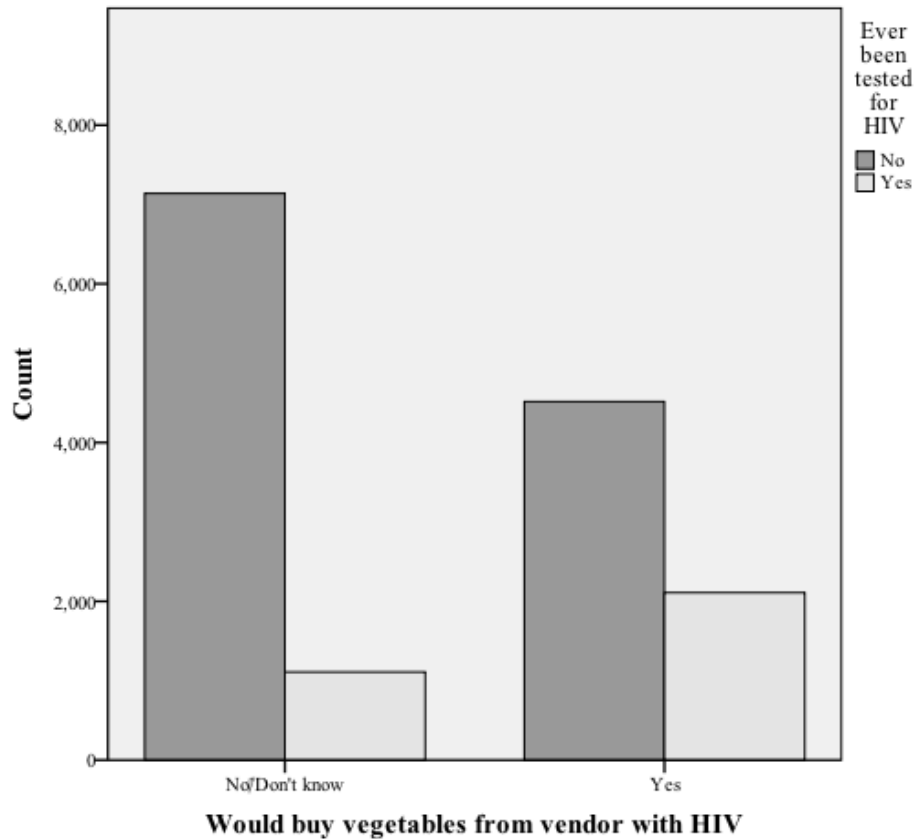


Figure 15. Would buy vegetables from a vendor with HIV by HIV testing (no/yes). Of the women not tested for HIV, 61.3% would not buy vegetables from a vendor with HIV ($p < 0.001$).

Interpersonal relationships are a key feature of survival in African society. As discussed previously, a diagnosis of HIV can lead to stigmatization and ostracism of a woman not only from her spouse and marital family, but also from her biological family. We wanted to evaluate

whether a woman would want to keep an HIV diagnosis secret from her family. Approximately 3 of every 4 women answered that they would want their HIV diagnosis to remain undisclosed to family (Not tested=70.1%, Tested: 79.9%; $p<0.001$). Importantly, women tested for HIV were more likely to want a diagnosis of HIV to remain secret from family, indicating that they were concerned about what the outcomes would be from obtaining such a diagnosis.

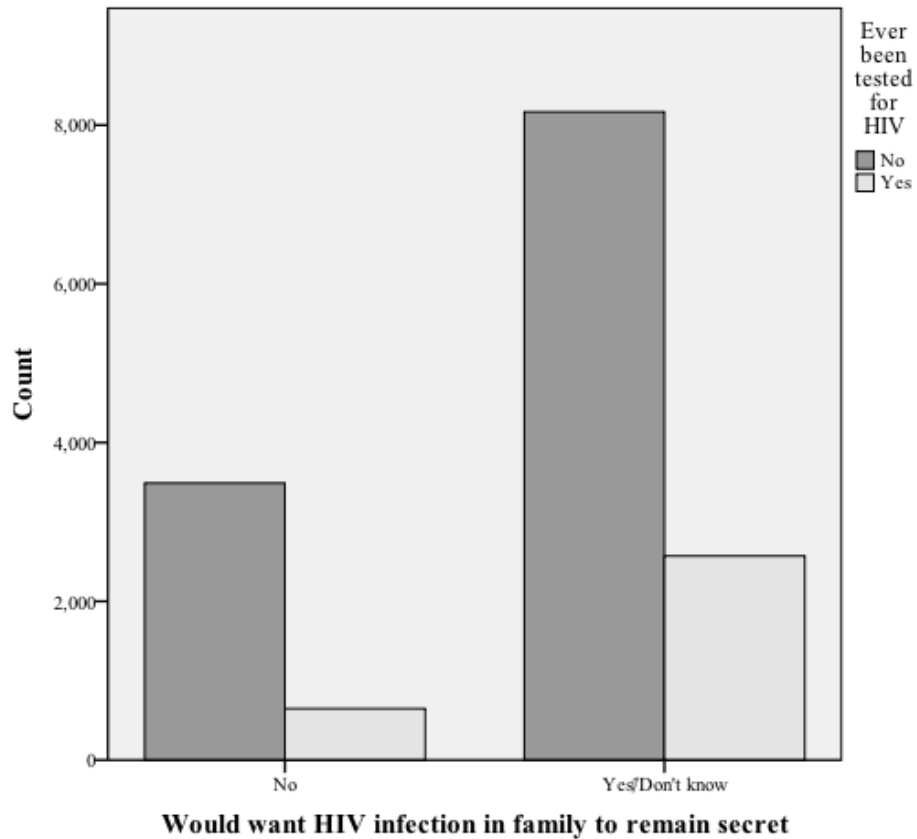


Figure 16. Would want family HIV diagnosis to remain secret by HIV testing (no/yes).

Most women in both groups (not tested=70.1%, tested: 79.9%) would want an HIV diagnosis in the family to remain a secret. Even though responses were high in both groups, the variable was still statistically significant ($p<0.001$).

Cultural and religious beliefs can have a direct impact on the understanding of disease transmission and influence what forms of treatment are sought by an individual with HIV (Carlos et al., 2015; MacIntyre et al., 2013; Hawkes et al., 2013; Maketa et al., 2013). Beliefs in the supernatural and holistic medicinal practices remain in common use throughout many sub-Saharan African countries, including the DRC. Research has yet to discover the association between supernatural beliefs and HIV knowledge in the DRC. To determine whether this had an influence on how women perceived the mechanisms of HIV transmission, they were asked if HIV could be transmitted by witchcraft or through supernatural means. Less than half of women in both tested (41.4%) and untested (42.9%) groups answered similarly believing HIV can be transmitted through supernatural means. This suggests that cultural beliefs regarding HIV transmission are deeply rooted in this culture and did not influence the rates of testing amongst the cohort ($p=0.136$). This variable was not found to be statistically significant and was not retained.

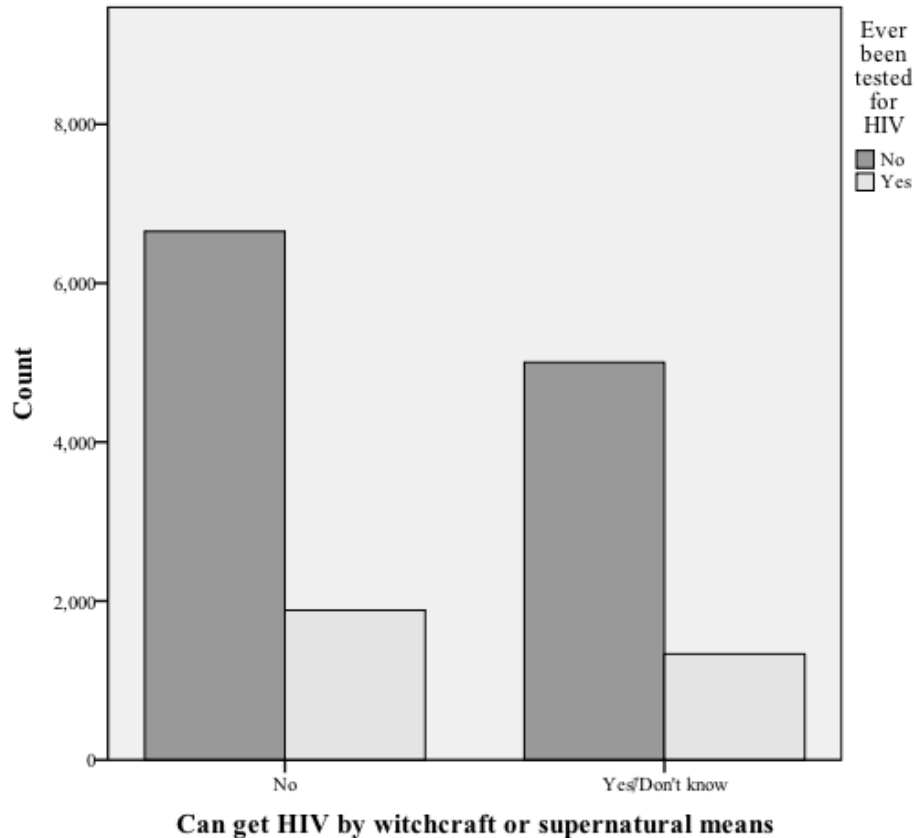


Figure 17. Can get HIV from supernatural means by HIV testing (no/yes). Women who were tested for HIV (41.4%) and not tested (42.9%) answered similarly, believing HIV could be transmitted by supernatural means, which led to this variable not being statistically significant ($p=0.136$).

Data suggest that women who do not have a voice in their relationships about their sexual health and sexually transmitted disease prevention are less likely to get tested for HIV, whether it be due to fear, risk of abuse or stigma. To evaluate how women perceived their sexual health in relationships in this cohort, women were asked whether a wife was justified in asking her husband to wear a condom if he was diagnosed with an STI. One third of women who had not been tested for HIV (33.7%) did not believe they were justified in asking their husbands to wear

a condom. Of those women who were tested, approximately 18.4% believed they were not justified ($p < 0.001$).

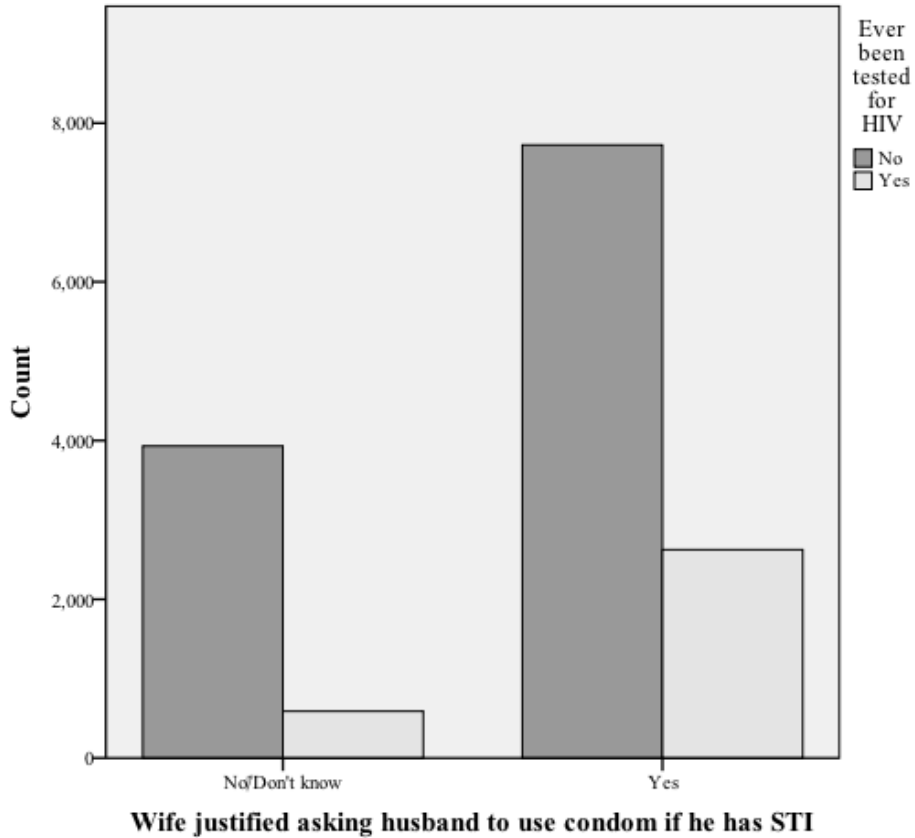


Figure 18. Wife justified in asking husband with STI to wear a condom by HIV testing (no/yes). One third of women (33.7%) not tested and 18.4% of women tested did not believe they were justified in asking their husbands to wear a condom ($p < 0.001$).

We were also interested in evaluating whether a women believed a husband is justified in beating his wife if she refuses sex, another indicator of a woman's status in the marriage. Over one-half of women (52.1%) not tested for HIV thought a husband was justified in beating his wife for refusing sex. This figure reduced to approximately one-third (38%) in women whom

had been tested for HIV. These data suggest that a woman who feels empowered to communicate in her marriage is less likely to support marital violence and is more likely to get tested for HIV ($p < 0.001$).

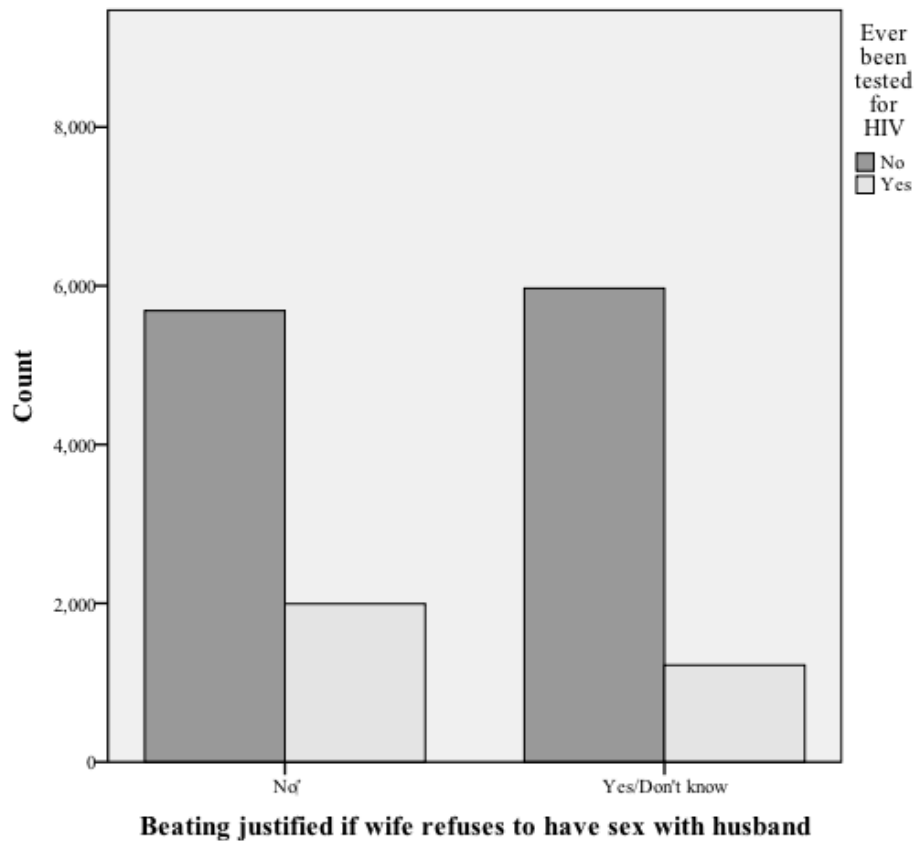


Figure 19. Beating wife is justified when she refuses sex by HIV testing (no/yes). More than one in two women (52.1%) not tested for HIV and one in three women (38%) tested thought a husband was justified in beating his wife for refusing sex ($p < 0.001$).

Socioeconomic status is known to impact HIV testing (Peters et al., 2008; Collins & Rau, 2000), and was included within the analysis as a control by using the wealth index quintiles in reference to the DRC in reference to the country's economic status. Figure 20 demonstrates a

positive correlation between testing and wealth on the wealth index scale with an inverse relationship in those not being tested. Of those tested, 6.6% presented in the poorest category, while 54% of those tested presented in the richest category. Of those not tested, 26.2% presented in the poorest category, with 11.6% in the richest category. This variable was found to be statically significant and was retained ($p < 0.001$).

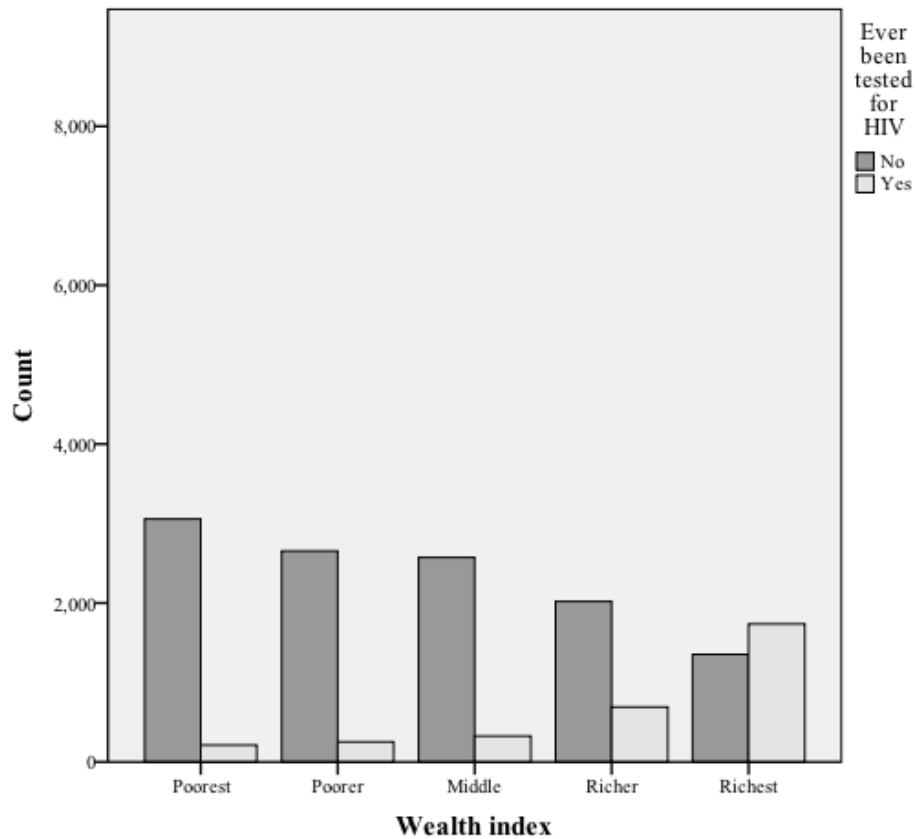


Figure 20. Wealth index quintiles by HIV testing (no/yes). As HIV testing increases, wealth index increases. Out of women tested for HIV, 6.6% are located in the poorest category and 54% in the richest category ($p < 0.001$).

Level of education has also been shown to be associated with socioeconomic status and access to care. Amongst those tested for HIV, up to 57.8% had obtained a secondary education level or higher. Of those not tested, 43% had obtained a primary level of education and only 1.6% had obtained a level of education higher than primary. This variable was retained for statistical significance ($p < 0.001$).

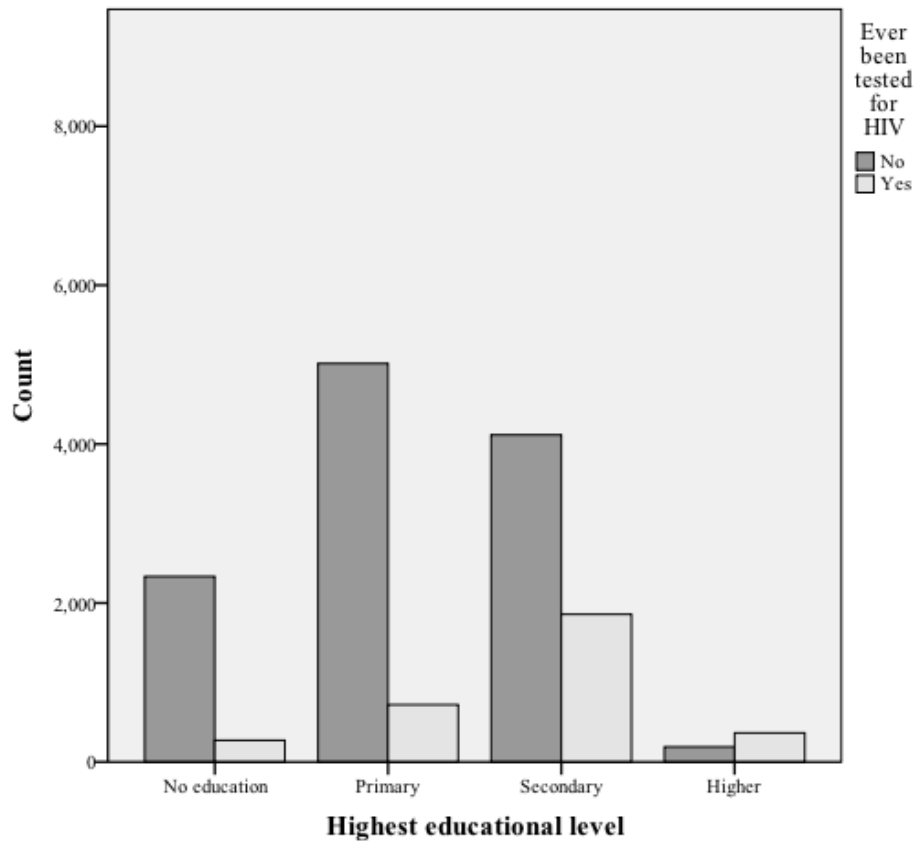


Figure 21. Educational level by HIV testing (no/yes). Out of women not tested for HIV, 43% had obtained a ‘primary’ level of education and only 1.6% obtained a ‘higher’ level of education. The ‘secondary’ level accounted for the highest percentage of women tested (57.8%) ($p < 0.001$).

Covariance Matrix

To insure that the selected variables were not accounting for the same variances, a covariance matrix was constructed to identify collinearity between variables (Table 17). Variables with a strong positive or negative correlation of 0.90 or higher and -0.90 or lower were removed from the analysis (Cohen, 1988; Field, 2013) and included only 'no education' and 'primary education' (0.855). All variables were within the appropriate range and were retained in the analysis.

Table 7. Correlation matrix between independent variables.

	Const.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
16. Rich Wealth Index	-0.377	0.002	-0.32	-0.06	0.00	0.037	-0.08	-0.04	0.034	0.01	-0.2	-0.22	-0.16	0.469	0.488	0.505	1
15. Middle Wealth Index	-0.447	-0.01	-0.51	-0.05	-0.004	0.037	-0.06	-0.04	0.027	0.017	-0.18	-0.19	-0.12	0.512	0.541	1	
14. Poor Wealth Index	-0.463	-0.02	-0.53	-0.05	-0.02	0.046	-0.04	-0.03	0.019	0.027	-0.18	-0.18	-0.1	0.511	1		
13. Poorest Wealth Index	-0.453	-0.02	-0.46	-0.06	-0.03	0.056	-0.04	-0.03	0.03	0.021	-0.21	-0.18	-0.1	1			
12. Secondary Education	-0.58	0.044	-0.02	-0.07	-0.03	0.011	0.011	0.024	-0.004	0.05	0.765	0.855	1				

	Const.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
11. Primary Education	-0.536	0.1	-0.07	-0.07	-0.05	0.039	0.005	0.037	0.027	0.075	0.783	1					
10. No Education	-0.549	0.13	-0.09	-0.07	-0.05	0.058	0.023	0.035	0.041	0.062	1						
9. Would buy vegetables from vendor with HIV	-0.155	0.018	0.001	0.028	0.164	-0.06	-0.003	-0.36	-0.02	1							
8. Wife justified asking husband to use condom if he has STI	-0.09	-0.03	0.018	0.057	0.053	-0.09	-0.05	-0.04	1								
7. A female teacher infected with HIV, not sick, should continue teaching	-0.056	0.017	0.024	0.038	0.066	-0.06	-0.001	1									
6. HIV transmitted by breastfeeding	-0.005	0.019	-0.03	-0.004	-0.02	-0.12	1										

	Const.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
5. A healthy looking person can have HIV	-0.119	0.022	0.046	0.015	0.048	1											
4. Can get HIV by sharing food with person who has AIDS	-0.126	0.005	-0.05	-0.04	1												
3. Beating justified if wife refuses to have sex with husband	0.03	-0.05	0.033	1													
2. Type of place of residence	0.408	0.007	1														
1. Respondent current age	-0.347	1															
Constant	1																

*0.90 value cut off for covariance between variables (Field, 2013; Cohen 1988).

Goodness-of-Fit Test

To assess the reliance of the designed model to estimate the odds of whether a woman has received HIV testing based on the questions selected, the Hosmer-Lemeshow Goodness-of-Fit Test was performed to determine the goodness of fit for each of the variables in the model (Hosmer & Lemeshow, 1989). Although this test has been criticized in the validation of regression models because it doesn't take over-fitting into account that can contribute to decreased power of the model, the test remains useful and is suggested for use as part of the analysis for logistic regression analysis (Field, 2013). The logistic regression analysis with the given variables from the covariance matrix had a p-value greater than $p > 0.05$ ($p = 0.749$), indicating the model cannot be rejected. The Omnibus Test of Model Coefficients that identifies whether the variance explained by the variables is greater from the model than expected by chance was also taken into consideration when looking at the fit of the regression model and was found to be statistically significant ($p < 0.001$).

Primary Analysis

Variables that were validated in the covariance matrix analysis were placed within a logistic regression model using SPSS software and were found to be statistically significant ($p < 0.001$). Based on this analysis, we determined based on the Omnibus Test and a fit suggested by the Hosmer-Lemeshow test that the variables we included directly influenced whether a woman would be tested for HIV ($p = 0.749$). Nagelkerke R Square is used as a variation of an adapted Cox & Snell R Square to specifically explain the amount of variance accounted for by the variables within the model (Field, 2013). Based on the Nagelkerke R Square value of 0.32, we could account for 32% of the variance in our model based on the questions selected, which is acceptable based upon the limitations imposed by using extant data. The adjusted logistic

regression model can be seen below in Table 8. We determined that the regression model was capable of predicting whether a woman had been HIV tested 81.8% of the time based on her responses. The model was also very strong in predicting women who had not been tested, correctly identifying them 92.8% of the time.

Table 8. **Adjusted Logistic Regression Model.

Variable (response coded 1)	Odds Ratio (tested)	95% C.I. for Exp(B)		Inverse Odds Ratio (not tested)	Sig. (p-value)
		Lower	Upper		
Age	1.012	1.007	1.017		<0.001*
Type of residence (urban)	1.566	1.374	1.785		<0.001*
Can you get HIV by sharing food? (no)	1.314	1.167	1.480		<0.001*
Can a person with HIV look healthy? (no)	0.480	0.567	0.740	2.083	<0.001*
Can HIV be transmitted by breastfeeding? (no)	0.702	0.635	0.775	1.425	<0.001*
Should a female teacher with HIV teach? (no)	0.798	0.722	0.883	1.253	<0.001*
Is a wife justified asking husband with STI to use condom? (no)	0.806	0.721	0.901	1.241	<0.001*
Would you buy veggies from vendor with HIV? (no)	0.665	0.600	0.737	1.504	<0.001*
Education					<0.001*
No Education	0.635	0.494	0.815	1.575	0.001*
Primary	0.536	0.431	0.668	1.866	<0.001*
Secondary	0.656	0.539	0.799	1.524	<0.001*
Higher (reference)	-	-	-		-

Wealth Index					<0.001*
Poorest	0.126	0.104	0.154	7.937	<0.001*
Poor	0.170	0.140	0.206	5.882	<0.001*
Middle	0.198	0.167	0.236	5.051	<0.001*
Rich	0.395	0.347	0.449	2.532	<0.001*
Richest (reference)	-	-	-	-	-
Constant	1.012				

*p value statistical significance indicated ($p \leq 0.05$)

**Three variables were included in the original analysis and removed for the final model due to lack of statistical significance, 'keeping HIV diagnosis secret' ($p=0.751$), 'know where to get HIV test' ($p=0.965$), and 'beating wife justified when refused sex' ($p=0.466$).

Logistic Regression

In generating the adjusted logistic regression model (Table 8), three variables were determined to not influence HIV testing and were rejected. Those variables that were rejected included 'keeping HIV diagnosis a secret' ($p=0.751$), 'know where to get an HIV test' ($p=0.965$), and 'beating wife is justified when refused sex' ($p=0.466$). All of the variables retained in the final adjusted logistic regression model were statistically significant ($p<0.05$) and can be seen in Tables 6 and 8.

The interpretation and impact of each included variable is evaluated below:

Age. When controlling for all other variables within the model, the odds of getting an HIV test increased in women by 1.2% per year ($p<0.001$). Therefore, as women aged, they were 1.2% more likely annually to be tested for HIV.

Residence. Women living in urban areas are 1.566 times more likely to be tested for HIV than women residing in rural areas ($p<0.001$).

HIV knowledge. Two variables pertaining to HIV knowledge were retained in the model based on statistical significance and association with the outcome variable. Women who knew that HIV could not be transmitted by sharing food were 1.314 times more likely to be HIV tested than women who did not know ($p<0.001$). A person who does not know that an HIV-infected individual can physically appear healthy were 2.083 times more likely to not get an HIV test when compared to women who do know they can ($p<0.001$).

Maternal health. The only variable retained in the final model pertaining to maternal health was 'can HIV be transmitted by breastfeeding'. Women who did not know that HIV could be transmitted by breastfeeding were 1.425 times more likely to not be tested for HIV when compared to women who did know ($p<0.001$).

Gender roles. Because the answer rates for variables in this section were greatly reduced, only two variables was retained in this model for the logistic regression model. Of

those, only one was found to be statistically significant in the adjusted logistic regression model. Women who did not believe that wives were justified in asking their husband who had been diagnosed with an STI to use a condom during sex were 1.241 times more likely to not be tested for HIV when compared to women who believed they were justified to ask ($p < 0.001$).

Stigma. Two variables identifying attitudes influencing HIV-related stigma were retained. Women who answered that HIV positive asymptomatic female teachers should not be allowed to continue to teach were 1.253 times more likely to not to be tested for HIV compared to women who believed that they should ($p < 0.001$). Those participants who would not buy vegetables from a vendor with HIV were 1.504 times more likely to not get an HIV test than those who would ($p < 0.001$).

Education. The level of education attained by subjects in our cohort was statistically significant in our model ($p < 0.001$). Dummy variables were introduced to account for each of the four levels of educational attainment classified within the dataset for use in the logistic regression model. The highest level of education, denoted as ‘higher’, was used as the reference category for the analysis. Women with no education were 1.575 times more likely to not be tested for HIV ($p < 0.001$). Women with a primary level of education were 1.866 times more likely to not be tested for HIV ($p = 0.001$). Women with a secondary level of education were 1.524 times more likely to not be tested ($p < 0.001$). These data are consistent with the results from the bivariate analysis as demonstrated in Figure 21.

Socioeconomic status. Wealth index was used as an indicator of socioeconomic status and was found to be statistically significant ($p < 0.001$). As with educational attainment, dummy variables were used to account to the five levels of the Wealth index and the highest level, ‘richest’, was used as the reference category in the analysis. Women in the “poorest”, “poor”, ‘middle’ and ‘rich’ categories were 7.937 ($p < 0.001$), 5.882 ($p < 0.001$), 5.051 ($p < 0.001$) and 2.532 ($p < 0.001$) times more likely than those in the richest wealth index to not be tested for HIV ($p < 0.001$). These data indicate that not receiving HIV testing is inversely related to wealth as observed in the bivariate analysis in Figure 20.

CHAPTER 5: DISCUSSION

The purpose of this study was to identify factors that influence HIV testing amongst women between 18-49 in the DRC. We chose to focus on this population because women have higher rates of HIV infection in SSA and the overall testing rate for HIV is low in the DRC. Based on a literature analysis, specific factors were identified that influenced HIV testing in women residing in the DRC including socioeconomic status, HIV knowledge and education, maternal health, stigma, gender roles, and cultural beliefs. An extant dataset was identified that had been collected by the USAID DHS program in the DRC between 2013-2014. Variables were selected from the dataset that asked questions pertaining to the categories identified from the literature. A detailed logistic regression analysis was performed on the variables matching the inclusion criteria as highlighted in Table 3. Logistic regression analysis was used to better understand the impact of the key factors influencing testing status identified from the literature on women from the DRC.

Summary of Results

A retrospective cross-sectional explanatory design was used to evaluate the responses collected from two cohorts of women who had or had not been tested for HIV. Logistic regression modeling was utilized to examine associations between independent variables and the outcome variable which was HIV testing. Analysis of the logistic regression model demonstrated good fit ($p=0.749$) and was determined to be statistically significant ($p<0.001$). The predictability of HIV testing was 81.8% accurate, accounting for 32% of the variance in the given model.

The first hypothesis we tested was that women experiencing poverty were less likely to be tested for HIV. In fact, we found that socioeconomic status was one of the most important factors influencing HIV testing amongst women in the DRC. Women who were the least affluent were almost eight times more likely to not be tested for HIV than those who were the most affluent when controlling for all other variables in the model. When considering all of the DRC, the country has an extremely low testing rate (22.1%) compared to other regions, therefore identification of the most susceptible population groups is critical to improving testing rates across the region. Women within the ‘poor’ (OR=5.882) and ‘middle’ (OR=5.051) quintiles are less likely than the most affluent to be tested for HIV, but as expected, the odds of being tested increase as the level of affluence increases.

Another important factor impacted by wealth index that influences access to care is one’s location of residence. We hypothesized that women who resided in rural areas without adequate access to testing facilities would be less likely to be tested for HIV. As expected, women in urban areas with improved access to health care facilities were 1.566 times more likely to be tested compared to those women residing in rural regions. These data support the needs to make health care services and HIV testing available to women who reside in rural areas of DRC.

We next sought to determine whether age was a factor in HIV testing. Although our first observations suggested that age did not appear to substantially influence HIV testing (Odds ratio 1.012) but because this is a continuous variable, we needed to evaluate this variable over time. In other words, for every year of life between 18 and 49, the odds of being HIV tested increases by 1.2%. As such, a 40-year-old female in the DRC is approximately 30% more likely than an 18-year-old to be tested for HIV. These data suggest that programs to promote HIV testing

should be focused on younger women who are less likely to be tested and who may be at higher risk of contracting HIV due to risky behavior, lack of education, or sexual/domestic violence.

We also hypothesized that lower educational attainment would be associated with decreased odds of HIV testing. Although the relationship was not as clear in this variable as it was with wealth index, individuals with a 'primary education' were the most likely to not be tested (OR=1.866). This was somewhat surprising since we expected that individuals with no education would be more likely than those with some education to be tested. We observed that individuals with 'No education' and 'secondary education' levels were both approximately 1.5 times more likely than those with higher levels of education to not be tested for HIV. Because there is no literature that addresses the influence of education on the rates of HIV testing, further studies to find out the reasons behind this are paramount.

We also wanted to evaluate whether HIV knowledge contributed to improved odds of HIV testing and was aligned with data from current literature that supports the theory that improved knowledge of HIV increases the rates of HIV testing (Brewer, 2011; Van der Borghet et al., 2010; Ayiga et al., 2013; Schirvel et al., 2009; Adeomi et al., 2014; Magnani et al., 2002; Mall et al., 2013; Scott-Sheldon et al., 2013). When we evaluated these data, we determined that women who did not believe that HIV positive people could look healthy were just over two times more likely to not be tested (OR=2.082). Similarly, those women believing that HIV could be spread by sharing food with an infected person were 1.314 times more likely to not be tested than those who better understood the process of disease transmission.

Three variables were selected for analysis in regards to HIV testing and maternal health, but only one was determined to be statistically significant in terms of the final logistic regression model. This variable was also linked to HIV knowledge because it involves knowledge of HIV

transmission. We hypothesized that women who were aware that HIV could be transmitted through breast milk would be more likely to be HIV tested to prevent transmission of the virus to her infant. We observed through our analysis that women who were unaware that HIV could be transmitted to the infant through breastfeeding were 1.425 times more likely not to be tested compared to those who did know. These findings were consistent with previous studies indicating that increased HIV education and knowledge lead to increased HIV testing rates (Brewer, 2011; Van der Borgh et al., 2010; Ayiga et al., 2013; Schirvel et al., 2009; Adeomi et al., 2014; Magnani et al., 2002; Mall et al., 2013; Scott-Sheldon et al., 2013).

The influence of stigma and cultural beliefs on individuals living with HIV has been well-explored in the literature, but the degree to which they influence testing in the DRC requires further analysis (Ayiga et al., 2013; Avert, 2014; Mbonu, van den Borne, & De Vries, 2009). To address the hypothesis whether stigma and cultural beliefs related to HIV could negatively impact the odds of getting tested, we evaluated questions specifically pertaining to behaviors associated with HIV-related stigma in the dataset. The first question asked whether women would choose to buy vegetables from a vendor diagnosed with HIV. Those individuals refusing to buy vegetables from an HIV-infected vendor were 1.504 times more likely to not be tested. This result begs the question whether individuals who are willing to stigmatize others living with HIV would not desire to be tested and know their own status for fear of experiencing this sort of stigma themselves. We are suggesting, however, that the act of not stigmatizing others with the disease appears to be associated with higher odds of testing. Women were also asked whether they believed an asymptomatic female teacher living with HIV should be allowed to continue teaching. Those who did not believe they should continue teaching were 1.253 times more likely to not be tested than those who would allow teaching to continue. This result indicates that

misconceptions about the disease and lack of knowledge regarding HIV can perpetuate fear and stigma within communities that can impact the livelihood of someone living with HIV.

Furthermore, they indicate that more research regarding the impact of these variables on testing rates is imperative to improving programs that not only increase rates of HIV testing and address stigma reduction within communities.

Cultural beliefs and gender roles not only impact stigma but also influence access to testing, care, and prevention. As mentioned above, most survey questions pertaining to gender roles within the culture went unanswered and therefore had to be excluded from the analysis. Of those that met the requirement for sample size, only one fulfilled all of the criteria throughout the regression process. Based on this question, we hypothesized that women who did not feel justified in asking STI-infected husbands to use protection during sexual intercourse were less likely to be tested for HIV. Data indicated that women who did not feel justified asking husbands with an STI to use a condom were 1.241 times more likely not to be tested than those who felt justified. In male-dominated societies including the DRC, women often lack a voice.

Gender roles tie into cultural practices and norms, which can impact many aspects of life, especially health outcomes. Few studies have been conducted to understand gender roles within this particular culture. Even when attempts have been made to study these cultural influences, the participants are reluctant to answer the questions leaving inadequate response rates for analysis. Aspects such as unsafe warzone environments, male-led households, women who are kept uneducated and left alone to provide for their children have been suggested as mechanisms that have suppressed women's voices and civil rights (Trenholm, Olsson, Blomqvist, & Ahlberg, 2016; World Bank, 2015; Tenal, 2017). This finding reinforces the necessity for further research

that explores this sensitive topic, possibly through the use of qualitative analyses since so little is known about these topics in the DRC.

Limitations

The most notable limitation of this study is the fact that extant data was used to conduct the analysis. As such, direct cause cannot be implied regardless of the findings. The lack of the investigator's ability to control external factors, development of the survey tools, and data collection procedures limit the extent to which the data can be used and to which conclusions can be drawn. The findings can be used as a foundation for future research studies that explore each of these factors in further detail, and the work does provide novel and valuable insight into factors that have not been documented in the literature about Congolese women in the DRC.

The investigators also recognize that other limitations exist within the study including a lack of information on access to care, data about tuberculosis comorbidity, and other diseases associated with HIV. Because variables were fixed within the survey due to the condition of using extant data, expansion on these topics in future studies to include more questions pertaining to the distance to clinics, cost of care, and other barriers that influence access to care would be useful to collect. The investigators noted that questions pertaining to tuberculosis, HIV-related cancers, malaria and other illnesses that are known comorbidities with HIV were not addressed in the questionnaires used in studies conducted in the DRC. In addition, questions that address sexual risk behaviors, disease comorbidities, and other sensitive topics are physically removed from the questionnaires by the DHS program in countries where they are deemed culturally inappropriate, which includes the DRC. This technique, although culturally sensitive to the needs of the Congolese participants, limits the number of variables available for use in this study.

Also absent was the ability to seek clarification and expansion on subjects that could have been addressed through a mixed-study design that employed qualitative interviews. Information obtained from qualitative data could have provided a more in-depth view of stigma and gender roles, along with the implications associated with each of those factors on HIV testing in Congolese women.

Implications of Findings

To understand the implications of this study, we must reflect upon a comprehensive view of daily life for Congolese women residing the DRC. A constant state of violence in an already male-dominated society has created an environment where many women do not have a say in their personal health and men make many decisions impacting the family. In the literature, women have reported feelings of insecurity rising from a culture of uncertainty and instability in daily life, along with a constant lack of safety (Trenholm, Olsson, Blomqvist, & Ahlberg, 2016). Although the government is attempting to restructure as violence declines, the necessary infrastructure to address all of the needs of the people has yet to be adequately achieved.

This study was designed to provide a glimpse into potential factors that influence HIV testing in Congolese women, and to truly understand the impact of these factors; truly comprehensive mixed methods studies are needed at a much more strategic level. Understanding the Bar before the Bars can give insight into how a Continuum of Care can be built for the DRC to ensure effective HIV testing, linkage to care, and treatment systems can be achieved. Findings and implications from this study should be used to guide public health professionals, NGOs, and researchers partnering with the DRC.

When designing this study, we assured control for socioeconomic status, as it has been identified in previous studies to influence HIV testing and knowledge. After ensuring

participants were evenly distributed across the wealth index quintiles, the results were more drastic than we were expecting. Women from the poorest wealth index were eight times more likely to not be tested for HIV, when controlling for all other variables in the model. This factor alone needs to be considered when programs are being planned and implemented. Simply living within the lowest socioeconomic status decreases the odds of obtaining an HIV test. Programs should target these populations and provide comprehensive resources to address this.

Aim 1: HIV knowledge. We expected to see the odds of being tested for HIV to increase, as HIV knowledge was present. Our findings were consistent with current literature pertaining to HIV knowledge. We also found this to be true of HIV knowledge under the scope of maternal health. Women who knew about HIV transmission and disease characteristics were more likely to be tested. An overall need exists within the DRC to have NGOs and other institutions provide HIV education programs before testing programs can be successfully implemented. Maternity clinics and care can also be potential points of contact to introduce HIV education, especially knowledge on how to prevent maternal-child-transmission. An emphasis should be placed on women within the lower levels of socioeconomic status. Improving knowledge is one way to empower women to make their own educated decision about their own HIV risk and whether or not they want an HIV test.

Aim 2: Access to care. Variables available to address this category were not as statistically significant as hypothesized. Knowing where to get an HIV test was not a statistically significant factor in the first logistic regression. Type of residency (urban/rural) was a significant factor influencing HIV testing. Women in urban areas were 1.566 times more likely to be tested for HIV compared to women in rural regions. This highlights the need for rural health program support to increase HIV testing availability. We suggest using this information

to target programs in rural areas and learning from neighboring countries with successful mobile testing programs.

Aim 3: Gender roles, cultural beliefs, and stigma. The majority of questions pertaining to gender roles could not be used because of a lack of response from participants. Though complete variables were not accessible for quantitative analysis, the overall lack of response is an imperative factor that cannot be overlooked. We did not collect the data and cannot assess why women did not answer these questions, but we can point out the importance of addressing this in future studies. We suggest the use of qualitative methods to uncover the complexities within gender roles and the impact they have on women's health.

Cultural beliefs were not as influential as we had expected within the context of extant data. None of the cultural belief questions asked within the survey were statistically significant, so none were used within the logistic regression model. We do know that cultural beliefs influence gender roles and stigma within a community, but we lacked the scope of exploring those within this dataset. We believe this can be addressed in a more comprehensive and focused way in future studies. Public health models including the Precede-Proceed Model focused on addressing community needs, culture, and sustainability within the context of implementing comprehensive health programs should be considered. Cultural influences need to be carefully dissected to specifically identify how culture influences gender norms and HIV-related stigma. Our study did not uncover as much insight into this construct as we had hoped, but it gave us new perspective in how to address it in future research.

Questions pertaining to behaviors associated with HIV-related stigma influenced HIV testing as hypothesized. Women expressing stigmatizing behaviors were less likely to be tested for HIV. Our study confirmed that HIV-related stigma negatively influences HIV testing. We

suggest using these findings to guide research that further explores and differentiates between internal and external HIV-related stigma within communities. We strongly suggest that researchers and public health professionals integrate stigma reduction components into HIV testing and education programs implemented in this region.

Researchers in the fields of TB, cancer, malaria, and other comorbidities should consider these findings when assessing points of care and treatment. Collaborative efforts to maximize care and reduce the number of clinic visits could contribute to comprehensive programs.

Application

These findings can be useful for NGOs and other organizations wanting to assist the DRC in building the HIV Continuum of Care as the government focuses on peace and restructuring. This study provided not only new knowledge about factors that may influence HIV testing among women in the DRC, but it also provided a methodology that has been adopted within Heart for the World International (HFTWI), a nonprofit that establishes public health programs globally. HFTWI has high interest in assisting the DRC by building HIV programs and addressing other public health needs. This study has established a foundation of knowledge to guide next steps to collect data and implement programs. The process of reviewing the literature and analyzing existing data using the methodology from this study has been integrated with formal public health assessments and global partnerships to enhance the effectiveness of HFTWI.

Future Research

Though it was not safe to travel to collect data at the time this study was completed, future plans will include data collection as the country reaches more stability. Empirical studies to understand culture, stigma, HIV knowledge, and the Bar before the Bars is being planned.

Qualitative methods will be used to obtain a better understanding of culture and stigma. Collaborations with experts in Photovoice and other proven qualitative tools are being discussed. Plans to assess and provide evidence for validity of the HIV-KQ-18 are also being explored. The overall goal of future research is to reduce the burden of HIV in the DRC by understanding the Bar before the Bars and building the Continuum of Care with a culturally competent approach.

Conclusion

Over 35 million people are living with HIV. Global response has been effective in many countries, especially those of higher socioeconomic status. The HIV Continuum of Care has recently led the way in providing context for individuals to get tested, linked to care, on medication, and ultimately reach viral suppression. Needs are greatest in countries of low socioeconomic status with lower testing rates, because the Continuum cannot begin until testing has taken place. NASTAD recognized barriers hindering testing, the first bar, and suggested several barriers that interfere with a decision to get tested. An addition to the Continuum, NASTAD created the Bar before the Bars. The purpose was to make health providers and researchers pause before building the Continuum for a community and look at the unique barriers that hinder testing and care. DRC was identified because the country has many risk factors for a high prevalence of HIV including neighboring communities with rates as high as 25%, conflict, and a low socioeconomic status, yet the country reports a prevalence rate similar to the U.S. (1%). Lack of HIV testing was recognized as a potential aspect to why the prevalence rate is reported so low. Drastically different testing rates can be seen amongst neighboring countries: Democratic Republic of the Congo (22.1%), Tanzania (67.1%) and Zambia (80.2%). This study focused on understanding the Bar before the Bars in the DRC to identify the factors that influence HIV testing.

Findings suggested several factors that may influence HIV testing. This study identified the associations between socioeconomic status, education, HIV knowledge, gender roles, access to care, maternal health, and stigma to HIV testing. From the available data the following survey questions were statistically significant in impacting HIV testing: age, type of residence, can get HIV by sharing food, HIV can look healthy, HIV transmitted by breastfeeding, female teacher with HIV should teach, wife justified asking husband with STI to use condom, would buy vegetables from vendor with HIV, education level, and wealth index.

Empirical studies are suggested to confirm these findings and explore specific aspects on a deeper level. Qualitative data is also needed to examine stigma, gender roles, and cultural competencies to create comprehensive testing programs that can reduce barriers. Collaboration is suggested with a public health framework and partnerships across disciplines from the U.S. and DRC. These findings should be used as a guide to plan next steps in assessing the Bar before the Bars on the ground. To insure the safety for and respect of the individuals involved, cultural considerations should be highly integrated throughout all future research programs. Cultural perspectives and appreciation, tribal traditions, and village practices can help researchers recognize which program features may need to be adapted to accommodate the needs of the participants. Adaptability, empathy and understanding from researchers and health professionals is needed to honor the culture and integrate unique cultural aspects within program models developed in the west.

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GLOSSARY

Definition of Terms and Acronyms

AIDS: Acquired immunodeficiency syndrome

ART: Anti-retroviral therapy

CD4: Immune cells destroyed by HIV and measured to understand disease progression (<200 cells/mm³ defines an AIDS diagnosis)

DHS: Demographic and Health Survey Program

DRC: Democratic Republic of the Congo

HIV: Human immunodeficiency virus

PLWHA: People living with HIV/AIDS

SSA: Sub-Saharan Africa

STI: Sexually transmitted infection

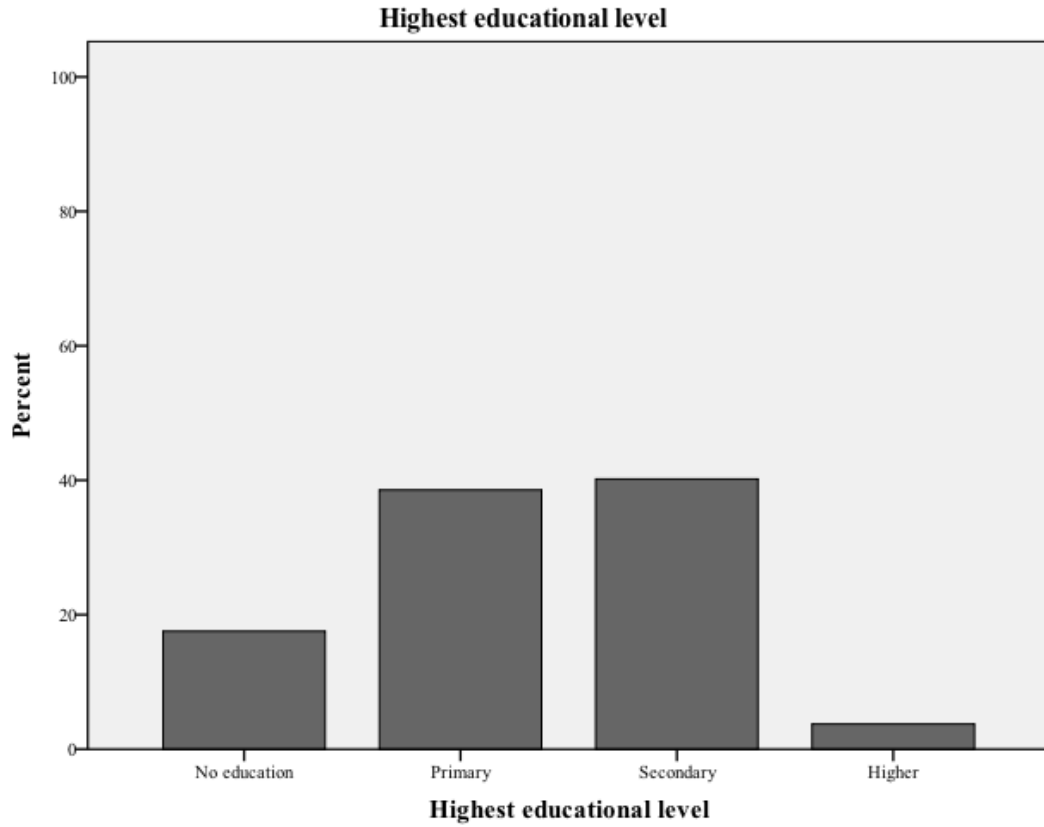
Viral Load: Amount of virus in the blood

Viral Suppression: Undetectable viral load (<50 copies/mL of virus in blood), which makes it difficult to transmit HIV

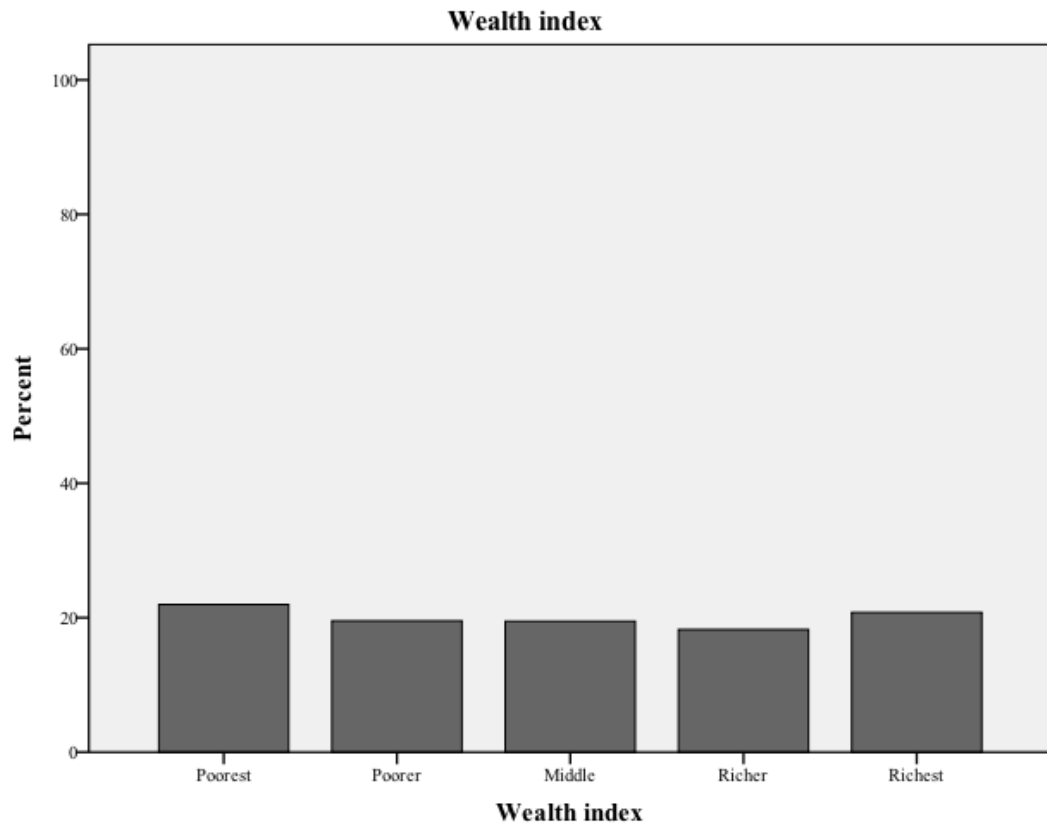
WHO: World Health Organization

APPENDIX A

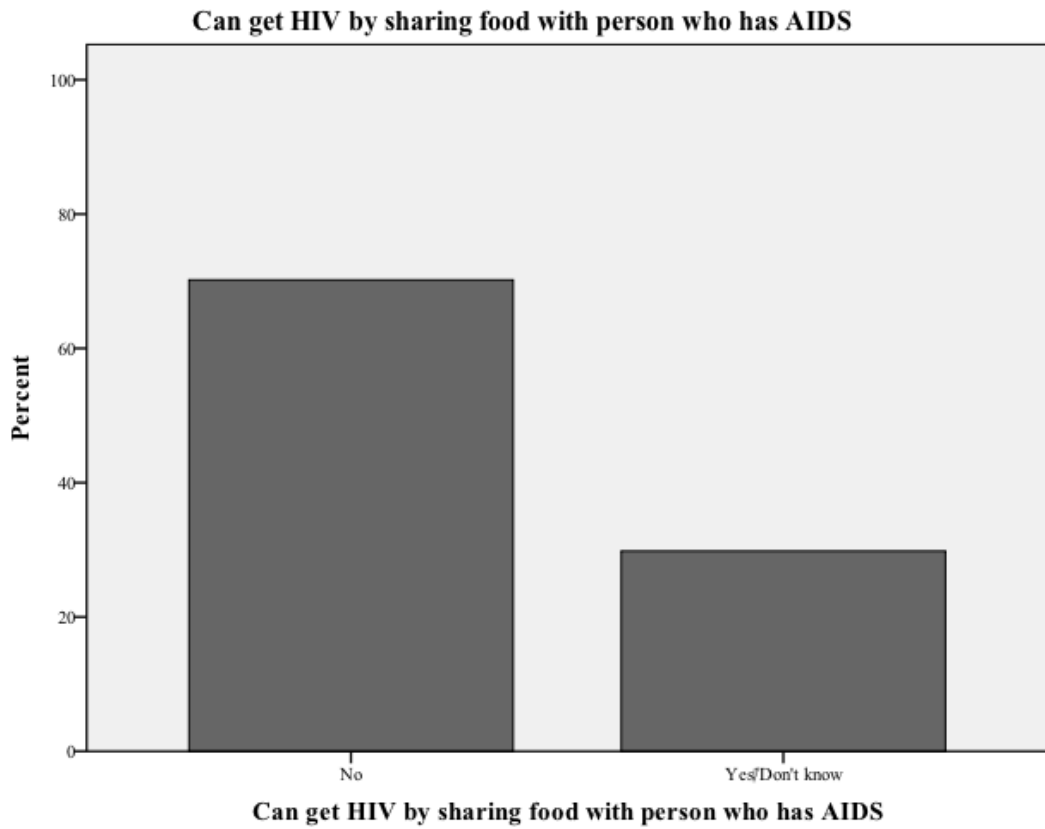
Figure 22 (A-P). The following charts represent the distribution of the descriptive statistics for each independent variable assessed for logistic regression. Further description of each variable retained and rejected can be found in Table 3.



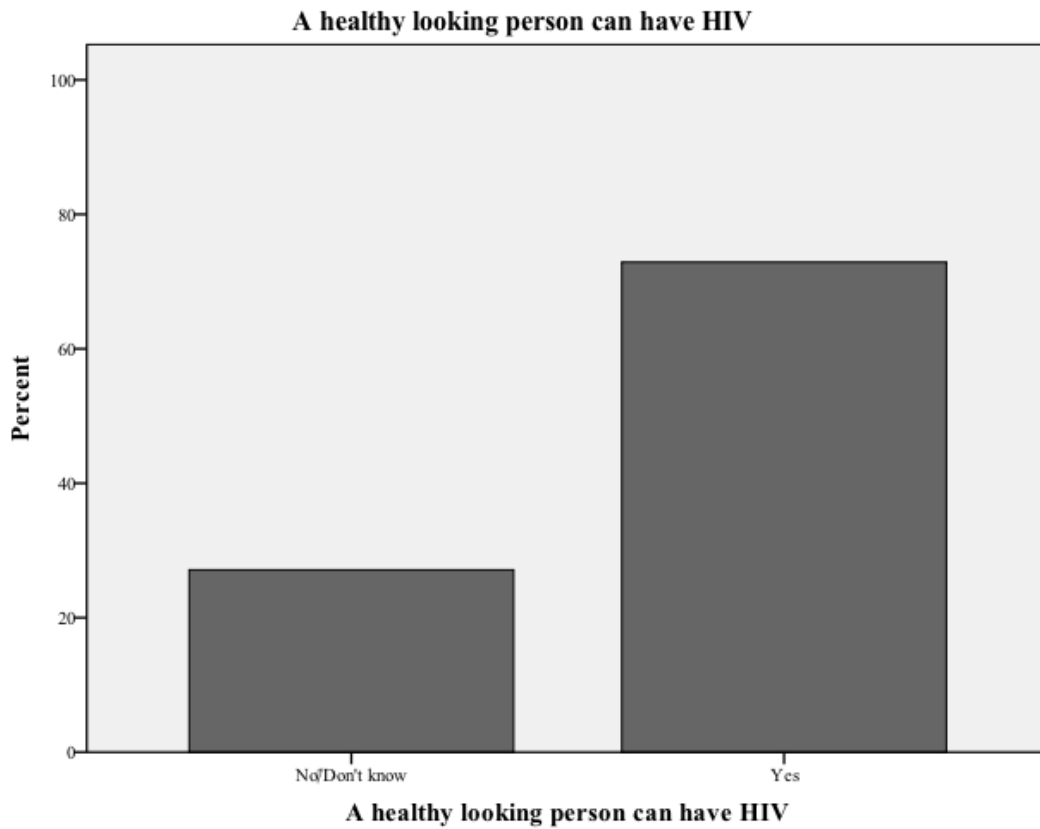
A.



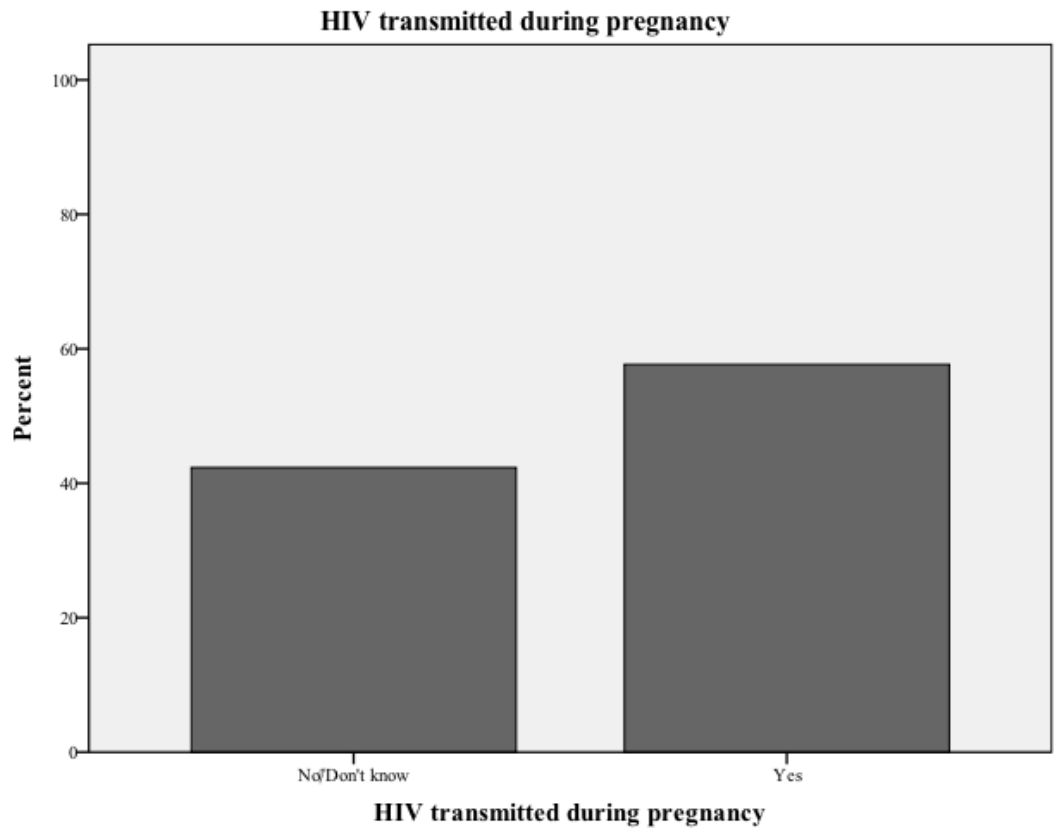
B.



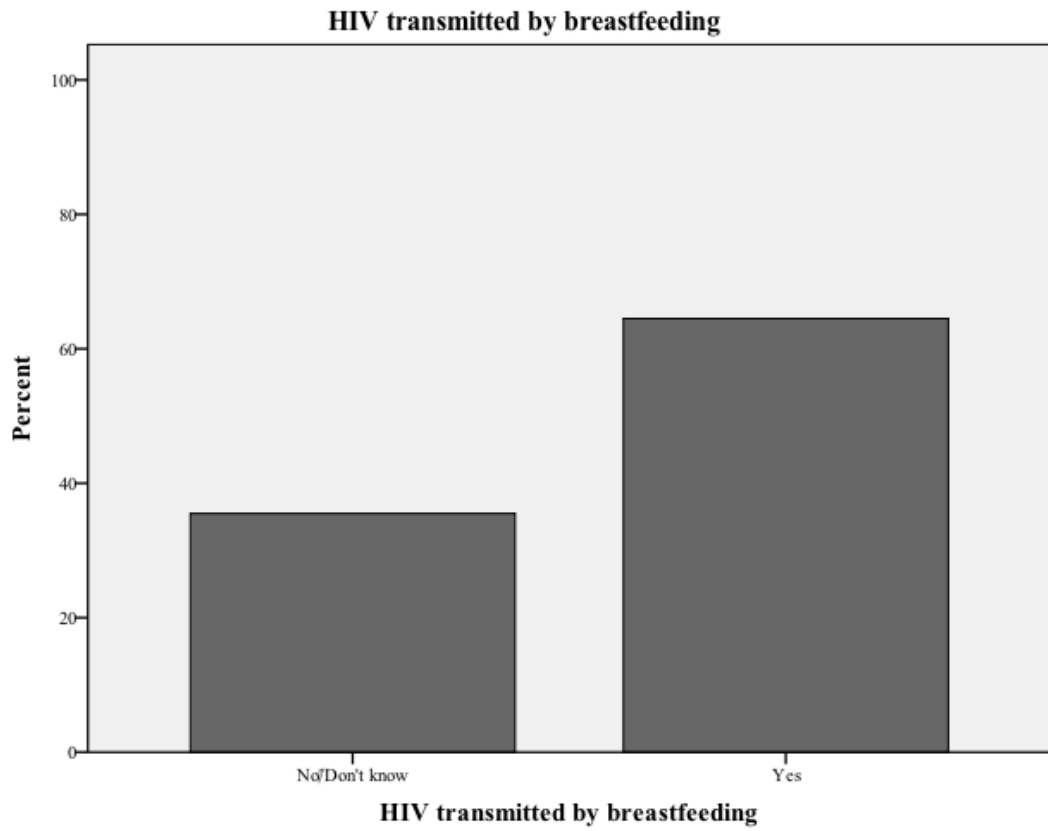
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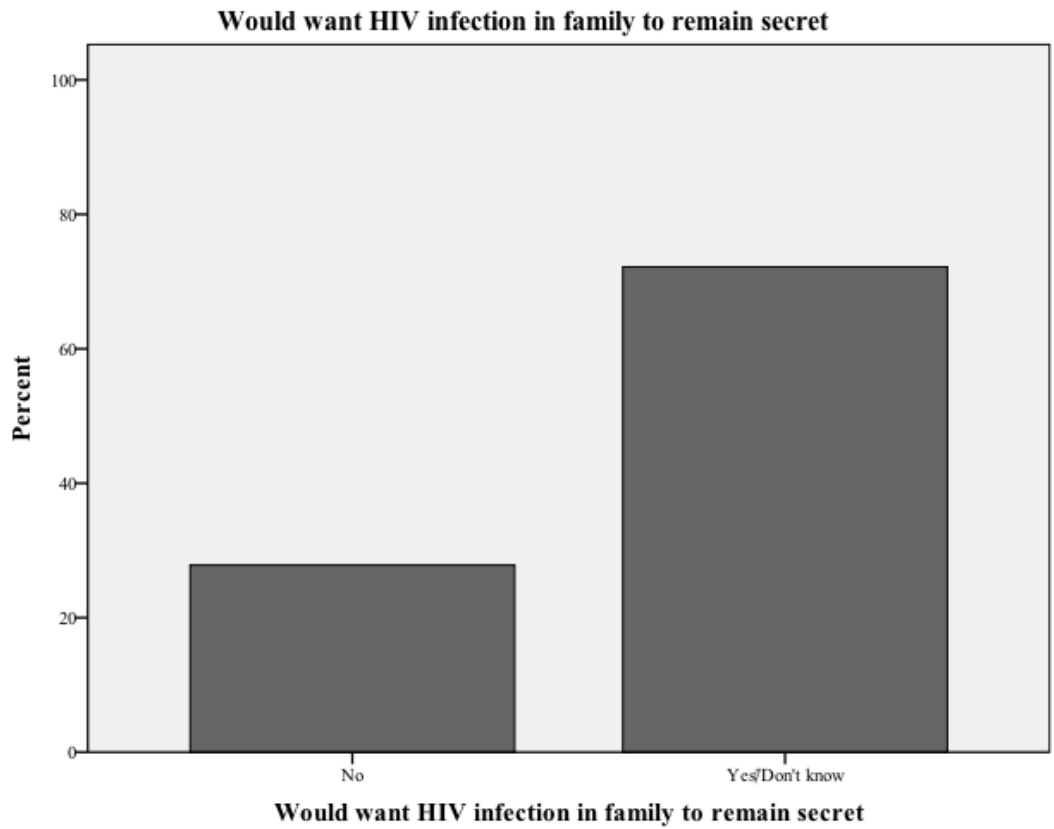
D



E.

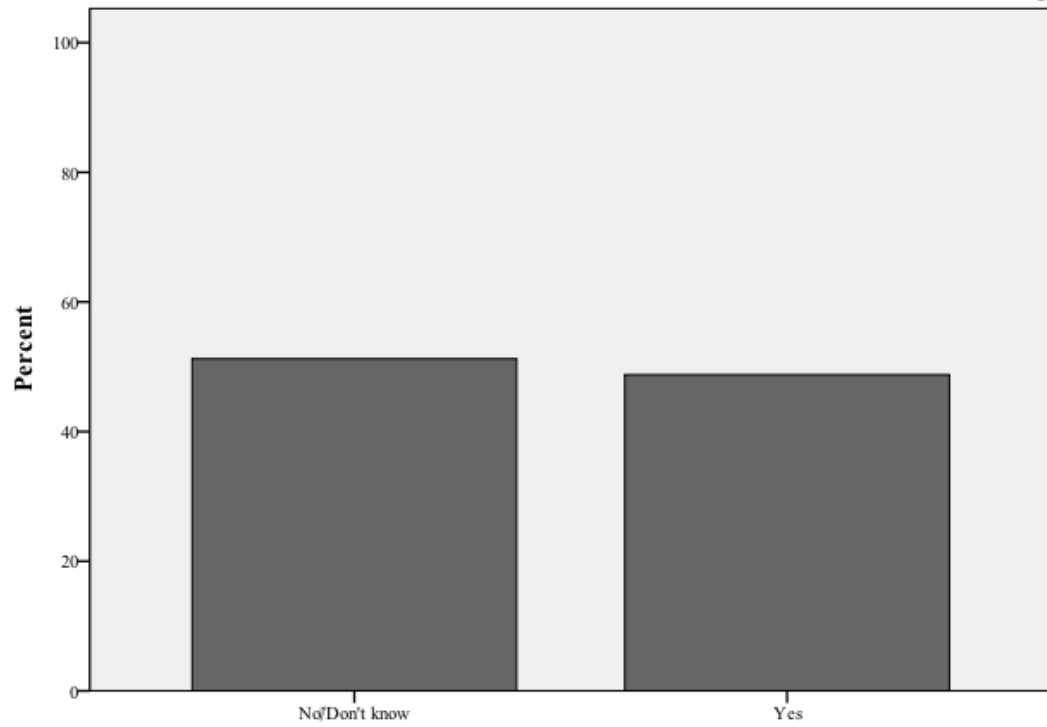


F.



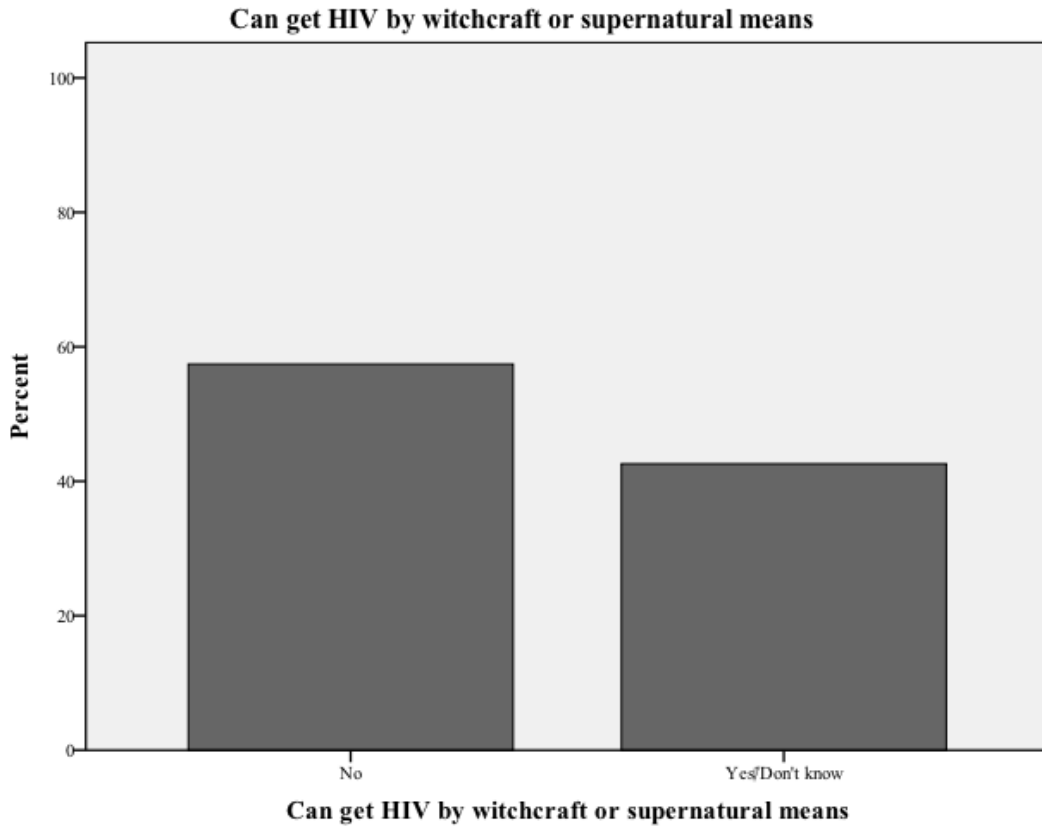
G.

A female teacher infected with HIV, but is not sick, should be allowed to continue teaching

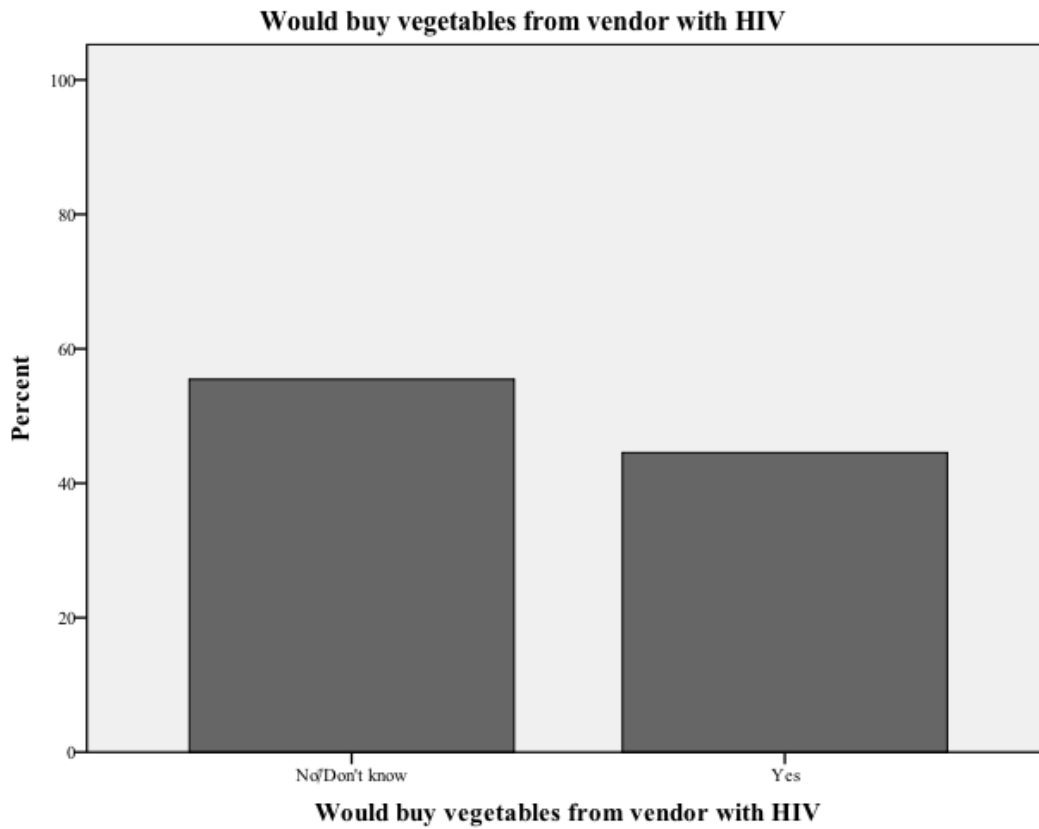


A female teacher infected with HIV, but is not sick, should be allowed to continue teaching

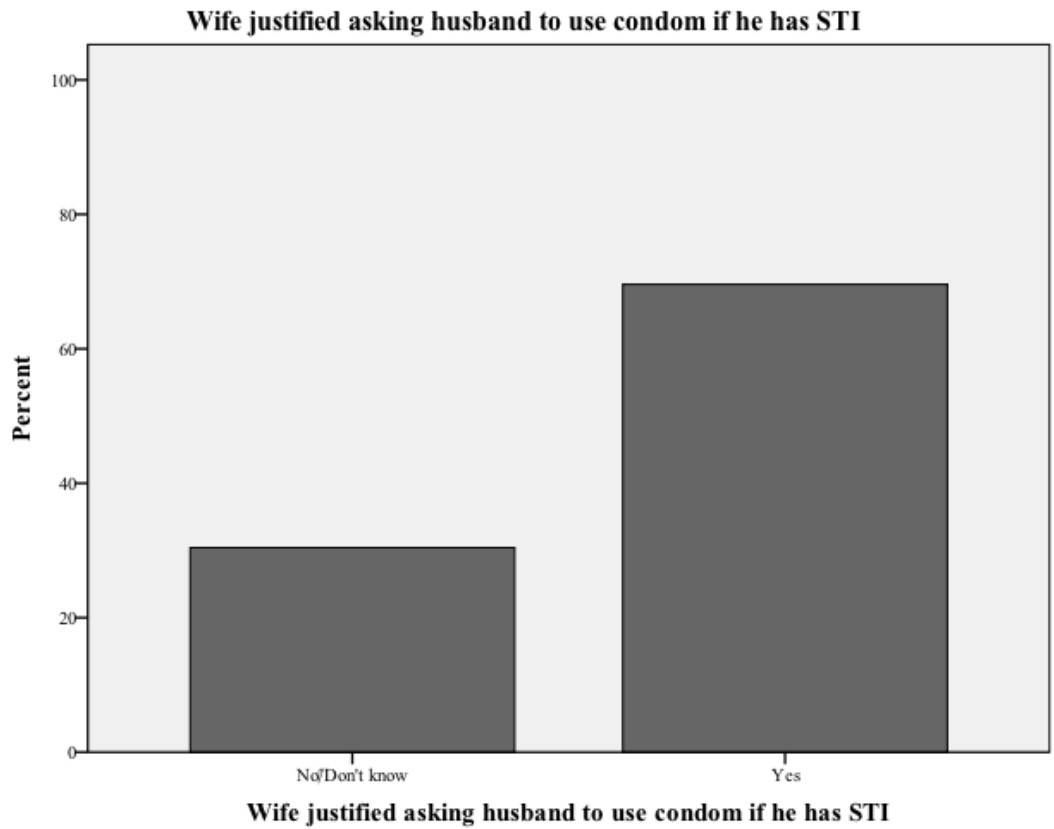
H.



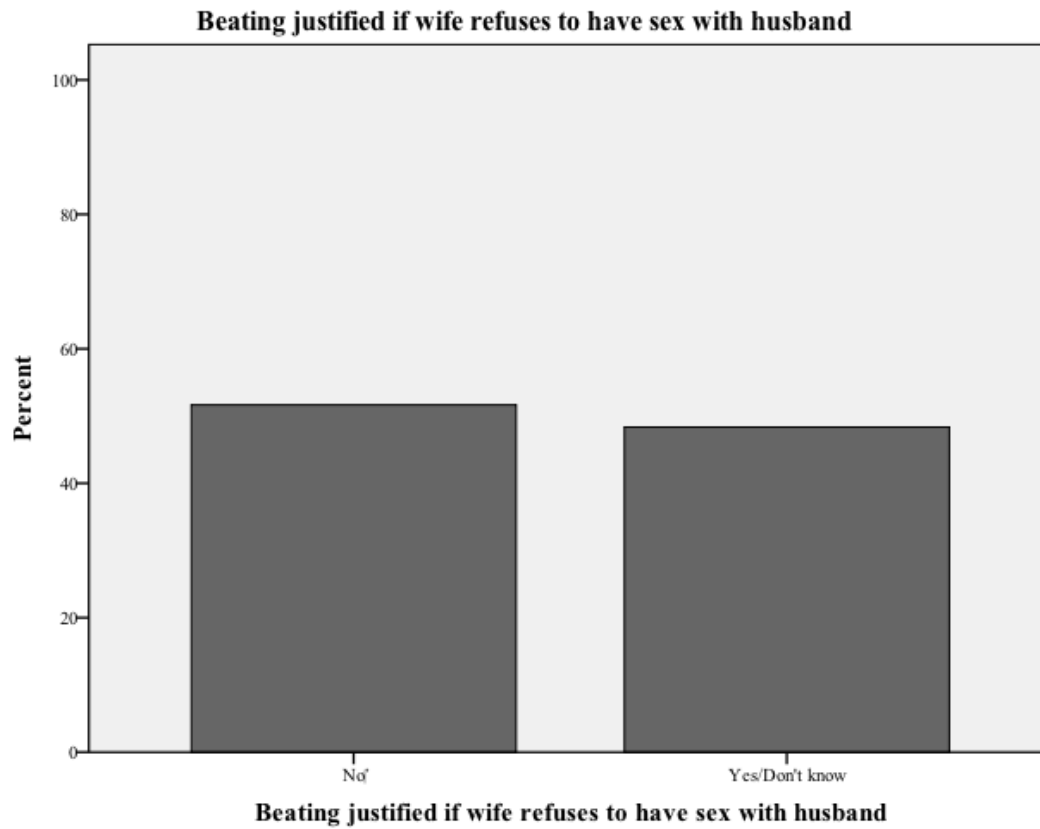
I.



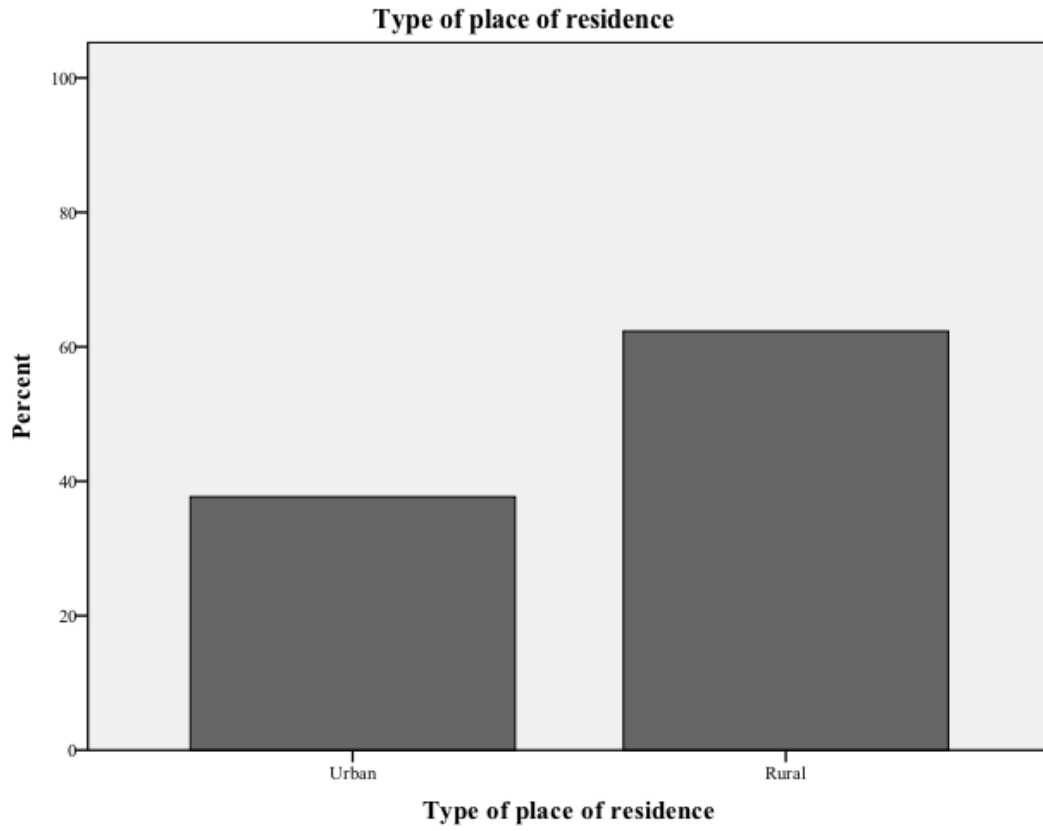
J.



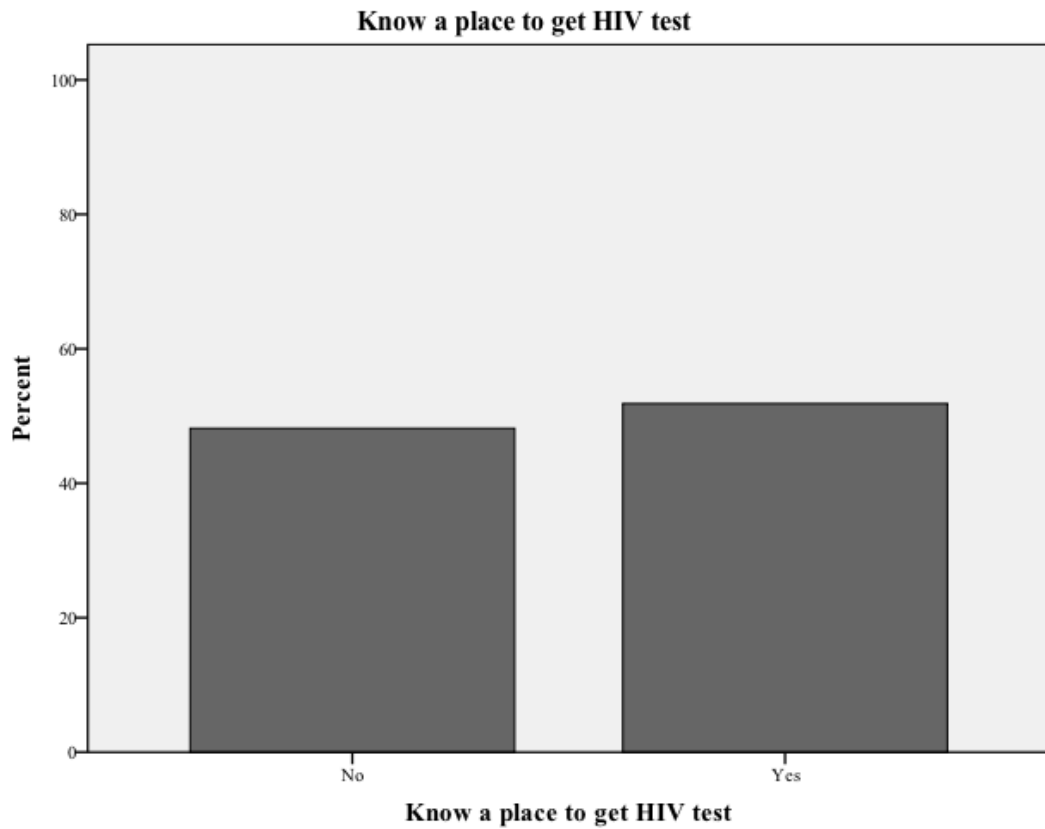
K.



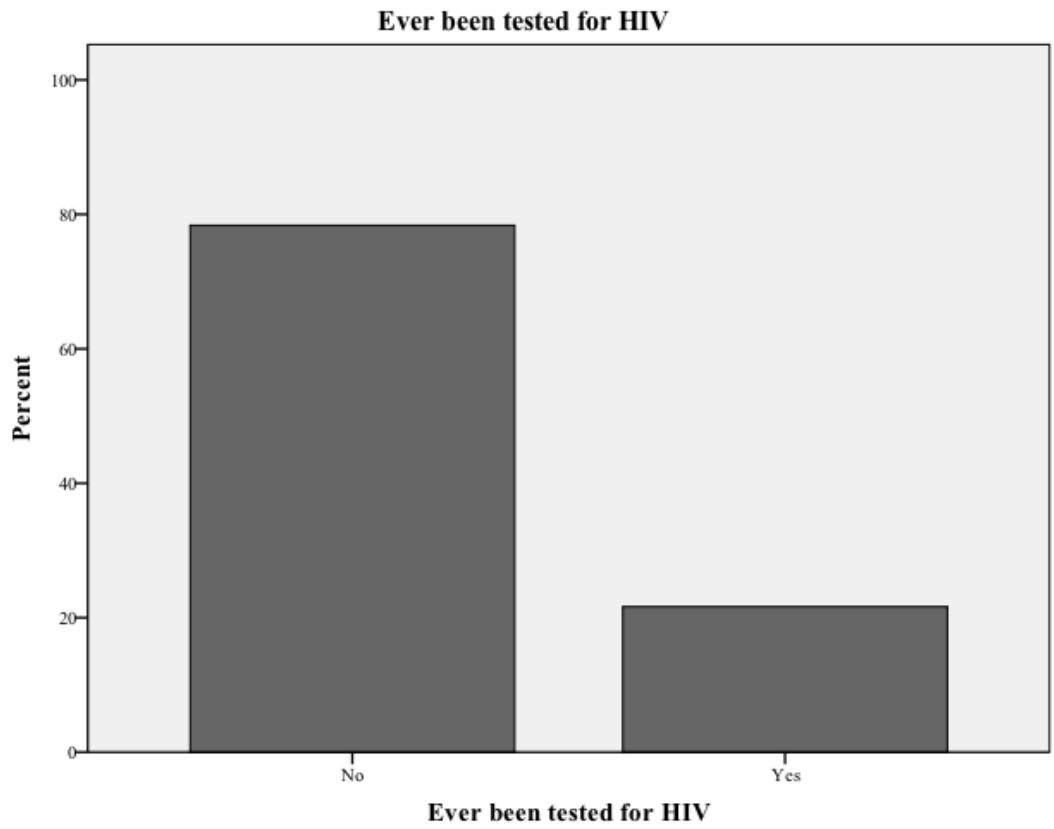
L.



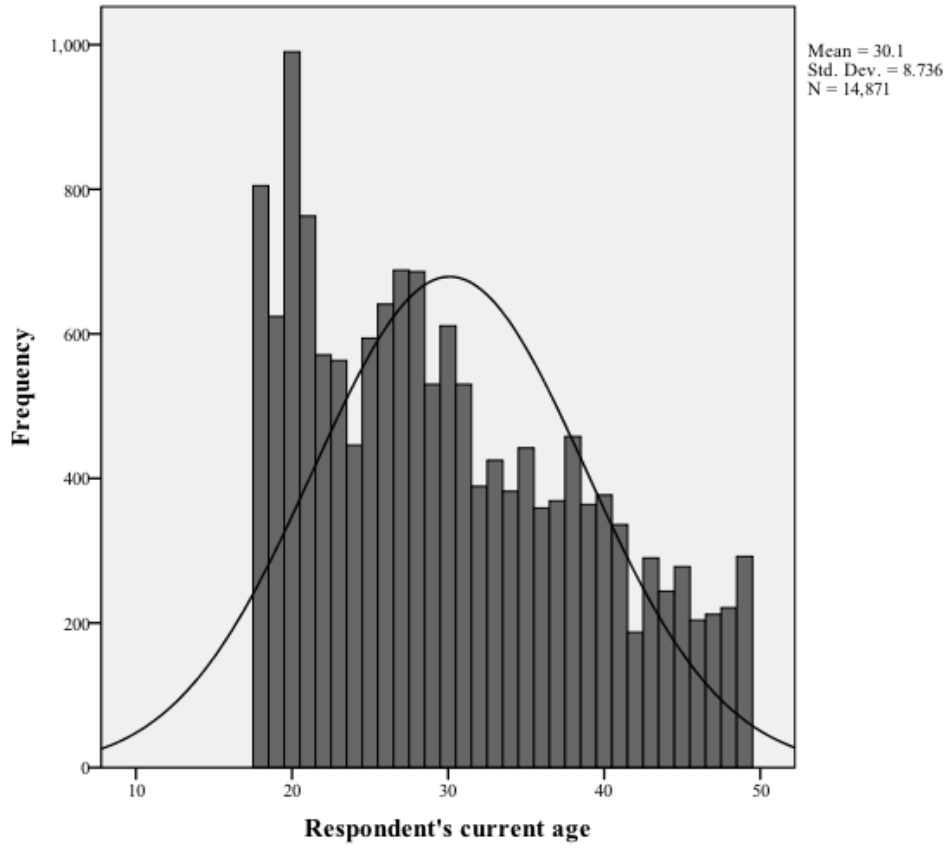
M.



N.



O.



P.

VITA

Danielle A. Walker started the Interdisciplinary Health Sciences Ph.D. Program at the University of Texas at El Paso in the fall of 2014. She recently earned her Public Health credentials as a Certified Health Education Specialist (CHES). She also holds a Master of Arts degree in Organizational Leadership from Azusa Pacific University, a Bachelor of Science degree in Public Health Education from California State University Northridge, and an Associate of Science degree in Biological Sciences from College of the Canyons.

Before relocating to the Southwest, Danielle worked at the Maine Center for Disease Control and Prevention (CDC) where she independently managed the AIDS Drug Assistance Program (ADAP) for the State. At the CDC she managed the \$1.9 million budget for the ADAP, which was mostly funded by federal and state grants. She also wrote state policies and legislative rules, and oversaw the Ryan White Part B ADAP Advisory Board.

Danielle has a passion for global health and helping those in greatest need. She has used educational and career opportunities to fight injustice, particularly within vulnerable populations and those living with HIV. She has traveled to the Philippines, Mexico, Africa, and parts of the U.S. to work among those living in extreme poverty.

Danielle currently works for Heart for the World International, a nonprofit established 17 years ago to bring resources to those living in extreme poverty around the world. As the Director of Global Research and Development, she travels to conduct community needs assessments, writes international contracts, and tracks progress of international partnerships. She is working on expanding this new division of the organization.

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