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# The Role of Prenatal Care and Systematic HIV Testing in Preventing Perinatal Transmission in Tanzania, 2011-2012

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Abstract

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Dissertation Submitted in Partial Fulfillment

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## Abstract

In 2012, Tanzania, the prevalence of HIV infection among Tanzanian women was 6.3%; that same year, 18% of Tanzanian children were born already infected with HIV. The purpose of this study was to determine the importance of prenatal care attendance on comprehensive knowledge of HIV mother-to-child transmission (MTCT), and HIV testing and counseling, as well as awareness of HIV testing coverage services, in Tanzania. The study population was Tanzanian women of childbearing, aged 15 to 49 years old. Guided by the health belief model, this cross-sectional survey design used secondary data from the 2011-2012 Tanzania Demographic Health Survey. Independent variables were comprehensive knowledge of HIV MTCT, HIV testing and counseling, and awareness of HIV testing coverage services; the dependent variable was prenatal care visit (PNCV) attendance. Findings showed that 69% of women had their first PNCV in the second trimester, meaning that they attended less than 4 visits. Multinomial logistic regression modeling assessed the association between independent variables and PNCV attendance after controlling for sociodemographic factors. Findings denoted that comprehensive knowledge of HIV MTCT after controlling for married vs. never married, maternal age, and wealth was associated with PNVC. HIV testing and post counseling, and awareness of HIV testing coverage services were also significant for women who attended their first prenatal visit in the 2nd trimester. These findings have positive social change implications by informing efforts to identify at-risk pregnant women through systematic HIV testing and counseling for early medical intervention; such efforts may reduce MTCT and encourage them to start their PNCV in the first trimester.

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# Dedication

I dedicated this doctoral dissertation to my parents, Professor Dr. Bianda Ntombo (Pediatric Surgeon) and Malundama Landi Marie-Jeanne. I also dedicated this work to my lovely children Marie-Pierre Diomi, Jeanne Landi Diomi, Patrick-Bryan Diomi, and Nathan Diomi. They have to study hard and give priority to the science of knowledge.

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# Chapter 1: Introduction to the Study

## Introduction

Approximately 4.7 million children die every year in Sub-Saharan Africa, including 1.2 million newborns; many of these deaths are due to human immunodeficiency virus (HIV) being transferred from their mother during pregnancy (Kinney et al., 2010). Consistent attendance to at least four prenatal care visits (PNCV), as recommended by the World Health Organization (WHO), can prevent, diagnose and treat health issues, including HIV that may harm the fetus and the mother (WHO, 2015). The first PNCV is critical as it allows health care providers to detect HIV infection among pregnant women with the possibility of counseling and therapeutic interventions for those who consent.

Early detection of HIV infection during the first visit reduces the likelihood of perinatal transmission, infant morbidity, and mortality. To encourage this reduction, many countries in Sub-Saharan Africa have started to integrate counseling and HIV testing into prenatal care visits (Sagna & Schopflocher, 2015). An understanding of the extent of the association between prenatal care and HIV testing is crucial to the efforts to increase infant survival in Tanzania by reducing the rate of vertical transmission.

In Tanzania, the setting of this research, the epidemic of human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS) has affected the quality-of-life indicators such as the infant mortality rate and life expectancy (Tanzania Commission for AIDS [TACAIDS], Zanzibar AIDS Commission [ZAC], National Bureau of Statistics, Office of the Chief Government Statistician, and ICF

International, 2013). Tanzania is located in East Africa, with a population of 51.82 million in 2014 (WHO, 2016). Tanzania is a low-income country with a gross domestic product per capita of U.S. dollars of 768 in 2014 (WHO, 2016). The prevalence of HIV was estimated at 5.3% in 2014 (WHO, 2016). The 2010 survey conducted in Tanzania showed approximately 96% of women participated in prenatal care visits (PNCV) one time during pregnancy while 42.8% attended all recommended PNCV (National Bureau of Statistics, 2011). Since 1983, the demographic consequences of the HIV/AIDS epidemic have been associated with the infant mortality rate and life expectancy (quality-of –life indicators); the government of Tanzania has made considerable improvement in HIV and AIDS prevention, care, and treatment since that time (TACAIDS et al., 2013).

In this chapter, I describe the background of the study, problem statement, and purpose of the study. I also introduce my research questions and hypotheses, the nature of the study, the conceptual framework. Finally, I discuss the assumptions, limitations, and delimitations associated with the selected methodology, as well as the study's potential significance and likelihood to promote positive social change.

## Background

Preventing mother to child transmission (MTCT) of HIV/AIDS is considered the most successful method to reduce the morbidity and mortality of infant and children in Sub-Saharan African countries. The rates of adverse outcomes for mother and baby increase when there is inconsistent attendance at prenatal care; this can delay the detection of HIV (Lema et al., 2014). To avoid this vertical transmission, it is crucial for

pregnant women to have the four recommended prenatal care visits and HIV counseling and testing in countries where the prevalence and incidence of HIV are high.

The primary objective of the global plan developed by the Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2011 was to reduce the new incidence of HIV infections among children by 90% by 2015 and reduce the rate of AIDS-related mortality by 50% (UNAIDS, 2011). The plan was to provide life-saving HIV prevention and treatment services for all women, especially those who are pregnant. Twenty-two countries with low-middle income and high estimated numbers of pregnant women living with HIV, including Tanzania, Zambia, and Zimbabwe, were covered by this plan. Plessis et al. (2014) stated that the reduction of MTCT of HIV seems to work effectively in developed countries due to significant coverage of prevention of mother-to-child transmission (PMTCT) services and antiretroviral therapy (ART). The PMTCT is well implemented in most of the Sub-Saharan Africa countries, but the rates of MTCT are still high. For example, the prevalence of HIV/AIDS among pregnant women in Tanzania was 3.2% in 2012 (TACAIDS et al., 2013).

HIV remains a serious issue and public health concern in Tanzania. In 2012, approximately 230,000 children under the age of 15 were living with HIV and 43,000 new pediatric infections per year were observed in Tanzania despite the extensive coverage of PMTCT services (Ngarina et al., 2014; Tanzania, Ministry of Health and Social Welfare, 2012a). The number of people living with HIV in Tanzania in 2014 was approximately 1,500,000, and the prevalence among adults aged 15 to 49 years was 5.3% (UNAIDS, 2014). An estimated 800,000 women (15 and older) in Tanzania were living

with HIV in 2014 (UNAIDS, 2014). The mode of transmission was approximately 80% heterosexual, and 18% MTCT (UNAIDS, 2012b). UNAIDS (2012b) reported that 96% of facilities in Tanzania implemented the PMTCT program, and 77% of HIV-infected pregnant women received ART. However, nearly 18% of infants were born HIV-positive, which was attributed to lack of access to PMTCT, inadequate antiretroviral regimens, poor compliance to treatment, or insufficient drugs (UNAIDS, 2012b). MTCT remains one of the greatest issues that face public health in Africa.

**Prenatal Care Visit and Prenatal Outcomes**

PNCV is considered a critical period for pregnant women because they receive all information and services about their health as well as the development of their unborn child during those visits (Nyamtema, Bartsch-de Jong, Urassa, Hagen, & Roosmalen, 2012). These services are education, counseling, screening, treatment, monitoring, and promotion of the well-being of the pregnant women and the fetus (Nyamtema et al., 2012). Early participation in PNCV might prevent perinatal transmission of HIV; therefore, appropriate therapeutic interventions should be addressed to avoid adverse fetal outcomes during pregnancy and delivery. The PNVC is also important as the health professional can detect the HIV status among pregnant women, and start early ART to prevent MTCT. The WHO recommends that all pregnant women should have a minimum of four antenatal visits to prevent, detect, and treat health problems during pregnancy (WHO, 2015).

In Tanzania, nearly 43% of women attended the four recommended prenatal care visits in 2010 (Lema et al., 2014; National Bureau of Health Statistics [NBS] & ICF

Macro, 2011). The attendance of women at four or more PNCV in Mainland (43%) was slightly less compared to the women in Zanzibar (49%) (NBS & ICF Macro, 2011). However, only 15% of women made their first PNCV before the fourth month of pregnancy and the majority of pregnant women did not attend the recommended number of PNCV (NBS & ICF Macro, 2011). Moreover, one-third of women made their first visit in their sixth month of pregnancy. In Table 1, I provide the number of PNCV and timing observed during the Tanzania 2010 survey.

Table 1

*Number of Prenatal Care Visit and Timing of First Visit in Tanzania, 2010 Survey*

| | Mainland | | | | |
|---|---|---|---|---|---|
| # and timing of PNVC | Urban | Rural | Total | Zanzibar | Total |
| **# of PNCV** | | | | | |
| None | 1.1 | 2.3 | 2 | 0.5 | 2 |
| 1 | 2.9 | 3.8 | 3.6 | 1.8 | 3.6 |
| 2-3 | 40.8 | 54.5 | 51.4 | 48 | 51.3 |
| 4+ | 54.8 | 39.1 | 42.7 | 48.9 | 42.8 |
| Don't know/missing | 0.4 | 0.3 | 0.3 | 0.7 | 0.3 |
| Total | 100 | 100 | 100 | 100 | 100 |
| **# of months pregnant at first PNCV** | | | | | |
| No PNCV | 1.1 | 2.3 | 2 | 0.5 | 2 |
| <4 | 19.1 | 13.8 | 15 | 17.1 | 15.1 |
| 4-5 | 49 | 49.9 | 49.7 | 49 | 49.7 |
| 6-7 | 29.6 | 31 | 30.7 | 31.9 | 30.7 |
| 8+ | 1.2 | 2.9 | 2.5 | 1.3 | 2.5 |
| Don't know/missing | 0 | 0.1 | 0 | 0.1 | 0 |
| Total | 100 | 100 | 100 | 100 | 100 |
| # of women with PNCV | 1,208 | 4,056 | 5,264 | 140 | 5,404 |
| Median months pregnant at first visit (for those with PNCV) | 5.2 | 5.5 | 5.4 | 5.3 | 5.4 |

Adapted from NBS and ICF Marc (2011). *Tanzania Demographic and Health Survey 2010*. Dar es Salaam, Tanzania: NBS and ICF Macro.

The lack of prenatal care and nonadherence to ART increases the likelihood of adverse pregnancy outcomes and neonatal mortality (Ades et al., 2013; Ezechi et al., 2013; Hae-Young et al., 2012). Adverse pregnancy outcomes include spontaneous abortion, stillbirth, intrauterine growth retardation, preterm delivery, and perinatal mortality (Chen et al., 2012; Ezechi et al., 2013; Hae-Young et al., 2012; Stratton et al., 1999). Adverse newborn outcomes include low-birth-weight, prematurity, neonatal death (Ades et al., 2013; Ezechi et al., 2013; Hae-Young et al., 2012; Stratton et al., 1999; Traore et al., 2013).

**Prenatal Care 2002 Guidelines in Tanzania**

The 2002 focused antenatal care guideline had been implemented to reduce the frequency of monthly facility visit to a least four times with counseling as well as clinical services (An et al., 2015). The concept of the antenatal care model reflects the understanding of the role of PNCV as promoted by the WHO (Von Both et al., 2006). Each visit consists of a well-defined set of activities linked to screening for conditions, providing therapeutic interventions as needed, educating women for safe delivery, and other issues related to pregnancy (Von et al., 2006). In Table 2, I present the partial rubric of the focused antenatal care model implemented in Tanzania (the content of each routine PNCV).

Table 2

*Partial Rubric of the Antenatal Care Model*

| Parameter | Focused antenatal care check list | | | |
|---|---|---|---|---|
| | First visit <16 weeks | Second visit 20-24 weeks | Third visit 28-32 weeks | Fourth visit 36 weeks |
| **Laboratory investigations** | | | | |
| **Blood:** | | | | |
| Haemoglobin | ✓ | ✓ | ✓ | ✓ |
| Grouping factor and rhesus | ✓ | | | |
| Rapid plasma reagin (RPR) | ✓ | | | |
| HIV testing | ✓ | | | |
| **Urine:** | | | | |
| Protein, sugar, acetone | ✓ | ✓ | ✓ | ✓ |
| **Drug administration and Immunization** | | | | |
| Iron | ✓ | ✓ | ✓ | ✓ |
| Folic acid | ✓ | ✓ | ✓ | ✓ |
| Antimalarial (Fansidar 3 tablets) | | ✓ | ✓ | ✓ |
| Tetanus toxoid | ✓ | ✓ | ✓ | |
| **Client education and counseling for the couple** | | | | |
| Process of pregnancy and complications | ✓ | ✓ | ✓ | ✓ |
| Diet and nutrition | ✓ | ✓ | ✓ | ✓ |
| Rest and exercise in pregnancy | ✓ | ✓ | ✓ | ✓ |
| Personal hygiene | ✓ | | | |
| Danger signs in pregnancy | ✓ | | | |
| Use of drugs in pregnancy | ✓ | | | |
| Effects of STI/HIV/AIDS | ✓ | ✓ | ✓ | ✓ |
| Voluntary counseling and testing for HIV | ✓ | | | ✓ |
| Care of breasts and breastfeeding | ✓ | | | |
| Symptoms/signs of labor | ✓ | | | |
| Plans of delivery (emergency, preparedness, place of delivery, transportation, financial arrangements) | ✓ | ✓ | ✓ | ✓ |
| Plans for post-partum care | ✓ | | | |
| Family planning | ✓ | | | |
| Harmful habits (e.g. smoking, drug | ✓ | ✓ | ✓ | ✓ |
| Schedule of return | ✓ | ✓ | ✓ | ✓ |

Adapted from" How much time do health services spend on antenatal care? Implications for the introduction of the focused antenatal care model in Tanzania", by C. Von Both, S. Fleba, A. Makuwan, R. Mpembeni, and A. Jahn, 2006, *BioMed Central, 6*(22), p. 4.

An et al. (2015) stated that 95.8% of pregnant women in mainland Tanzania attended at least one PNCV with skilled providers between 2005 and 2010. In addition, 23.1% of women having an issue in accessing health care facilities, which might be one of the factors that lead them to refrain from attending the four recommended PNCVs.

**Comprehensive Knowledge of Prevention of Mother-to-Child Transmission**

Understanding the level of knowledge about HIV transmission from a mother to the fetus/child and reducing the risk of transmission by taking antiretroviral drugs as recommended will considerably decrease MTCT during pregnancy, delivery, and breastfeeding (NBS & ICF Macro, 2011). It is important that prenatal attendees have knowledge about HIV MTCT and the prevention of vertical transmission (Byamugisha et al., 2010). General knowledge of HIV MTCT will enable prenatal attendees to be aware of their HIV status.

**HIV Counseling and Testing**

HIV counseling and testing are included in the focused antenatal care list in Tanzania. It is crucial to consider this option in the PNCV among women because knowing their HIV status allows them to make wise decisions for their health and the health of their unborn child. An et al. (2015) stated that the integration of HIV counseling and testing, which are positively perceived in Tanzania, will improve the coverage of HIV testing and treatment, resulting in early treatment for HIV-infected pregnant women to prevent vertical transmission. The perceptions of mothers and health care providers on integrating HIV testing in Tanzania with routine PNCV were positive, but stigma and

breaches of confidentiality lead to some women to discontinue services or refuse to seek health care (An et al., 2015).

Several factors may contribute to pregnant women's resistance to HIV testing such as stigma, discrimination, and fear of rejection by a family member. Pretest counseling and HIV testing among pregnant women are relevant to prevent HIV transmission, and this promotion is possible with the compliance of health care professionals (Sagna & Schopflocher, 2015). Knowledge of HIV status allows practitioners as well as pregnant women to make early decisions about starting ART, and allows future mothers to make informed decisions about breastfeeding (Sagna & Schopflocher, 2015). HIV counseling increases awareness of prenatal care and motivation to attend prenatal care as recommended (Lema et al., 2014). Moges and Amberbi (2011) analyzed the factors associated with readiness to accept voluntary counseling and testing among pregnant women during antenatal care. Moges and Amberbi concluded that there was a significant relationship between voluntary counseling and testing with knowledge on MTCT, gravidity, gestational age, and educational level.

This study assessed the comprehensive knowledge of HIV MTCT among Tanzanian women and the attendance of prenatal care visit.

## Problem Statement

The United Nations Inter-Agency Group for Child Mortality Estimation (UNIGME, 2014) reported that the United Republic of Tanzania had the highest amount of neonatal mortality (38,611) in Sub-Saharan Africa in 2013. This compared poorly to

other Sub-Saharan Africa countries such as South Sudan (37,025), Zambia (17,783), and Zimbabwe (17,311). There is strong evidence that HIV-infected women have a greater chance of having adverse pregnancy outcomes such as miscarriage and stillbirth and neonatal mortality compared with uninfected women (Kim et al., 2012). The integration of systematic HIV testing might improve the health outcome for both mother and child (An et al., 2015), consequently reducing neonatal and infant mortality.

According to Cunningham, Leveno, Bloom, Hauth, Gilstrap III & Wenstrom, 2005), prenatal care should be initiated as soon as there is a confirmed test of pregnancy. Prenatal care is essential because it determines the health status of the mother and fetus. Also, prenatal care allows health care practitioner or physician to initiate a plan for obstetrical care such as routine and high risk. Moreover, the importance of prenatal care is to define the health status of the mother and fetus; to estimate the gestational age of the fetus; to initiate a plan for continuing obstetrical care (Cunningham et al., 2005). A further goal of PNCV is to identify HIV-infected women in order to refer them to prevention of MTC HIV transmission services (Lema et al., 2014). Thus, consistent PNCV reduces maternal, perinatal morbidity, and mortality. Regular visits at specific intervals are necessary to screen pregnant women and fetus for abnormal health conditions that might develop during pregnancy Most women in developing countries attend PNCV at least once during their pregnancy, and fewer attend at least four visits (WHO, 2015).

This lack of prenatal care attendance is a serious public health problem as it is crucial to determine the HIV status of pregnant women during PNCV, especially where

the prevalence of HIV is extremely high. Educating pregnant women about the importance of PNCV will increase knowledge of HIV MTCT, as well as the frequency of obstetric visits. A comprehensive approach of HIV PMTCT during PNVC can reduce the perinatal transmission considerably and enhance HIV-infected pregnant women to adhere to ART. There is a need to address this lack of prenatal care in Sub-Saharan Africa, especially in Tanzania.

## Purpose of the Study

This quantitative cross-sectional survey design used secondary data from the TDHS to assess the relationship between comprehensive knowledge of HIV MTCT and prenatal care attendance after controlling for sociodemographic characteristics. The TDHS were collected from December 2011 to May 2012 (DHS, n.d.). The dependent variable is the prenatal care attendance. The independent variables are comprehensive knowledge of HIV MTCT (knowledge of HIV prevention methods, knowledge of HIV transmission during pregnancy, delivery, and through breastfeeding), HIV testing and HIV counseling, and awareness of HIV testing services coverage. The population of interest consisted of women aged 15-49 years who gave birth three years before the 2011-2012 survey.

## Research Questions and Hypotheses

- RQ1: Is there an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care?

- *Null Hypothesis ($H_0$)*: There is no statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.
- *Alternative Hypothesis (Ha)*: There is a statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.

- RQ2: Is there an association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care?
  - *Ho2*: There is no statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
  - *Ha2*: There is a statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
- RQ3: Is there an association between awareness of HIV testing coverage services and attendance of prenatal care?
  - *Ho3*: There is no statistically significant association between awareness of HIV testing services coverage services among women aged 15-49 years and attendance of prenatal care.
  - *Ha3*: There is statistically significant association between awareness HIV testing coverage services among women aged 15-49 years and attendance of prenatal care.

The dependent variable is the four recommended PNCV. The independent variables are knowledge of HIV MTCT, HIV counseling and testing, and awareness of HIV testing coverage services. The confounders are age, marital status, educational attainment, wealth quintile index, residence, and timing of first PNCV.

## Theoretical Framework for the Study

The theoretical framework for this study is the health belief model (HBM). The HBM is considered as the most widely used model in health behavior research to explain health-related behaviors in response to a diagnosed disease (Becker, 1974). The model was developed in 1950 by social psychologists in the United States Public Health Service to describe individuals' failure to participate in health prevention programs (Champion & Skinner, 2008; Rosenstock, 1974). Several concepts have been identified in the HBM that predict the way an individual will take action to prevent or to control disease conditions (Champion & Skinner, 2008). One of the concepts of this model is individuals who showed beliefs in their personal susceptibility to the disease (e.g., HIV) and about the benefits of early detection, will be willing to obtain a screening test or prevention services (Hochbaun, 1958). Thus, when individuals have susceptible perceptions to serious diseases and believe that the condition may have a serious potential effect on their health, they will adopt a preventive behavior to reduce the risks. Individuals weigh the benefits of adopting healthy behavior or accepting any recommended health action. Knowledge of HIV MTCT will help HIV-infected pregnant women to adopt a preventive behavior, especially women with high-perceived susceptibility (Moges & Alemayebu, 2011).

## Nature of the Study

This study was a quantitative cross-sectional survey using secondary data conducted in Tanzania from December 2011 to May 2012. A cross-sectional design is often used in survey research where a random sample of selected participants respond to a set of questions concerning their characteristics, backgrounds, past experiences, and attitudes (Frankfort-Nachmias & Nachmias, 2008). Cross-sectional studies can be conducted in a short period of time, which reduces the costs, and the results are highly generalizable if the studies are based on a sample of the general population (Aschengrau & Seage III, 2008). I used secondary data from the Tanzania Demographic and health surveys (TDHS). The datasets contain responses to questions about knowledge and behavior concerning HIV/AIDS and malaria, measures of HIV prevalence among women and men aged of 15-49, and measures of the presence of malaria among children. This study focused only on HIV/AIDS among women aged of 15-49 who participated in the survey. In the original study, the female's respondents were asked to provide information about birth history, antenatal care, and pregnancy. This study analyzed the level of knowledge about HIV MTCT, awareness of HIV testing services coverage, and HIV testing and counseling among women respondents aged 15-49 years with live birth in the last two years preceding the survey.

The TDHS used random sampling to select women to participate in the survey during the year of 2011 and 2012. The sampling method used by the DHS is a multistage stratified sampling to ensure that different groups of a population are represented adequately in the sample. The data were collected in mainland Tanzania and Zanzibar.

Mainland Tanzania consists of 10 zones (Western, Northern, Central, Southern Highlands, Lake, Eastern, Southern, and Southwest Highlands) and 25 regions (Dodoma, Njombe, Dar es Salaam, and more). Zanzibar consists of five regions (Unguja North and South, Town West, and Pemba North and South). The map in Figure 1 displays the regions of Tanzania.


*Figure 1*: Map of Tanzania. From http://www.worldlanguage.com

The data analysis plan included descriptive and inferential analyses. SPSS Statistical software, version 21, has been used to conduct statistical analyses between the dependent variable and independent variables to estimate their association. I provided more details about the nature of the study and the collection of the data in Chapter 3.

## Operational Definitions of Terms

*Acquired immune deficiency syndrome (AIDS):* A disease first identified in 1981 after an unusual cluster of cases of infections with Pneumocystis carinii in five young homosexual men in the United States (Clutterbuck, 2004, p. 202; Fauci & Lane, 2005, p. 1076). AIDS is caused by the human immunodeficiency virus infection (Clutterbuck, 2004, p. 202; Fauci & Lane, 2005, p. 1076; Zolopa & Katz, 2014, p. 1306).

*Adherence to HIV treatment:* The extent to which a patient is taking the recommended medications as prescribed by the health care provider (WHO, 2003).

*Antiretroviral therapy* (ART): Agents or drugs that are used to suppress the replication of HIV by interrupting the HIV life cycle at various stage (Clutterbuck, 2004, p. 255; Zolopa & Katz, 2014, p. 1326).

*CD4 count:* A measure of the extent of damage to the immune system which is reflected in depletion of the T-helper lymphocyte subset bearing the CD4 surface antigen (Clutterbuck, 2004). It is considered as the most reliable single predictor of the probability of developing opportunistic infection, AIDS or death (Clutterbuck, p. 220).

*Differentiation of T lymphocytes:* Cellular or cluster differentiation (CD) glycoproteins present on the surface of many cells of the body (Dunn, 2001, p.385). CD4 and CD8 T lymphocytes are the two major types of T cells, and they are classified as CD4+ lymphocytes and CD8+ lymphocytes (Dunn, 2001, p.385). The CD8+ are the CD positive (CD8 killer cells), which contribute to the cell-mediated immune response against virus-infected cells or tumor cells. HIV infects HIV-specific CD4+ T cells, principal cellular receptor for HIV (Clutterbuck, 2004, p. 205; Fauci & Lane, 2005, p.

1076). For untreated patients or individuals with no adherence to therapy, the CD4 + cells drop below 200/μL. The patients then become highly susceptible to opportunistic infections, AIDS-defining illnesses (Fauci & Lane, 2005, p. 1088). Thus, CD4 T cell count is considered as an indicator for initiation of antiretroviral therapy (Lu et al., 2015).

*Focused antenatal care:* A goal-oriented prenatal care approach recommended by researchers in 2001 and adapted by the WHO in 2002 (WHO, 2002). The goal of this model is to provide timely and appropriate care to pregnant women to reduce maternal morbidity and mortality as well as having healthy newborn (The United Republic of Tanzania, Ministry of Health and Social Welfare, 2009).

*Highly active antiretroviral therapy:* A combination of three or more antiretroviral drugs administered simultaneously, which were introduced in the mid-1990s. This combination improves the prognosis of persons with HIV/AIDs (Clutterbuck, 2004, p. 202; Zolopa & Katz, 2014, p. 1306).

*Human immunodeficiency virus (HIV)*: The virus that causes HIV infection. There are two types of viruses (HIV-1 and HIV-2) which belong to the family of human retroviruses and the subfamily of lentiviruses (Clutterbuck, 2004, p. 202; Crane & Kitahata, 2006, p. 136; Fauci & Lane, 2005, p. 1077). HIV-1 is the most common cause of HIV infection. HIV-2 is found in West Africa and is less virulent than HIV-1 (Clutterbuck, 2004, p. 202).

*Neonatal death:* The death of a liveborn neonate 0-29 days after birth. Early neonatal death refers to the death of a liveborn neonate during the first seven days after

birth, while late neonatal death refers to death after seven days but before 29 days (Cunningham et al., 2005, p. 5).

*Non-nucleoside reverse transcriptase inhibitor* (NNRTI): Delavirdine, efavirenz, etravirine, nevirapine [NVP], and rilpivirine (Katz & Zolopa, 2015).

*Nucleoside reverse transcriptase inhibitors* (NRTIs): Abacavir, didanosine, emtricitabine, lamivudine [3TC], stavudine, tenofavir, zalcitabine [ddc] and Zidovudine [AZT or ZDV or retrovir] (Katz & Zolopa, 2015).

*Prenatal care:* A comprehensive antepartum care program that involves a coordinated approach to medical care and psychosocial support that optimally begins before conception and extends throughout the antepartum period (American Academy of Pediatrics and the American College of Obstetricians and Gynecologists, 2002). The preconceptional care, prompt diagnosis of pregnancy, initial presentation for pregnancy care, and follow-up prenatal visits are the concept of a comprehensive program (Cunningham et al., 2005, p. 204). According to the American Academy of Pediatrics and The American College of Obstetricians and Gynecologists (2012), it is important to identify early a high-risk pregnancy to allow prevention and treatment of conditions associated with maternal and fetal morbidity and mortality (p. 6).

*Protease inhibitor* (PI): Amprenavir, atazanavir, fosamprenavir, indinavir, lopinavir/ritonavir [LPV/r] (Kaletra), nelfinavir, ritonavir (Novir), saquinavir, darunavir/ritonavir, tipranavie/ritonavir, and maraviroc (Katz & Zolopa, 2015).

*Viral load:* A quantitative measurement of HIV ribonucleic acid (RNA). Viral load is a predictor of future progression of the disease and death (Clutterbuck, 2004). The viral load is the best marker of response to ART (p. 220).

## Assumptions, Scope and Delimitations, and Limitations

### Assumptions

I assumed that all collected data from the DHS are accurate and reliable and therefore suitable to use to answer my research questions. I also assumed that the respondents understood the questionnaires that were prepared in English and translated into Kiswahili, which is an official language in Tanzania. This study considered that the information provided by the TDHS is valid and reliable, and the DHS selected nationally representative households (DHS, n.d.). Furthermore, I assumed that the data from the TDHS was weighted to adjust for unequal sampling and nonresponse.

### Scope and Delimitations

The variables and methodology defined the boundaries of the study. The study was delimited to the Republic of Tanzania, where the DHS program collected the datasets between December 2011 and May 2012. The participants were all women between 15 and 49 years of age who gave birth up to three years prior to the survey. Nomadic and institutional populations were excluded from the survey.

### Limitations

The study used a cross-sectional survey design, with DHS-collected data from Tanzania at one period of time, from December 2011 to May 2012. In cross-sectional design, the independent variables cannot be manipulated; therefore, the direction of

causation will be theoretical inferred (Frankfort-Nachmias & Nachmias, 2008). The information gathered during the interview was self-reported, which introduces the possibility of recall bias. This study used secondary data; therefore, the data set in which I am interested may have missing data that can interfere with the analysis.

## Significance and Implication of Social Change

One of the highest priorities of public health is the health of pregnant women and children (Schneider, 2012). The fetal and infant stages of development provide the foundations of good health throughout life (p.310). Prenatal care is considered an important fundamental component of reproductive health care. Many services offer preventive strategies for MTCT of HIV and malaria, as well as immunizations, education, counseling, and screening to pregnant women to reduce maternal and newborn/infant morbidity and mortality (Nyamtema et al., 2012). Infant mortality is an indicator of the health status of the whole population and reflects children's health (Schneider, 2012). In Tanzania, infant mortality was estimated at 46.2 per 1,000 live births in 2012 (es Salaam, 2015). The rate of maternal mortality was estimated at 432 maternal deaths per 100,000 live births in 2012. In addition, the 2012 Population and Housing Census in Tanzania reported that 15,056 out of 56,178 female deaths were pregnancy-related. According to es Salaam (2015), socioeconomic demographic characteristics (mother's age, education attainment, marital status, occupation) and survival of preceding sibling(s) are considered as the most frequently reported causes of infant and child mortality. Women with low socioeconomic status, low educational level, young/single minority women are more

likely to lack access to medical care due to financial and others reasons (Schneider, 2012).

The lack of prenatal care has been linked with an increased risk of infant and maternal mortality. Pregnant women should attend the four recommended PNCV to reduce maternal and infant morbidity and mortality. This study focused on comprehensive knowledge of HIV MTCT among pregnant women as the Sub-Sahara African countries have a high prevalence of HIV. Having knowledge about HIV and its prevention will allow women to participate in HIV counseling and to accept HIV testing. In addition, pregnant women will be more active in attending PNCV as prenatal care promotes the well-being of the mother and her fetus. The positive social change implication of this study's findings will be to encourage pregnant women to attend the PNCV and to introduce systematic HIV screening along with counseling to all pregnant women. This can be possible with a comprehensive health education of HIV/AIDS including the myth of misconception during each prenatal visit. The clinical and public health implications based on the findings will strengthen the prevention of HIV MTCT and reduce all barriers that prevent women from adhering to PNCV as recommended by the WHO.

## Summary

In this chapter, I have provided a detailed introduction to the study. I have produced the results of multiple studies to discuss the obstetrical and neonatal outcomes among HIV-infected women in Sub-Saharan Africa. Some barriers have been attributed to lack of prenatal care visits. Despite the many efforts that Sub-Saharan countries are

engaged in to reduce the vertical transmission by implementing efficient PMTCT, most of the countries did not reach the 2015 UNAIDS recommendations. The recommendations are to reduce considerably the prevalence of HIV and to eliminate MTCT. The government of Tanzania has made considerable efforts to improve HIV and AIDS prevention, especially among pregnant women. Consistent prenatal care visit is a significant component to reduce the risk of perinatal transmission. Having knowledge of HIV MTCT and understanding the importance of HIV testing will increase the chance of having a healthy baby. The purpose of the study, research questions, and significance of the study were discussed in this chapter. Finally, the assumptions, limitations, scope and delimitations were stated.

The literature reviews as related to the study population, dependent, and independent variables were described in Chapter 2. In Chapter 3, I discuss the research methods for this study, which includes the research design, methodology, threats to validity, and ethical procedures.

# Chapter 2: Review of the Literature

## Introduction

Sub-Saharan Africa is experiencing an epidemic with approximately 90% of HIV-infected infants and children becoming infected due to vertical transmission during pregnancy, delivery, and breastfeeding (United Nations International Children's Emergency Funds [UNICEF], 2015; Yogev & Chadwick, 2004). Despite efforts to prevent mother-to-child transmission in Sub-Saharan Africa, the rate of transmission remains high (du Plessis, Shaw, et al., 2014). Tanzania had the highest incidence of neonatal mortality (38,611) in 2013 compared to other Sub-Saharan countries such as the Republic of South Sudan (37,025), Zambia (17,783), and Zimbabwe (17,311; UNIGME, 2014; Ubesie, 2012).

The WHO recommends at least four antenatal care visits (UNICEFF, 2015; WHO, n. d.). The risk of HIV MTCT infection can be significantly reduced if the mother follows the antenatal care and prenatal care recommendations appropriately. In Tanzania, pregnant women attend fewer recommended antenatal care visits or make antenatal care visits much later in pregnancy (WHO, 2014). The number of women living with HIV in 2012 was estimated at 730,000 in Tanzania (UNICEF, 2013) and 780,000 in 2015 (UNAIDS, 2016). This quantitative study assessed the relationship between comprehensive knowledge of HIV MTCT and prenatal care attendance after controlling for sociodemographic characteristics.

In this chapter, I review the recent literature on prenatal care and comprehensive knowledge of MTCT, and HIV testing and counseling. I provide a literature-based

analysis of how the health belief model (HBM) has been applied in previous studies. I also provide a rationale for the choice of this model and explain how it is related to the present study. I review and synthesize studies related to key variables and provide justification for selecting dependent, independents variables, and covariates. I concisely summarize major themes from the literature and describe how this study extends knowledge in the discipline as well as the methodology used in the reviewed literature.

## Literature Review Research Strategy

This review is based on literature I obtained from documents found through search engines including PubMed, MEDLINE, ProQuest, ERIC, and MeSH, and in key journals such as *African Health Sciences*, *African Journal of Reproductive Health*, *Annals of Internal Medicine*, *Current HIV Research*, *Ethiopia Journal of Health Science*, *BioMed Central*, *BioMed Central Pediatrics*, *BioMed Central Public Health*, *British Medical Journal*, *British Journal of Obstetrics and Gynaecology*, *Current HIV Research*, *HIV Medicine*, and *Journal of Acquired Immune Deficiency Syndromes*. In addition, other relevant sources were found from websites such as the World Health Organization/Sub-Saharan (WHO), the Ministry of Health and Social Welfare Tanzania, Tanzania Commission for AIDS (TACAIDS) and United Nations Programme on HIV, AIDS (UNAIDS), Central Intelligence Agency (CIA), United Nations International Children's Emergency Funds (UNICEF), and the National Institutes of Health. I also used some medical textbooks for accurate information about HIV, and its mode of transmission as well as its diagnosis and treatment. I also used academic libraries to access to ProQuest and search many other relevant databases needed for this literature review.

The keywords used to locate articles or books were linked to my research topic. The keywords were *pregnancy and HIV, infant mortality and HIV, prenatal care and neonatal mortality and HIV mothers, pregnancy and adherence to ART, Sub-Saharan countries and HIV, pediatric HIV infection and PMTCT*, *Tanzania HIV*, *neonatal mortality*, and *HIV testing and counseling*. During my preliminary literature searches, I selected only a few relevant articles by setting criteria for inclusion in and exclusion from the review. The criteria for inclusion were the language of the literature (English) and the setting of the study (Sub-Saharan Africa countries and Tanzania). After reviewing the literature, I identified all useful articles, designed my literature matrix, and then drafted summaries of the most relevant articles. Most of the articles selected were published within five years, except for a few articles that were published between 1970 and 2008.

## Theoretical Framework

HBM was the theoretical framework for this study. The model is the most commonly used in health promotion and education as well as health behavior research (Champion & Skinner, 2008; Glanz, Lewis, & Rimer, 2002). Rosenstock and Hochbaum developed the BHM in the 1950s by to understand the reasons why some people attended the screening programs of tuberculosis and others did not attend (Rimer, 2008). The objective of this model was to understand the determinants of individuals' health –related behaviors and how they can adopt positive behavior changes (Rimer, 2008). In addition, the BHM has been used to understand why some people accept health prevention services but do not adhere to health care or medical regimens (Champion & Skinner, 2008). This model was used in HIV counseling on MTCT prevention and has assisted researchers in

understanding the factors that are related to the acceptance of voluntary counseling and testing during prenatal care (Moges & Amberbir, 2011; Sagna & Schopflocher, 2014). Wangwe, Nyasinde & Charles (2013) stated that the HBM describes health behavior as a function of individuals' sociodemographic characteristics, knowledge and attitudes. Applying this model has had a positive effect on behavioral changes, however, these changes have a little influence on HIV/AIDS due to the confounder factors (perceived barriers) on people's decisions concerning their health behaviors that enhance their decision to adopt healthy behavior (Wangwe et al., 2013; Hounton, & Carabin, 2005).

The concepts of this model include individual's personal beliefs and perceptions of the disease and the strategies used to reduce the recurrence of the illness (Hochbaum, 1958). The HBM has several concepts that predict the health-related behavior of individuals to accept health education and prevention to reduce the risk of getting a disease (Champion & Skinner, 2008). These concepts are:

- perceived susceptibility,
- perceived severity,
- perceived benefits,
- perceived barriers,
- cues to action, and
- self-efficacy (Strecher & Rosenstock, 1997).

Figure 2 displays a flow chart of the HBM and its key constructs.

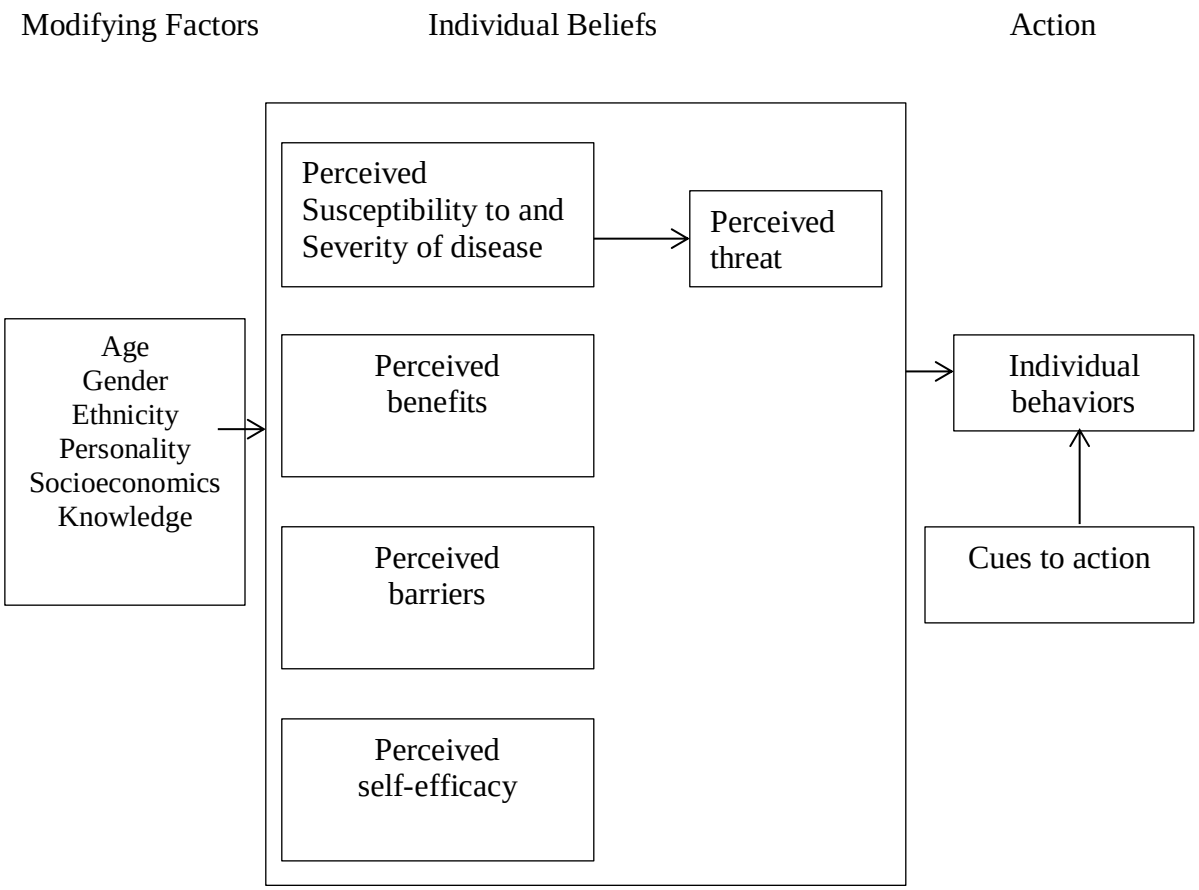


*Figure 2*. Flow chart of HBM and key constructs. Adapted from "Health Belief Model Components and Linkages", by K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (p. 49). San Francisco, CA: John Wiley & Sons, Inc.

According to Rosenstock (1974), the HBM's constructs have been applied successfully in research to explain a variety of preventive health behaviors, sick-role behaviors, and clinic utilization behaviors. The cues of action can be applied in this study because of the strategies of activating action such as willingness or readiness to be tested for HIV. Strecher and Rosenstock (1997) defined the cues of action as all internal or external factors that cause action. The HBM also provides a way to approach information

(e.g., HIV counseling) and how to promote awareness by using appropriate reminder systems (Champion & Skinner, 2008). Furthermore, Hampanda (2012) stated that interventions using the HBM framework normally try to increase knowledge through education and counseling as the *cue to action* to mothers.

Perceived severity is defined as the feeling of the seriousness of contracting the disease or leaving the illness untreated may lead to medical and clinical consequences such as death or disability (Champion & Skinner, 2008). Champion and Skinner defined perceived of susceptibility as the chance of getting a disease. For instance, the mothers have to believe that there is a likelihood of transmitting the HIV to their infants during pregnancy if their HIV test results are positive, and if they are not attending prenatal care as well as adhering to ART. The combination of the perceived susceptibility and severity is considered as perceived threat in the HBM, and has relevance for many health-related behaviors (Champion & Skinner, 2008).

The HBM construct of perceived susceptibility has been used to explain pregnant women's acceptance of HIV testing and the results, and to explain their willingness to acknowledge that their infants are susceptible to contracting HIV through MTCT (Hampanda, 2012; Igumbor, Pengpid & Obi, 2006; Moth, Ayayo & Kaseje, 2005). The perceived benefits are linked to mother's knowledge and belief that PMTCT interventions are advantageous and efficient to prevent MTCT (Hampanda, 2012; Igumbor, Pengpid & Obi, 2006). However, the concept of benefits is not universal in Sub-Saharan Africa countries (Hampanda, 2013); perceived barriers are a significant element in the PMTCT intervention (Hampanda, 2012). In a tangible and psychological

cost-benefit analysis, individuals have to weigh the advised action against the perceived threats and risks (Champion & Skinner, 2008). Assistance from a health care provider, reassurance through counseling, and correction of misinformation about HIV can reduce the risk of perceived barriers (negative thoughts of taking health action).

The construct of self-efficacy references the beliefs in a person's ability to perform a kind of behavior that may lead to outcome expectations (Bandura, 1997). Sociodemographic factors such as education and level of income may also indirectly influence individual perceptions (Champion & Skinner, 2008). As a result, there needs to be confidence in an individual's ability to take action. For example, the construct of perceived self-efficacy can be used to consider the perceived ability of pregnant women to attend prenatal care and adhere to PCV, PMTCT, and ART.

**Previous Literature-Based Analysis of HBM Application**

HBM is one of the most common models used as a theoretical framework in public health research and prevention. Several studies have applied this model in HIV prevention research to understand individuals' beliefs and actions to adopt preventive behavior based on personal perceptions of illness.

Kloeblen and Batish (1999) investigated the applicability of the HBM in research aimed at understanding the intention to follow a high folate diet permanently among low-income pregnant women in the Grady Health System in Atlanta, Georgia. A cross-sectional convenience sampling was used as the selection method, and 251 low-income pregnant women participated in 15-minute interviews regarding their attitudes and beliefs based on the HBM framework. The study participants were recruited as volunteers from

the Women, Infants, and Children (WIC) Program and prenatal care clinic. A brief synopsis of Folic Acid was provided to participants before the HBM assessment, and they received education about folate and neural tube defects (NTDs) after their interview. The dependent variable was the intention to follow permanently a high folate diet (folate intention). The perceived susceptibility construct was measured as a higher score if the participants perceived the risk of having a newborn with NTDs or pregnancy complications. The perceived severity construct was construed as higher if the score was reflecting greater perceived of seriousness of NTDs. The perceived benefits construct was measured with a higher score if the participants' responses indicated more perceived advantages to permanently following a high folate diet. The perceived barriers construct was scored high if the participants' responses represented greater perceived costs to permanently following a high folate diet. The self-efficacy construct was scored high for participants who had greater confidence in one's ability to permanently follow a high folate diet.

The HBM total scores in Kloeblen and Batish's (1999) study ranged from 22-110 with the higher scores, showing the appropriateness of this framework in research on pregnant women and their intentions to follow the recommended preventive health actions. In addition, the authors used the construct cues to action, which was measured individually. The authors found consistent correlations between HBM constructs and folate intention. The regression analysis suggested that the perceived benefits construct was the most predictable of folate intention. The model provides a useful base for developing folate educational interventions at the community and individual level with

specific target among low-income women of child-bearing age to improve perinatal outcomes (Kloeblen & Batish, 1999).

Workagegn, Kiros, and Abebe (2013) applied the HBM to identify the predictors and possible barriers of HIV-testing among prenatal care attendees in Addis Ababa, Ethiopia. The study was an institution-based cross-sectional survey of 308 pregnant women. Participants were interviewed using structured questionnaires adopted and modified based on the context of the study. The outcome variable was the utilization of PMTCT-HIV-test. The independent variables were the six HBM constructs and sociodemographic characteristics. Multivariate logistic regression analyses were conducted to analyze the predictors associated with HIV-test use. The results suggested that the perceived net benefit was not associated with the use of PMTCT-HIV test, AOR 0.34 (95% CI 0.19-0.58, $p<0.001$); however, the findings suggested that perceived self-efficacy, AOR 1.90 (CI 1.09-3.33, $p<0.05$) was associated with the outcome. Prenatal care attendees with high perceived self-efficacy were 1.9 times more likely to use HIV-test for PMTCT. The authors concluded that sociodemographic variables (age and marital status), and the perceived self-efficacy and lack of net benefit among HBM constructs were the key predictors of PMTCT-HIV-testing utilization of prenatal care attendees. The study was effective to design and improve HIV/AIDS prevention programs as well as to focus on health communication and counseling during prenatal care.

Moges et al. (2011) conducted a health institution based cross-sectional study along with qualitative methods to analyze the readiness to voluntary counseling and

testing (VCT) service utilization and related predictors among antenatal care attendees based on HBM in northwestern Ethiopia. The study had 418 pregnant women who attended the prenatal care clinics. The outcome variable was the readiness to utilize VCT services. The independent variables included sociodemographic variables (age, residence, marital status, religion, ethnicity, education, occupation, gravidity, and gestational age); knowledge of HIV/AIDS, MTCT, VCT; and HBM constructs. The results suggested that 63.4% participants had low perceived susceptibility to HIV whereas the perceived barrier to VCT utilization was high (78.3%). The barriers were stigma, discrimination, fear of knowing HIV status, and the influence of male partner. The authors concluded that less than 50% of participants were willing to use VCT based on the HBM constructs. The HBM was beneficial in this study as it helped the authors to identify the predictors and to assist for health behavioral intervention.

**Rationale for the Choice of HBM and its Relationship to This Study**

The HBM has been used extensively to define associations between health beliefs and health behaviors, and to inform interventions (Champion & Skinner, 2008). The HBM constructs can help to identify key strategies for preventing MTCT among prenatal care. The HBM predicts that pregnant women will be more likely to adhere to prenatal care recommendations if they feel susceptible to HIV/AIDS, believe AIDS is an extremely severe illness, perceive barriers to HIV testing and counseling as lower than perceived benefits, have higher self-efficacy for obtaining HIV testing, and receive a cue of action.

The HBM was used in this dissertation study to consider the association of knowledge of HIV/AIDS, acceptance of counseling and testing, and knowledge of services available to PNCV. In my research, I also included sociodemographic characteristics (as available) as covariates based on the HBM constructs.

## Literature Review Related to the Key Variables and Concepts

### History of HIV and the Burden of HIV Infection in Tanzania

The epidemic of HIV and AIDS started in 1983 in Tanzania, when three cases were reported in Kagera region (Lake zone; Tanzania Commission for AIDS [TACAIDS], 2015). In 1986, HIV/AIDS was reported in all regions of Tanzania, with an estimated 600,000 having developed AIDS and 2 million people infected with HIV (TACAIDS, 2015). In the same year, 75% of new HIV infections were reported among people aged of 25 to 49, and 15% of young people between 15-24. By 1999, 72,000 newborns were infected with the virus each year and 600,000 children were orphaned to the disease. According to UNAIDS (2012), as of 2011, approximately 1.6 million of people were living with the virus in Tanzania, including 1.3 million people aged 15 and older (UNAIDS, 2012). As of June 2012, the number of people on ART was 626,444, which exceeded the predicted target of 440,000 by 2011according to the Ministry of Health and Social Welfare (2012).

In 2014, nearly 1,500,000 people were living with HIV in Tanzania, and an estimated of 800,000 were women aged between fifteen years and over (UNAIDS, 2014). Also, it has been noted that in 2013, the number of people living with HIV in Tanzania was estimated at 1,400, 000; the number of new HIV infections among children aged

between 0 to 14 years old was approximately 250,000 (UNAIDS, 2013). It is estimated that 690,000 women between 15 and over were living with HIV in 2013 (UNAIDS, 2013). In 2011-2012, the prevalence of HIV was ranged from of less than 1% in Pemba region (Zanzibar) and 1.2% of people in Unguja (Zanzibar) to a high of 14.8% of people in Njombe region (TACAIDS et al., 2013). Njombe region is located in the Southern Highlands Zone of the Mainland of Tanzania. The HIV prevalence by residence was 7.2% of men and women in urban Mainland Tanzania, accounted for 8.9% of women age of 15-49. Whereas the prevalence in rural Mainland Tanzania was 4.3% of people, accounted for 5.1% of women age of 15-49. Thus, the total prevalence of HIV in Tanzania was 5.1% of individuals with 6.2% attributed to women age 15-49 (TACAIDS et al., 2013). The highest prevalence has been reported among people living in the wealthiest households (TACAIDS et al., 2013).

This estimation reflects that the prevalence of HIV is high in Tanzania compared to other Sub-Saharan countries.

**Risk Factors Related to MTCT of HIV**

According to Yogev & Chadwick (2004), there are three stages with a risk of MTCT of HIV: antepartum, intrapartum, or postpartum (breastfeeding). Polymerase chain reaction (PCR) can identify HIV from fetal tissue at ten week's gestation (Yogev & Chadwick, 2004; Tóth, Bácsi, Beck, & Szabó, 2001). It has been proven by immunocytochemistry and in situ hybridization that the placental tissue (first trimester) from HIV-infected women contains HIV (Yogev & Chadwick, 2004). Early detection of HIV infection among pregnant women during prenatal care reduces the vertical

transmission, as well as associated adverse pregnancy outcomes. In addition, some studies have shown that viral detection immediately after birth may be associated with early onset of clinical symptoms and quick progression to AIDS, which is consistent with more long-standing infection during the gestation period (Yogev & Chadwick, 2004). The detection of proviral DNA in a neonate's blood sample within forty-eight hours of life confirms that the transmission has happened in the intrapartum period (Tóth, Bácsi, Beck, & Szabó, 2001). The presence of DNA PCR in the neonate's blood sample after seven days suggests that the transmission had occurred in peripartum period (Tóth, Bácsi, Beck, & Szabó, 2001).

**Diagnosis of HIV**

Laboratory criteria can define the HIV infection based on detection of HIV1 or HIV 2 antibodies or HIV 1 HIV 1 p24 antigen (Heymann, 2015). The enzyme-linked immunosorbent assay (ELISA) is the standard test for HIV infection (screening), which is confirmed by Western Blot (WB) assay or immunofluorescence assay (Yogev & Chadwick, 2004). WB can have indeterminate results with early HIV infection, HIV-2 infection, pregnancy, autoimmune disease, and recent tetanus toxoid administration (Zolopa & Katz, 2007). Therefore, in the case of acute HIV infection, plasma HIV-1 RNA test is performed along with the HIV antibody test (AIDSinfo, 2015). Virologic diagnostic testing in infants with perinatal exposure, at ages 14 to 21 days, 1 to 2 months, and 4 to 6 months is recommended (AIDSinfo, 2015). Bassett, Chetty, et al. (2011) demonstrated that acute HIV infection is detectable through pooled serum HIV RNA screening. This test should be recommended to women during prenatal care where the

prevalence of HIV-infection is high, especially those women with indeterminate WB. According to Bassett et al. (2011), HIV screening has the potential to identify acute and chronic HIV infection that was undetectable with standard HIV testing algorithms.

Rapid HIV antibody test of blood or oral fluid samples provides results within 20 minutes, but the positive results must be confirmed with ELISA and WB (Katz & Zolopa, 2015; Zolopa & Katz, 2007). The rapid test is helpful when the results are needed immediately, such as with pregnant women in labor who have not been tested for HIV (Katz & Zolopa, 2015). The absolute CD4 lymphocyte count is used to predict the progression of the HIV infection; the CD4 lymphocyte percentage is more reliable (Zolopa & Katz, 2007). The CD4 [also known as helper-inducer] is the principal cell infected in HIV infection (Zolopa & Katz, 2007). The HIV viral load tests measure the level of active viral replication of the HIV and provide useful prognostic information, which is independent of CD4 counts (Katz & Zolopa, 2015; Zolopa & Katz, 2007). Viral load testing is an indicator or marker for ART (AIDSinfo, 2015).

According to Yogev & Chadwick (2004), the antibody test is positive among all neonates born to HIV-infected mothers due to the passive transfer of maternal HIV antibody through the placenta during pregnancy. HIV infection is indicated by the presence of immunoglobulin A (IgA) or immunoglobulin M (IgM) in the neonate's circulation because IgA and IgM do not cross the placenta Yogev & Chadwick (2004).

**Treatment of HIV Among Infected Pregnant Women**

Current recommendations are to initiate ART to all HIV-positive pregnant women regardless of the CD4 counts or the plasma HIV RNA copy (AIDSinfo, 2015b; Katz &

Zolopa, 2015). The goal of antiviral therapy is to keep the viral load under the limit of detection during pregnancy and to reduce significantly the risk of vertical transmission (AIDSinfo, 2015b). In addition, the goal is to maintain the CD4 T-lymphocyte count below 200 cells to reduce the risk of developing opportunistic infections.

**Neonatal Antiretroviral Regimens**

According to Yogev & Chadwick (2004), antiretroviral drug dosages for neonates may be difficult to determine because of their liver's immaturity. As HIV nucleic acid testing can be performed within the first days of life to diagnose neonatal infection, it is recommended to initiate antiretroviral drugs in HIV-infected neonates as early in the pregnancy as possible (AIDSinfo, 2015). In 2011, the Ministry of Health and Social Welfare (MoHSW) in Tanzania recommended that all positive HIV-infected women receive a fixed dose combination of Tenofovir/Lamivudine/Efavirenz for life regardless of the level of CD4 T lymphocyte count. The duration of antiretroviral prophylaxis was reduced to six weeks for all infected children (MoHSW, 2013). The PMTCT program implemented in Tanzania provides routine HIV testing and counseling; lifelong ART for infected mothers and prophylaxis to neonates until the age of six weeks (MoHSW, 2013). In addition, neonates born to HIV-infected mothers should receive a daily dose of nevirapine after birth according to the MoHSW, 2013. The national guidelines are based on the WHO recommendations as well as the national HIV/AIDS policies and strategies. Despite these recommendations, MTCT remains a major public health in Tanzania with an estimated of 21,900 new pediatric infections in 2011 (AVERT, 2012).

**Adherence to Medications**

According to the World Health Organization (WHO) PMTCT guidelines, all pregnant and breastfeeding infected-HIV women should be on ART for life (called Option B+) to prevent vertical transmission (WHO, 2013). Exposed neonates should be treated with nevirapine or zidovudine until the age of six weeks (WHO, 2013). In Option B+, all pregnant and breastfeeding women should be in triple antiretroviral drugs regardless of CD4+ cell count, and children should receive daily nevirapine or AZT from birth to four-six weeks (Coutsoudis, Goga et al., 2013). In contrast, Option B requires that pregnant HIV-women should be treated with triple ART for life if the CD4+ is ≤ 350 cells per microliter (μl), but if the CD4+ is > 350 cells per μl, the treatment will start at 14 weeks of gestation and continued intrapartum through childbirth (Coutsoudis, Goga et al., 2013). The ART may be stopped one week after the mother is no longer breastfeeding, according to Coutsoudis et al. (2013). The infant shall receive daily NVP or AZT from birth through the age of 4 to 6 weeks regardless the breastfeeding option. In 2011, the government of Tanzania adopted the option A of 2010 WHO guidelines, which is the use of ARV medications for treating pregnant women and preventing MTCT of HIV (An et al., 2014). PMTCT policies engaged testing and counseling partners in the health facilities, however in 2013, the option B and B+ were implemented with all HIV-infected pregnant women and breastfeeding mothers. In a study conducted in Dar es Salaam, Tanzania, some of the pregnant women participants opted for option B+ as it will help them to live longer and raise their children. Because of the stigma and discrimination,

other women prefer option B for PMTCT during the breastfeeding period (Nagira et al., 2014).

Adherence to ART during pregnancy and in the postpartum period reduced the transmission of HIV infection from mother to child (Siegfried, Van der Merwe, et al., 2011). Parker, Jobanputra, Okello et al. (2015) affirmed that the failure to start lifelong ART among HIV-infected women exposed them to an increased risk of morbidity and mortality due to HIV and AIDS. Kim et al. (2015) stated that early initiation of ART, along with the duration of coverage before delivery, could reduce the mother to child transmission. However, there are some barriers that contribute to the lack of adherence to ART; these could be overcome with such measures as developing appropriate health messages about the PMTCT program among pregnant women (Parker et al., 2015). Also, the fear of disclosure of the HIV status to the family could be a potential barrier to the initiation of ART among women, according to Parker et al. (2015).

Parker et al. (2015) found that the health service in Swaziland was the predominant barrier to initiating the ART regimens among women with HIV infection. Westreich et al. (2012) stated that social and personal problems such as stigma and intimate partner violence might contribute to nonadherence to ART. As the prevalence of HIV-infected women is high in Sub-Saharan Africa, it is crucial to initiate on-time highly active ART to prevent MTCT (Westreich et al., 2012). A study done in Mwanza, Tanzania by Watson-Jones et al. (2012), demonstrated that starting highly active ART during pregnancy at the antenatal clinic improves counseling and reduces the stigma that surrounding disclosure of HIV results. Because it will benefit the continuing care of HIV-

infected pregnant women, it is important to recognize all the challenges that could interfere with the implementation of the ART initiation among pregnant women during their prenatal care.

**MTCT in Sub-Saharan Countries**

HIV/AIDS, and childhood infections have contributed to the rise of child mortality rates in children (Kinner, Kerber, Black et al., 2010). Maternal-fetal is the most common mode of transmission of HIV infection in developed countries, according to Fauci and Lane (2005). The transmission occurs most commonly in the prenatal period (Fauci & Lane). According to Duri et al. (2010), the antenatal serum of HIV-1 RNA viral load, the total lymphocyte count (TLC), and the hemoglobin level were significantly related to vertical transmission in the third trimester, independent to the time of transmission. The presence of a high viral load and low maternal CD4+ T cell predict the transmission of HIV infection from mother to the fetus/infant (Fauci & Lane, 2005). Therefore, prenatal treatment of the HIV-infected mother plays an important role in the prevention of vertical transmission of the disease (Yogev & Chadwick, 2004). ART should be initiated in the second semester to avoid fetal adverse during the stage of development (Katz & Zolopa, 2015).

It has been observed that HIV and AIDS remain a major public health issues, especially the transmission between mother and child during pregnancy and breastfeeding. Some attribute the causes to loss of follow up, and others to socioeconomic status. An example of this can be found in Sidze et al. (2015) who studied different factors related to the loss of follow-up of infants born to HIV or infected

mothers. The risk of mother-to-child transmission of HIV infection can be prevented if the mother follows the recommendations for antenatal care and prenatal care adequately. Ahoua, Ayikoru, Gnauck, et al., (2010) confirmed that prevention of MTCT is important for controlling HIV/AIDS. The risk of mortality has been highly reported among infants with a lack of intrapartum antiretroviral prophylaxis (Ahoua et al., 2010). Sidze, et al., (2015) stated that other factors can be identified for MTCT such as poverty, lack of paternal support, the cost of transport, and the long distance from the house to the healthcare facility.

O'Gorman, Nyirenda & Theobald (2010) stated that the positive diagnosis of HIV and the fear of stigma might influence women's decision on taking or not taking nevirapine (antiretroviral treatment). Some mothers will not adhere to medication because of fear of stigma or omission, according to O'Gorman, Nyirenda & Theobald (2010). PMTCT can be inaccessible, ineffective, and unacceptable if community members, as well as family members, do not support mothers affected by HIV in a rural area. Azria, Moutafoff, Schmitz, Le Maux, Krivine, Pannier, et al. (2009) stated that early initiation of high active retroviral therapy along with appropriate monitoring prevents MTCT. Ades, Mwesigwa, Natureeba, Clark, Plenty, Charlebois, et al., (2013) reported a high neonatal mortality rate in a cohort of children born to HIV mothers who were on antiretroviral therapy in a rural town in Uganda; the prematurity and infection resulted in neonatal death. Despite the PMTCT and antiretroviral prophylaxis, the rate of neonatal mortality was still very high among HIV-infected infants (Ades et al., 2013).

Humphrey, Marinda, Mutasa, Moulton, LLiff, et al. (2010) affirmed that during primary maternal HIV infection, the risk of transmission is high when associated with breastfeeding, which was observed by a peak of HIV load in breast milk. Kuonza, Tshuma, Shambira, & Tshimanga (2010) affirmed that if there is no prevention, 20-45% of infants born from HIV-infected mothers will be vertically infected with HIV. The risk is higher among HIV-infected women with an advanced stage as demonstrated by Kim, Kasonde et al. (2012). Their study showed that the advanced HIV-infection was related to adverse pregnancy consequences such as stillbirth and neonatal mortality. Kim, Kasonde, et al. (2012) confirmed that the incidence of neonatal mortality among advanced HIV-infected pregnant women was more likely due to low birth weight and prematurity. The study has shown that 91% of HIV-infected women in Sub-Saharan countries need to be treated to reduce the MTCT, according to (Kim et al., 2012). However, 54 of those infected women received prophylactic antiretroviral drugs (Kim et al., 2012).

In Kenya, the prevention of mother-to-child transmission faced some challenges such as lack of partners' disclosure of HIV and fewer antenatal care visits (du Plessis, Shaw et al., 2014). Women in Kenya began their antenatal care after 20 weeks' gestation, which is considered late for their initial ART based on the 2012 PMTCT guidelines (du Plessis, Shaw et al., 2014). Aizire, Fowler & Coovardia (2013) stated that HIV screening of all pregnant women followed by antiretroviral treatment for PMTCT, as well as, intensive care of HIV–infected family members may considerably reduce new pediatric infections and the HIV rate amongst reproductive-age women in Sub-Saharan Africa. Kellerman, Ahmed, Feeley-Summerl et al. (2013) affirmed that the progression of

PMTCT may reduce the rate of pediatric infection to less than 1% in the developed countries. However, the Sub-Saharan countries have lagged behind in achieving their goals.

**Prenatal Care Among HIV-Infected Women in Sub-Saharan Africa**

According to Lema, Sando et al., 2014, antenatal care is vital for pregnant women as it prevents, diagnoses, and treats any illness or conditions that might occur during pregnancy or delivery. Detection of HIV status among pregnant women could save the life of both mother and child by allowing the initiation of an antiretroviral prophylaxis regardless of the CD4 T lymphocyte counts (WHO, 2013). According to (WHO, 2006), pregnant women should attend at least four prenatal care visits starting in their first trimester. The prevention of MTCT of HIV in Sub-Saharan countries was implemented a few years ago, and includes HIV testing, HIV counseling, and ART provided to mothers and their neonates (WHO, 2015). A study in South Africa found that failure to diagnose maternal HIV infection prior to delivery was the main cause for omitting prevention treatment for MTCT (Technau, Kalk et al., 2014).

During 2010 alone in Tanzania, about 98% of women attended antenatal care for at least one visit, while only 43% attended the recommended four times (Lema et al., 2014). It has been shown that late and inconsistent prenatal care attendance will delay the early detection of HIV infection in pregnant women and in the time for a referral to the program for mother-to-child transmission in reducing the vertical transmission of HIV infection (Lema et al., 2014). Increasing awareness of the importance of prenatal care among pregnant women, especially women at high risk, will reduce perinatal

transmission. A cluster-randomized controlled trial found that community health worker intervention for improving prenatal care uptake, HIV testing, and prevention mother-to-child transmission in urban Tanzania was possible at a low cost and on a large scale (Lema et al., 2014). However, MTCT of HIV continues to be major public health issue in Tanzania, especially in Dar es Salaam, according to Lema and colleagues. A cluster-randomized trial conducted in South Africa has shown that community health worker home visits increased adherence to infant ART prophylaxis rather than adherence to ART among mothers in preventing vertical transmission (Le Roux, Tomlinson, et al., 2013).

**Fetal/Perinatal and Newborn Outcomes**

The extant literature (Ezechi, Gab-Okafor, Oladele, et al., 2013; Barroso, da Silva, Ribeiro et al., 2015; Watts, Williams and et al., 2013) reveals that fetal/perinatal and newborn outcomes associated with HIV are:

- Spontaneous abortion, stillbirth or fetal demise, perinatal mortality
- Intrauterine growth retardation (IUGR)
- Low birth weight (LBW)
- Small–for-gestational-age (SGA)
- Preterm birth (PT)
- Low Apgar-score

In a retrospective cohort study done by Salihu et al. (2012), seizures and feeding difficulties were observed among neonates born from HIV/AIDS-infected mothers. A study in Nigeria found that the adverse neonatal outcomes independently associated with HIV were low birth weight, preterm delivery, perinatal death, and spontaneous abortion

(Ezechi, Gab-Okafor, Oladele, et al., 2013). Low CD4 T lymphocyte count and opportunistic infections were related to adverse obstetric and neonatal outcomes, according to Ezechi et al. (2013). Barroso, da Silva, Ribeiro et al. (2015) reported that the principal consequence of maternal HIV infection to the fetus is the vertical transmission, which leads to preterm birth, low birth weight, and intrauterine growth restriction. Adverse perinatal outcomes were observed more among neonates born to mothers with AIDS compared to HIV-infected mothers who did not develop AIDS (Barroso et al., 2015).

A study in Tanzania showed that maternal HIV infection was associated with a higher risk of low birth weight among mothers with an advanced clinical stage of illness, and that vertical transmission contributed to poor intrauterine growth (Defreyfuss, Msamanga et al., 2001). However, concomitant infection such as malaria and intestinal parasitic/helminthic infections may also contribute to the adverse fetal outcomes during pregnancy in Sub- Saharan Africa (Defreyfuss, Msamanga et al., 2001). Low-birth-weight and SGA increase the risk of neonatal death among neonates born from HIV-infected mothers secondary to HIV or indirectly through maternal nutrition during pregnancy, according to Defreyfuss et al., 2001). In a study done by Habib, Daltveit et al. (2008) in Tanzania, it was shown that untreated HIV-infected pregnant women had a higher risk of adverse pregnancy outcomes such as SGA, low birth weight, preterm birth and perinatal death (Habib, Daltveit et al., 2008). Indeed, stigma and discrimination attached to HIV/AIDS and fear of lack of confidentiality prevent HIV-infected women from seeking access to ART or accepting HIV testing and counseling for reducing

vertical transmission. It has been shown in Sub-Saharan Africa, that advanced maternal HIV infection increased the risk of adverse pregnancy outcomes such as spontaneous abortion and stillbirth secondary to low CD4 T lymphocytes count and high viral load (Kim et al., 2012). A study in Tanzania had reported that low birth weight was strongly related to neonatal mortality among infants born to HIV-infected mothers (Wei, Msamanga et al., 2004).

Other studies have found that the risk of stillbirth in HIV-infected pregnant women was related to low CD4 cell counts and not to plasma viral ≥ 100,000 copies per millimeter or less. Kim et al. (2012) stated that the risk of stillbirth was significantly higher (median value 76,560 vs. 39,783 copies per millimeter, p=0.01) in their study. Yet, symptomatic mothers with clinical manifestation were at more than three-fold risk of having a stillbirth compared to those with no clinical manifestations of AIDS (Kim et al., 2012). Kim et al. also observed in their study that a high maternal viral load and low hemoglobin were significantly associated with preterm birth and low birth weight.

Ades et al. (2013) stated that a strong predictor of neonatal mortality among HIV-exposed neonates born to mothers who received ART was premature delivery. Children born small for gestational age and immature were more likely to die in the neonatal period (Ades et al., 2013). The distance from the care facility and the rural site often delay pregnant women from attending prenatal care therefore, contributing to neonatal death (Ades et al., 2013). Despite the combination of ART provided to HIV-infected women in rural Uganda, the neonatal mortality rate was high with prematurity as the leading cause of death, according to Ades et al.

Van der Merwe et al. (2011) found in a cohort of HIV-infected women from South Africa that a low level of CD4 T-lymphocyte counts less or equal to 250 per millimeter cube, and early highly active ART exposure increased the chance for women to have a preterm birth. Watts & Mofenson, 2012 echoed that the initiation of highly active antiretroviral therapy (HAART) to HIV-infected pregnant women was based on the lower level of CD4+ lymphocyte counts, and the observed effect of adverse outcomes may be confounded by the advanced stage of illness. Some studies demonstrated that the increased risk of preterm birth among HIV- women on HAART was highly compared to those who received zidovudine (ZDV) alone or a combination nucleoside therapy for MTCT prevention (Kourtis, Schmid, & Jamieson, 2007; Thorne, Patel, & Newell, 2004). The risk is also observed among HIV-infected pregnant women who received only HAART to prevent vertical transmission (Watts & Mofenson, 2012; Patel et al., 2010).

**Preventing Perinatal Transmission of HIV**

The prevention of perinatal transmission of HIV starts by proposing HIV counseling and testing to all pregnant women as well as to all women of childbearing age. Women with positive results should start with at least three medications. For women with high CD4 count and low HIV-RNA, it may be reasonable to hold the treatment until the second trimester to initiate therapy to decrease the likelihood of harm to the developing fetus from the medications (Katz & Zolopa, 2015). Watts, et al. (2013) observed that the combination of antiretroviral drugs with PI in the first trimester of pregnancy is related to the increased risk of prematurity compared with NNRTI or triple- NRTI administered early in pregnancy. There was no association of preterm birth when the PI was

administered late in pregnancy (Watts, Williams et al., 2013). The changes in the immune system and the inflammatory mediators observed early in pregnancy may contribute to adverse pregnancy outcomes such as preterm birth and small gestational age (Watts, Williams and et al., 2013). The combination of antiretroviral drugs in the first trimester plays a major role in reducing the vertical transmission of HIV to less than 1% (Townsend, 2008). Therefore, initiation of a combination of antiretroviral regimens should be based on certain factors related to pregnancy and HIV infection, though the correlation between the drugs and adverse birth outcomes is not well understood (Chen et al., 2012). The World Health Organization (2012) recommended HAART for all women regardless the CD4 cell count and a single dose of universal HAART (Option B+) for treating HIV-infected mothers and preventing vertical transmission in resource-limited settings. However, early initiation can be more efficient in preventing perinatal transmission of HIV. Women with negative results should be offered HIV counseling.

**Comprehensive Knowledge of HIV/AIDS in Prenatal Care Services**

Acquiring knowledge of HIV/AIDS during prenatal care through health education is a foundation for achieving the goal of HIV PMTCT. Malaju and Alene (2012) analyzed the factors that predict pregnant mothers' knowledge of MTCT of HIV and its prevention in Gondar health facility, Northwest Ethiopia. The authors conducted a health institutional based cross-sectional quantitative study, and a stratified sampling technique was used to select 400 pregnant women who attended PNCV. A structured questionnaire was employed to collect data among participants. The outcome variables were of pregnant women's knowledge of MTCT of HIV and PMTCT of HV. The independent

variables were the number of PNCV, comprehensive knowledge of HIV/AIDS, risk perceived of HV, perceived benefit of the HIV test, the stigma attitude towards people infected with HIV/AIDS, and sociodemographic characteristics. Their results showed that 83% of pregnant women had knowledge of HIV MTCT and PMTCT. The knowledge of HIV MTCT was positively related to PNCV done in the hospitals (AOR=4.49; 95% CI: 1.003, 20.06) and mothers living in the urban zone (AOR=2.46; 95% CI: 1.19, 5.09). In addition, knowledge of HIV MTCT and PMTCT were associated with educational level/secondary and more (AOR=6.85; 95% CI: 1.96, 24.01). However, the knowledge of HIV MTCT was negatively associated with advanced maternal age. The results were similar for the knowledge of HIV PMTCT. The authors concluded that a majority of pregnant women was aware of HIV MTCT and HIV PMTCT as well as ART prophylaxis. Lack of knowledge of HIV MTCT and PMTCT, as well as limited access to PNVC, may increase the incidence of pediatric HIV infection. This study was a cross-sectional survey; therefore, causation cannot be concluded from the results.

**HIV Testing and Counseling in Prenatal Care Services**

Because of stigmatization, fear of receiving a positive test, and breach of confidentiality by the health care provider there is reduced acceptance of HIV testing and counseling; this remains a major problem for public health in most of the Sub-Saharan countries (An et al., 2015). HIV testing allows women or pregnant women to be aware of their HIV status and to prevent MTCT and start ART early (Sagan & Schopflocher, 2015). Women with higher levels of education are more likely to participate in the pretest counseling as they can understand health information and the importance of prevention of

mother to child transmission (Sagan & Schopflocher, 2015). Systematic HIV testing may play a crucial role during the first prenatal visit, as pregnant women will not have to make a choice whether they will accept or decline.

Gunn et al. (2016) conducted a cross-sectional study to evaluate individual and health system-level factors that influence HIV testing as part of prenatal care services in Congo, Mozambique, Uganda, and Nigeria. The data were obtained from the DHS collected between 2011-2013. A total of 25,201 pregnant women were included in the study. Participants were women who received prenatal care five years from the survey. The outcome variable was prenatal care provider categorized as skilled or nonskilled. The independent variable was an uptake of HIV testing. The covariates were sociodemographic characteristics, difficulty accessing a medical facility, stigma towards someone with HIV and comprehensive HIV knowledge. Statistical analysis included chi-square and logistic regression models. The findings showed that women, in all four countries, who received their prenatal care from a skilled attendant were more likely to be tested for HIV compared to those who were seen by an unskilled attendant (OR=1.78; 99% CI: 1.45-2.18). However, HIV testing rates were lower in rural zones among poor and low educated women as well as those with low knowledge in HIV. This study demonstrated individual, and health system causes that influence pregnant women's acceptance of HIV counseling and testing as part of their prenatal care services in sub-Saharan Africa. These causes are age, poverty, lack of knowledge of HIV, stigma, low level of education, difficulty in accessing a health care center, and unskilled attendants.

Health care workers need to be trained to educate pregnant women about HIV/AIDS during prenatal care and support those who receive positive results.

During PNCV, HIV testing and counseling are important, as those will determine the status of HIV among pregnant women, and allow for prompt access to HIV ART as well as other health care assistance. Early detection can save the lives of mother and newborn. However, few prenatal care mother's attendees are not willing to accept HIV testing due to long waiting times, inaccessibility of drugs and lack of follow-ups (Boateng, Awunyor-Vitor, & Jasay, 2012). Health care providers or clinic should resolve these issues to allow mothers to participate in the prevention program (Boateng et al., 2012).

Kwapong, Boateng, Agyei-Baffour, and Addy (2014) conducted a study to determine the influence of health facility associated predictors on HIV testing and counseling among pregnant women during PNCV in Kumasi, Ghana. The study was a cross-sectional design using quantitative and qualitative methods. The sample included 300 pregnant women aged 18 to 49 years who had attended PNCV and HIV counseling more than twice at the time of the survey. The dependent variable was the utilization of HIV testing and counseling. The independent variables were waiting time, privacy and confidentiality, being listened to, being treated with respect and trust by health workers, and feeling attended to. A structured questionnaire was used to collect data for quantitative method while focus group discussions were for qualitative methods. The authors used logistic regression analysis to assess the perception of quality of PMTCT services and its influence on HIV testing and counseling. ATLAS.ti was employed to

analyze qualitative data. The findings showed that 22% of pregnant women did not go for HIV testing and counseling, and the perception of pregnant women of quality of care at the clinic was significantly influenced by their decision to attend (feeling attended to). Pregnant women who did not feel attended to by health care workers had odds less than those who did feel attended to, OR=0.48, 95% CI: 0.30, 0.77; $p<0.05$. Pregnant women who were not listened to by health care workers were less likely to participate in HIV testing and counseling, OR=0.52, 95% CI: 0.30, 0.87; $p<0.01$. The variable "waiting for a long time" had a significantly negative impact on HIV testing and counseling, OR=0.43; $p<0.001$. Similar results were observed in multivariate analysis. The authors concluded that there were not enough advantages to associate HIV testing and counseling into prenatal care services because of lack of confidentiality, trust, and inadequate health education. Training of health workers about medical ethic associated with HIV/AIDS will improve the use of HIV testing and counseling during PNCV.

## Literature Related to Methodology

The research studies described in this literature review were both observational and experimental. Randomized clinical trials, cross-sectional studies, and cohort studies have been used as study designs for this type of research. The design used in this study, selected in part on my review of the literature, was a cross-sectional study.

### Cross-Sectional Studies

A cross-sectional study is an observational study that assesses the association between disease and other variables of interest at a specific point in time in a defined population (Aschengrau & Seage III, 2008). The study also investigates the relationship

between risk factors and the outcome of interest at one time for a defined population (Levin, 2006). It allows a researcher to assess the disease prevalence in relation to past exposures when the dates of exposures are ascertained (Aschengrau & Seage III, 2008). The strength of cross-sectional study is that investigators can evaluate many outcomes and risk factors. The design is practical for public health planning, understanding illness etiology, and it is less expensive than other studies (Levin, 2006).

There is a limitation in cross-sectional study as epidemiologists have to establish the right temporal sequence between exposure and a disease to support the hypothesis exposure-disease (Aschengrau & Seage III, 2008). Cross-sectional studies, which collect data on exposures and outcomes at a single point in time, cannot demonstrate a cause and effect association. For instance, Asefa & Beyene (2013) conducted a cross-sectional study of awareness and knowledge on the timing of MTCT of HIV among pregnant women who attended prenatal care in Southern Ethiopia in 2011-2012. The analysis included Kolmogorov-Smirnov test, Pearson's chi-square tests, Hosmer-Lemeshow test, and multiple logistic regression analysis. They found that 11.5% of pregnant women have full knowledge on timing of MTCT and this was associated with level of education, AOR= 3.68, 95% CI: 1.49-9.08, $p<0.05$; students, AOR= 2.44, 95% CI: 1.09-5.47, $p<0.05$; daily laborers, AOR= 3.05, 95% CI: 1.11-8.34, $p<0.05$; and government employee, ARO=2.50, 95% CI: 1.23-5.70, $p<0.05$. However, they were not able to suggest a cause and effect relationship due to their choice of study design. An additional limitation of this study was that it could not be generalized to all pregnant women in the region, as the sample was not random. However, the study did suggest that

sociodemographic and economic characteristics play a significant role in knowledge of HIV MTCT and PMTCT during PNCV.

Byamugisha, Tumwine, Ndeezi, Karamagi, & Tylleskär (2010) conducted a cross-sectional survey design among 388 new antenatal attendees in Eastern Uganda to assess their attitudes towards routine HIV testing, as well as their knowledge of MTCT of HIV and infant feeding options for HIV-infected mothers. The outcome of interest was a positive attitude of pregnant women to routine counseling and testing for HIV. The second outcome was participant's knowledge about MTCT of HIV and infant feeding options for HIV-infected mothers. The results of a multivariate logistic regression showed that after adjusting for independent variables, "having completed secondary school" (OR= 2.5; 95% CI: 1.3-4.9), "having three or more pregnancies" (OR=2.5; 95% CI: 1.4-4.5), and "belonging to a non-Bagisu ethnic group" (OR= 1.7; 95% CI: 1.0-2.7) were associated with more knowledge of exclusive breastfeeding as one of the measures for preventing MTCT of HIV. Systematic HIV testing was not examined; as verbal consent was required. The authors were not aware of the participants' HIV status and so could not determine if those with HIV positive were more knowledgeable of MTCT than uninfected pregnant women. Due to the nature of the study design, it was not possible to generalize the findings to other Sub-Saharan countries or to establish a cause and effect relationship.

Sagna and Schopflocher (2015) conducted a cross-sectional survey study in Swaziland to examine individual and contextual level influences on the reception of HIV pretest counseling and acceptance of HIV testing during the antenatal period. The

population of the study was women aged 15-49 years with a live birth in the past five years preceding the survey and attended antenatal care (ANC). Receipt of HIV pretest counseling and uptake of HIV testing during prenatal care were the outcome of interest. The covariates were marital status, age, parity, educational level, household wealth, timing at the first ANC visit, and so forth. Descriptive analysis and multilevel regression analysis were employed to examine the characteristics of the sample and the influence of individual/community characteristics on interventions linked to PMTC, respectively. The findings showed that the chance of receiving HIV pretest counseling increases significantly with parity, education level, wealth, and ANC visits but lower in the area with poverty OR= 0.474 and OR=0.598 in rural zones. Pre-test counseling is an important determinant of HIV testing, which increases the chance of accepting HIV testing by 77% (Sagna & Schopflocher, 2015). Based on their results, they concluded that high levels of poverty in a community might affect the chance of receiving HIV counseling during prenatal care as poor people seek care at medical facilities that lack trained medical professionals and resources. While HIV testing may reduce the risk of HIV MTCT, HIV counseling and voluntary testing during prenatal care are not broadly available or accessible (Sagna & Schopflocher). As the study was a cross-sectional survey, causal inferences could not be drawn.

Kuonza et al. (2010) conducted a cross-sectional analytic study to determine the prevalence and factors associated with nonadherence to a single dose of nevirapine regimen for PMTCT and concluded that maternal nonadherence to nevirapine was extremely high among HIV pregnant women who attended less than three prenatal care

sessions in Bindura, Zimbabwe. Becka et al. (2015) conducted a cross-sectional study to assess the lack of knowledge of MTCT HIV transmission and found that it is important to strengthen the need for prenatal care and its critical role in HIV education.

## Summary

In this chapter, I presented a literature review of prenatal care, adherence to ART, perinatal/fetal adverse outcomes among neonates born from HIV-infected mothers, comprehensive knowledge of HIV/AIDS**,** and HIV testing and counseling, Prenatal care plays a crucial role during pregnancy for the prevention, diagnosis, and treatment of HIV and MTCT of HIV, especially among HIV-infected mothers (Lema et al., 2014). Early initiation of ART during prenatal care reduces the transmission of HIV infection among newborns, especially at the time of birth. Information from the literature revealed some perinatal/fetal adverse outcomes such as stillbirth, preterm birth, intrauterine grow restriction, low birth weight, neonatal mortality, and suggested adverse outcomes can be reduced with proper medical treatment. These adverse outcomes may be predicted and preventable if the HIV-pregnant women are willing to attend the four prenatal care visits as recommended by the World Health Organization (WHO, 2006). The risks of adverse pregnancy outcomes increased among pregnant women who are not aware of their HIV status and because of lack of knowledge of MTCT of HIV (Habib, 2008). Some authors attributed reductions in these outcomes to combination ART.

It is difficult to control pregnancy outcomes in resource-poor settings, as the health care system is limited. The literature also suggested that fear of disclosure, stigma, and being rejected by society contribute to the lack of prenatal care and noncompliance to

ART. Identifying and understanding the barriers or challenges that increase the adverse outcomes among HIV-pregnant women with lack of prenatal care and poor knowledge of HIV transmission from mother to child as well as ignorance of HIV status during pregnancy in Tanzania during 2011-2012 will contribute to filling the gap in the previous literature.

The literature supports my use of the HBM as a framework for my study and my chosen study design (cross-sectional) and methodology, which I describe in detail in Chapter 3. In that chapter, I also explain in detail the sampling scheme, inclusion and exclusion criteria, dependent and independent variables, and how I will collect and analyze my data.

# Chapter 3: Research Method

## Introduction

United Nations estimates of child mortality suggest that the United Republic of Tanzania has the highest rate of neonatal mortality among Sub-Saharan countries (UNIGME, 2014). Evidence suggests that HIV-infected women are more likely to experience adverse pregnancy outcomes and that these may be linked to HIV MTCT(Yogev & Chadwick, 2004; Tóth, Bácsi, Beck, & Szabó, 2001). HIV testing and treatment offered during prenatal care may reduce the risk of HIV MTCT and adverse pregnancy outcomes. This quantitative cross-sectional study, which used secondary data from TDHS, was designed to assess the relationship between comprehensive knowledge of MTCT HIV and prenatal care attendance after controlling for sociodemographic characteristics.

This chapter describes the research methodology I used for this study. I restate the research questions and hypotheses first introduced in Chapter 1. I then discuss my use of secondary data obtained from the TDHS, including information on the population of the study and the sampling scheme used in the original collection of the data. I also provide details of my data analysis plan, and finally discuss ethical considerations and potential threats to this study's validity and reliability.

## Research Design and Rationale

### Research Questions and Hypotheses

- RQ1: Is there an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care?

- *Null Hypothesis ($H_0$)*: There is no statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.
- *Alternative Hypothesis (Ha)*: There is a statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.

- RQ2: Is there an association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care?
  - *Ho2*: There is no statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
  - *Ha2*: There is a statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
- RQ3: Is there an association between awareness of HIV testing coverage services and attendance of prenatal care?
  - *Ho3*: There is no statistically significant association between awareness of HIV testing services coverage services among women aged 15-49 years and attendance of prenatal care.
  - *Ha3*: There is statistically significant association between awareness HIV testing coverage services among women aged 15-49 years and attendance of prenatal care.

A cross-sectional design was the best choice to assess the relationship between independent variables and dependent variable in this study, as I used secondary data that was collected at a single point in time. The cross-sectional survey is an appropriate design when the research question focuses on the prevalence of a disease, present practice, or an opinion (Sullivan, 2012), which was the case for this research. This design also allowed comparison between participants' groups based on the age, marital status, and so forth. However, the inferences from the model were limited to the time of the data collection, and provide limited generalization to future points in time or other populations. In addition, nonresponse from participants can result in bias or limit generalizability further.

My goal was to determine the association between comprehensive knowledge of MTCT HIV and prenatal care attendance among women between 15 and 49-year-old. I used multivariate methods to adjust for potential confounders such as age, marital status, and level of education. I also analyzed the association between pregnant women who had been counseled and testing for HIV with the recommended minimum of four prenatal visits. Assessing the lack of knowledge of MTCT HIV transmission during pregnancy will contribute to the body of evidence on the importance of prenatal care and its critical role in HIV counseling (Becka et al., 2015).

# Methodology

## Setting and Sample

**Population.** The study population was consisted of that of a population-based survey conducted in Tanzania between December 16, 2011 and May 24, 2012. The population of study was women aged 15 and 49 years who delivered a live infant with the two years prior to the survey. I requested datasets access by becoming a user of the DHS Program website. I also submitted my research project title and a description of the analysis, which were required for the data access approval process. The DHS Program usually reviews the data request within 24 hours and provides notifications when a request has been granted.

**Sample and sampling procedures.** The National Bureau of Statistics (NBS) in collaboration with the Office of the Chief Government Statistician conducted the 2011-2012 Tanzania HIV and Malaria Indicators Survey from December 16, 2011 to May 24, 2012. TACAIDS and the Zanzibar AIDS Commission authorized this survey. The United States Agency for International Development, TACAIDS, and the Ministry of Health and Social Welfare provided the funds to conduct the survey. In addition, the ICF International through the MEASURES DHS project supported the survey; the USAID-funded program provided technical assistance (TACAIDS et al., 2013). The TDHS datasets are the property of Tanzania's NBS, which is a Federal Government Agency.

The objectives of the 2011-2012 Tanzania HIV and Malaria Indicators Survey were to provide updated information on the prevalence of HIV among Tanzanian adults and the prevalence of pediatric malaria and anemia (TACAIDS et al., 2013). In addition,

it was designed to assess the level and trends in HIV/AIDS knowledge, attitudes towards people infected with the HIV, and patterns of sexual behavior (TACAIDS et al., 2013). New health strategies were developed based on the findings of this survey, which were compared with the previous surveys conducted in 2007-2008 and 2003-2004 (TACAIDS, 2013). The results assist policy makers and program implementers to monitor and evaluate existing programs and to design new strategies for fighting the HIV/AIDS epidemic in Tanzania (TACAIDS et al., 2013).

Tanzania's NBS developed the sample frame that was used for the 2011-2012 survey (TACAIDS et al., 2013). The TDHS used a cross-sectional survey of a nationally representative sample of individuals aged from 15-49 years living in Tanzania between December 2011 and May 2012.The nomadic and institutional populations such as individuals in the hotels, prisons, and barracks were excluded from the sample (TACAIDS et al., 2013). The sampling method used was a multistage stratified sampling to ensure that different groups of a population are represented adequately in the sample.

Two stages were selected in the sample, sample points/clusters and systematic sampling households (TACAIDS et al., 2013). The cluster consisted of the enumeration areas delimited for the 2002 Population and Housing Census. A total of 583 clusters were selected from 50 sample points from mainland Tanzania and 15 sample points from Zanzibar. A sample size of 10,496 households was chosen from the systematic sampling, 18 households were selected from each cluster. As of 11,423 eligible women age 15-49 were identified for the survey and a total of 10,967 women completed the interview,

which represent a response rate of 96%. The number of women with a live birth three years prior the survey was 4,627.

The sample was randomly selected to ensure that each sampling unit of the population has an equal probability of being included in the sample. Weighting factors were added to the data file to have the results at the national level (TACAIDS et al., 2013). This study focused on women aged 15 to 49 years who responded to the household survey questionnaire (Figure 3). Based on the demographics characteristics, 910 women were HIV positive (TACAIDS et al., 2013). This study included only women aged 15-49 years who gave birth within the past three years prior the survey and attended prenatal care. Each household signed the consent form prior the collection of the blood samples for HIV testing (TACAIDS et al., 2013).

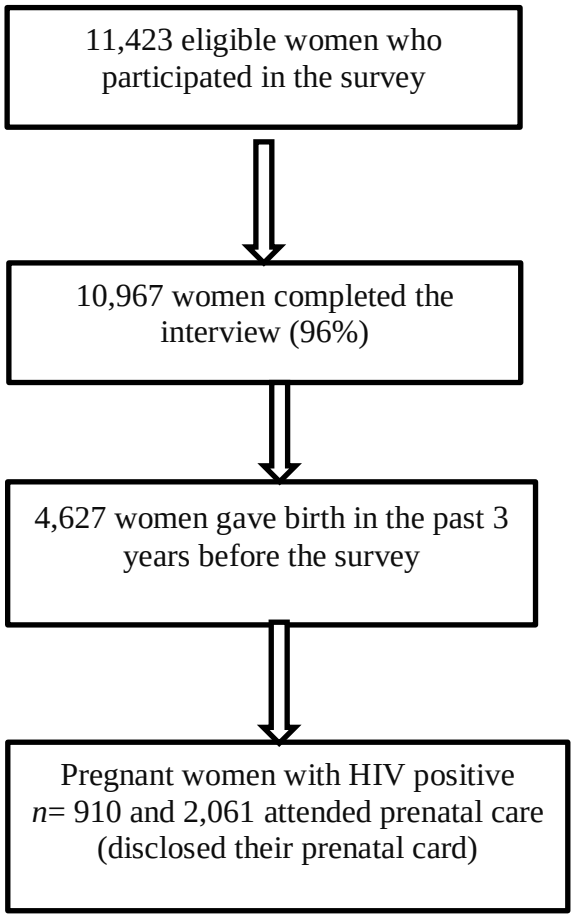


*Figure 3*. A flowchart showing the sample selection (weighted).

**Sample size analysis**. This study used secondary data, meaning that I did not have control over the available sample size, thus was not necessary to perform sample size calculation. However, it is important to determine the sample size prior conducting a study, using the G*power version 3.1.9.2 (Buchner, Erdfelder, Faul, & Mayr, 2007), whether the sample size calculated is lower than the sample size I anticipated having. I conducted an analysis of the minimum sample size based on my planned use of multinomial logistic regression, an alpha of .05, and a power of 0.80 with a medium effect size. The minimum required sample size for this particular statistical test, with a

power of 80%, was 560; as my anticipated sample size is greater than 560, I was able to achieve a power of at least 80%. In the next chapter, I determined the sample size of 2,061 participants by applying the inclusion and exclusion criteria.

**Inclusion and exclusion criteria**. The TDHS selected all women and men who were permanent resident of the household or a visitor who stayed in the house the night prior the interview. The nomadic and institutional populations were excluded from the survey. A total of 11,423 women were eligible to participate in the surveys and 10, 967 women were successfully interviewed (TACAIDS et al., 2013). The women with a live birth in the past three years prior to the survey and who attended the prenatal care visit were included.

## Instrumentation

The data for this study were selected from the results of the survey conducted by the DHS program, Tanzania DHS. The DHS program distributes at no cost, unrestricted survey data files for legitimate academic research (DHS Program, n.d.). While the datasets were available at no cost upon registration, a brief description of this study was provided to obtain authorization. The DHS provides a nationally representative population-based survey with large sample sizes ranging from 5,000 to 30,000 (DHS Program, n.d.). It provides information on health issues, which include reproductive health, fertility, family planning, early childhood mortality, maternal and child health, sexual behaviors, and HIV or AIDS in poor countries. During the survey the household questionnaire and the individual questionnaire were used to collect data. The questionnaires were prepared in English and translated into Kiswahili, which is an

official language in Tanzania. These questionnaires were customized to reflect the population and health problems pertinent to Tanzania.

The individual questionnaire collected information from eligible participants between the ages of 15 and 49. The study datasets consist of the responses to the individual questionnaire as responded to by women. All women responders were asked to answer questions about background characteristics, such as education, birth history, antenatal care, pregnancy; marriage and sexual activity; employment; HIV testing and HIV counseling; and awareness and behavior concerning HIV/AIDS and other sexually transmitted infections. Additional indicators for comprehensive knowledge of HIV, defined as knowing the two methods of preventing the sexual transmission of HIV (using condom and limiting sex to one faithful, uninfected partner), being aware that a healthy looking person can be infected with the AIDS virus, and rejecting the two most common local misconceptions about HIV transmission; and for knowledge of the prevention of MTCT were computed (DHS Program, n.d.; TACAIDS et al., 2013). Of 10,967 women interviewed during the survey, the DSH program was able to collect biomarkers data concerning infectious and sexually transmitted diseases from those individuals who were eligible for the interview and signed the consent form (DHS Program, n.d.). The AIDS Indicator Surveys were also used for this research because the surveys focus on HIV/AIDS.

I created a subset of the data from the TDHS with the variables of interest to this study and use that in my analysis. The survey datasets files provide information on individuals, births, and HIV test results recorded from December 2011 to May 2012. The

codebook for the TDHS program from the year 2011 and 2012 survey is available to use and has more explicit information. The THMIS 2011-2012 final report publication was published in March 2013 and provides additional information about the survey.

**Variables**

The variables were limited to those collected for the TDHS data. The dependent variable in this study is prenatal care attendance and the independent variables are comprehensive of knowledge of HIV transmission; and awareness of HIV testing coverage services, HIV testing, and counseling services. The potential confounders are age, marital status, level of education, wealth quintile, and residence (see Table 3). Definitions of variables and coding are found in Appendix F.

Table 3

*Variables Descriptions and Measures*

| Variable role | Name | Potential Responses | Level of measurement |
|---|---|---|---|
| Dependent | Prenatal care attendance | 0 Less than 4 visits/2nd and 3rd trimester<br>1 4 or more visits/1st trimester | Ordinal |
| Independent | Comprehensive knowledge of MTCT of HIV | 0 Not knowledgeable<br>1 Knowledgeable | Binomial |
| | HIV testing and counseling | 0 Not tested or counseled<br>1 Tested and counseled | Binomial |
| | Awareness of coverage of HIV testing and services | 0 Not aware<br>1 Aware | Binomial |
| Potential confounders | Marital status | 0 Never married<br>1 Divorced/separated/ widowed<br>2 Married | Nominal |
| | Maternal education | 0 Primary incomplete<br>1 Primary complete<br>2 Secondary | Ordinal |
| | Maternal age | 1 15-24<br>2 25-29<br>3 30-39<br>4 40-49 | Ordinal |
| | Residence | 1 Rural<br>2 Urban | Nominal |
| | Wealth quintile | 0 Lowest<br>1 Second lowest<br>2 Middle<br>3 Second highest<br>4 Highest | Ordinal |

## Data Analysis Plan

In this study, the variables are quantitative. The outcome measure (variable of interest) is the attendance of prenatal care. The independent variables are comprehensive knowledge of HIV transmission, HIV testing and HIV counseling, and awareness of HIV testing coverage services. The variables age, marital status, educational level, residence, and wealth quintile were used to ensure that any associations observed between the variables indicated in the hypotheses were adjusted using confounders and therefore more likely to represent reality, in alignment with Frankfort-Nachmias and Nachmias (2008). The Statistical Package for the Social Sciences (SPSS) version 21 or Predictive Analytics Software (PASW) was used for all the analysis and statistical significance will be established with a $p$-value $\leq 0.05$. The file SPSS.sav was selected from the TDHS to analyze the data. I used STAT compiler from the DHS program, which is a tool designed to visualize and analyze data in column charts, line graphs, and scatter plots. This STAT is linked to the datasets that I will use for this study.

### Preparing the Data

**Cleaning data**. The most common source of error is missing data, typing errors on data entry, coding errors, column shift, and measurement and interview errors (Tulane University, n.d.). These errors can be detected by performing descriptive statistics using frequency tables, scatterplots, and histograms.

**Handling missing data**. Missing data can be handled by using the traditional treatments such as list-wise deletion or the pair-wise deletion, or the hot deck imputation, or the mean substitution, or the regression substitution (Howell, 2015). Missing data

should be handled properly to obtain accurate data. I used the Statistical Package for the Social Sciences- version 21 to perform missing data imputation and analysis.

**Multicollinearity and outliers**. Multicollinearity problems may occur when an explanatory variable is strongly related to a linear combination of the other independents variables (Forthofer, Lee, & Hernandez, 2007). Meaning that the correlation between independents is equal to 1 or -1. This relation increases the variance of the regression coefficients. However, the assumption of the model is not violated. Multicollinearity is often seen when the data survey is used. The scatterplot matrix or the correlations between the variables can be used to recognize multicollinearity among a set of explanatory variables. The variance inflation factors (VIF) of explanatory variables can be calculated to resolve the multicollinearity problems by using this formula: [$VIF_j=1/1-R^2_j$ ]. The VIF less than 10 indicates that there is not issue multicollinearity for the multiple regression analysis of the model being used, and greater than 10 suggest a serious concern (Forthofer, Lee, & Hernandez, 2007). A formal detection-tolerance ($1-R^2_j$) can also be used to detect multicollinearity, and a tolerance less than 0.20 or 0.10 signifies multicollinearity issues. For this study, I calculated the variance inflation factor to ensure that there is not the issue of multicollinearity.

An outlier is an observation value distant from other values in a random sample; values outside the range of those generally expected (Sullivan, 2012). It is important to detect outliers as they can modify the findings of the data analysis. Outliers are scores that fall between 1.5 and 3 box lengths. For this study, I used the descriptive statistics analysis in SPSS to check for outliers by inspecting the histogram and the Boxplot.

**Data weighting.** As I conducted descriptive analysis on the TDHS study which can involve weights for clustering of samples. I used a quantitative statistical package "SPSS" for weighting cases to ensure that the population of interest is not over or under-represented. Thus, sample weighting was performed to allow for adjustments for the cluster sampling design and sampling probabilities within clusters and strata. The weighting adjustment will assign an adjustment weight to each participant's respondent, and the sample will be representative. Statistical adjustments can be made with post stratification weighting for reducing variances and selection bias (Kisch, 1965). The DHS recommends using weights to avoid the coefficients to be biased toward the over-sampled sub-populations. I computed and applied weights to conduct data analysis. The sample weight for frequency (v005 unit analysis for women) was divided by 1,000,000 as recommended by DHS statistical guide to include the decimal point in the datasets. I created a new weight variable using the women weight variable before adjusting for complex sampling design in SPSS. The design variables allowed us to select variables that define the strata (v022), clusters (v021), and sample weight (v005). The number of strata was 30; 545 for clusters, 2061 for observations, and the sum of weights was 2003366090.

**Statistical Analyses**

Each of my research questions has been analyzed using descriptive and inferential statistics. Inferential statistics was conducted at the bivariate and multivariate levels. In Table 4, I listed the dependent and independent variables as well as my analysis for each of my research questions.

Table 4

*Statistical Analysis per Research Question*

| Research Question | Variables | Statistical analysis |
|---|---|---|
| RQ1: Is there an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care? | Comprehensive knowledge; Attendance of prenatal care | Descriptive statistics: Frequency, mean, median<br>Inferential bivariate statistics: Crosstabulations and chi-square<br>Ordinal logistic regression<br>Multivariate statistics: Multinomial logistic regression |
| RQ2: Is there an association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care? | HIV counseling and testing; Attendance of prenatal care | Descriptive statistics: Frequency, mean, median<br>Inferential bivariate statistics: Crosstabulations and chi-square<br>Ordinal logistic regression<br>Multivariate statistics: Multinomial logistic regression |
| RQ3: Is there an association between awareness of HIV testing coverage services and attendance of prenatal care? | Awareness of HIV testing coverage; Attendance of prenatal care | Descriptive statistics: Frequency, mean, median<br>Inferential bivariate statistics: Crosstabulations and chi-square<br>Ordinal logistic regression<br>Multivariate statistics: Multinomial logistic regression |

*Note.* RQ=Research question; MTCT= Mother-to-child transmission

**Descriptive analyses.** Descriptive statistics involves summarizing distributions of scores by developing tabular or graphical representations, then computing descriptive statistical indices (Forthofer, Lee, & Hernandez, 2007). The distribution of a quantitative variable can also be summarized with the use of statistical indices. Mean, median, and mode are measures of central tendency, and the most common measures of variability are

the variance and its square-rooted form, the standard deviation (Forthofer, Lee, & Hernandez, 2007). The standard deviation is the more accurate and described estimate of dispersion as an outlier may overestimate the range (Trochim, 2006). I used SPSS to compute the measure of central tendency as well as the measure of variability. The numbers were used to summarize and describe the data. In addition, the statistical indices will tell the presence or absence of the outliers and missing data. The frequency distribution table as well as the bar charts were used to summarize categorical variables. The description of the bar will be described in details in chapter 4.

**Inferential analyses.** Inferential analysis is used to make inferences from the data to more general conditions (Trochim, 2006).

*Bivariate analysis.* Crosstabulations and chi-square analyses have been performed to assess the association between the independent variable and the outcome. The chi-square statistical test was used to check the statistical significance of the crosstabulations table, and to determine if the variables are statistically independent or associated. The relationship means that multinomial regression can be performed to explain the association contained in the contingency table.

*Ordinal logistic regression.* I used ordinal logistic regression to determine the association between the independent variables (comprehensive knowledge of HIV, HIV testing and HIV counseling, awareness of HIV and HIV testing services coverage) and the outcome (prenatal care attendance). This model is a statistical test appropriate for this study as the outcome of interest is ordinal. The assumption of proportional odds is the fact that the association between the dependent variable and the independent variables are

the same across categories. I also used this approach to determine whether there is confounding by marital status, education, age, residence, or wealth quintile.

*Multivariate analyses.* Multinomial logistic regression analysis has been performed to assess the association between the independent variables, comprehensive knowledge of HIV, HIV testing and HIV counseling, awareness of HIV testing services coverage; and the dependent variable, attendance of prenatal care. In each analysis, multinomial logistic regression allowed me to observe these associations after adjusting for confounding variables (age, marital status, level of education, residence, and wealth quintile). Based on these analyses, I was able to reject or fail to reject the null hypotheses associated with my research questions.

## Validity and Reliability

Data are collected by direct observations or measurement and from responses to households and individual's questionnaires. The validity and reliability issues of concern for the collected data will be the misinterpretation of the questions; therefore, a wrong or inappropriate response may be obtained. Many people are reluctant to provide accurate information concerning their characteristics background or health related issues. For example, questions concerning sexual behavior, or prenatal care attendance, or birth history.

### Internal Validity

The internal validity of the study is defined as the extent to which a clear, causal conclusion may derive from the study (Crosby, 2013). The critical step to ensure the internal validity of the study is to have a same group within the sample after

randomization (Crosby, 2013). For instance, if there are significant differences in sociodemographic characteristics (age, income) and outcome of interest, these differences can confound the findings. The internal validity is the truth about inferences concerning cause-effect (Crosby, 2013). This study used cross-sectional survey design, thus, the threats to internal validity (history, maturation, testing, instrumentation, statistical regression, selection bias, and mortality) cannot be addressed before conducting the study because I used secondary data.

### External Validity

The external validity threats occur when inferences are incorrectly drawn from the sample data to others settings (Creswell, 2009). The external validity is defined as the extent to which it is possible to generalize a particular population beyond those involved in the study (Crosby, 2013). In this survey, I selected a large sample size from the datasets to increase the target population of interest and to improve the external validity. Therefore, the sample was representative of the population. Each person has an equal likelihood of being chosen from the population (Creswell, 2009), and the sample comprises individuals with the same characteristics.

## Ethical Issues

I obtained consent to conduct this study from the Institutional Review Board (IRB) at Walden University. The IRB approval number was 08-10-16-0375309. The IRB-approved procedures for DHS public-use datasets do not allow respondents, households, or sample communities to be identified. The IRB ensures that the research procedures fulfill with the federal regulations and university policies. I have obtained an

agreement authorization from the DHS/Inner City Fund (ICF) International. All data gained access to has already been deidentified. I was unable to determine from whom the data was collected. I completed the National Institutes of Health Offices of Extramural Research Web-based training course "Protecting Human Research Participants" on March 14, 2014, and the certification number is 1419444.

## Summary

In this chapter, I presented a detailed discussion of my study methodology, which included the research questions and hypotheses, research design, sampling, data collection, inclusion and exclusion criteria, instruments, variables, data analysis plan, validity and reliability, and ethics. A cross-sectional survey design is the research design chosen for this study. Secondary data was collected from the TDHS program. The population of study was all women aged 15 and 49 years with a live birth within two years prior to the survey who attended prenatal care. The dependent variable is attendance of prenatal care and the independent variables, comprehensive knowledge of HIV, HIV testing and HIV counseling, and awareness of HIV testing services coverage. Potential confounding variables are sociodemographic factors, including marital status, maternal education and age, residence, and wealth by quintile. Sample weighting, multicollinearity, and outliers will be tested before conducting data analysis. The SPSS Statistical software version 21 was used to conduct statistical analysis. Ordinal logistic regression and multinomial logistic regression analyses have been used to generate the crude and adjusted odds ratios representing the tested associations. The ethics approval

was obtained from Walden University; the IRB approval number is 08-10-16-0375309 (Appendix D).

# Chapter 4: Results

## Introduction

A nationally representative cross-sectional survey from the Tanzanian Demographic Health Survey (TDHS) was used in this study. The purpose of this study was to determine the importance of prenatal care attendance on comprehensive knowledge of HIV mother-to-child transmission (MTCT), and HIV testing and counseling among Tanzania women of childbearing, aged 15 to 49 years old. The source of the data was two questionnaires used for the 2011-2012 Tanzania HIV/AIDS and Malaria Indicator Survey: the Household questionnaire and the Individual. The questionnaires were constructed on the Measure DHS Standard AIDS Indicator Survey and Malaria Indicator Survey questionnaires. These were adapted to reflect the population and the health issues relevant to Tanzania. This study used the individual questionnaire to collect information on birth history, HIV/AIDS, and basic demography information. The research questions for this study were:

- RQ1: Is there an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care?
    - *Null Hypothesis ($H_0$)*: There is no statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.
    - *Alternative Hypothesis (Ha)*: There is a statistically significant association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care.

- RQ2: Is there an association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care?
    - *Ho2*: There is no statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
    - *Ha2*: There is a statistically significant association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care.
- RQ3: Is there an association between awareness of HIV testing coverage services and attendance of prenatal care?
    - *Ho3*: There is no statistically significant association between awareness of HIV testing services coverage services among women aged 15-49 years and attendance of prenatal care.
    - *Ha3*: There is statistically significant association between awareness HIV testing coverage services among women aged 15-49 years and attendance of prenatal care.

In this chapter, I report the baseline descriptive statistics on the demographic characteristics of the sample population and describe representativeness of the sample. I also describe the results of primary bivariate analyses, tests of statistical assumptions, and multivariate tests used to evaluate the research questions and hypotheses.

## Data Collection

### Inclusion and Exclusion Criteria

The sample size was based on the inclusion and exclusion criteria (Figure 4).

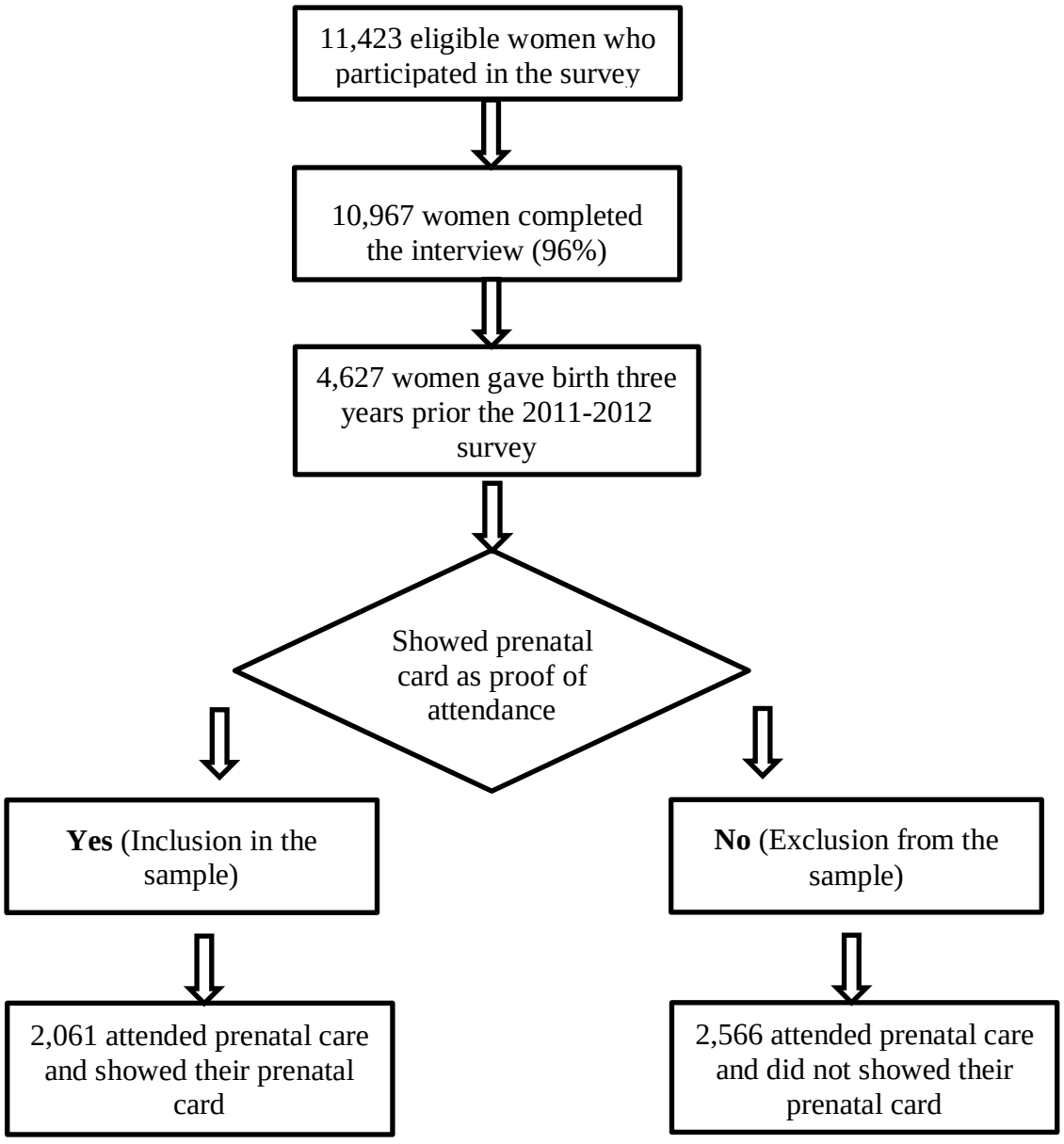


*Figure 4.* A flowchart showing the sample selection (weighted).

A total of 10,697 women completed the interviews yielding a response rate of 96%; all respondents were either a permanent resident of the household or a visitor who

stayed in the house the night prior to the survey. The primary source of information was self-reported; therefore, I took steps to reduce recall bias by selecting 4,627 women out of the 10,967 who had given live birth three years prior the surveys. Of a total of 4,627 women, 2,566 women were excluded because they did not present their prenatal cards at the time of the interview as a confirmation of antenatal care attendance during pregnancy. The remaining 2,061 women were included in the study. The sample size differs from that expected as this data includes women who gave live birth within three rather than two years as originally proposed.

In this study, I conducted descriptive analysis to assess the characteristics of the sample. Then, I used an ordinal logistic regression modeling method to examine the relationship between the PNCV attendance and comprehensive knowledge of HIV MTCT and HIV testing and counseling, and awareness of HIV testing coverage services. The ordinal logistic regression modeling was the most appropriate test for this study as the dependent variable had more than two categories and was ordered (ordinal). All the analyses were performed with Statistical Package for the Social Science (SPSS) version 21. Table 5 and 6 describe the independent variables used in this study.

Table 5

*Variables of Knowledge of HIV MTCT and HIV Testing*

| Scheme (s) and Value (s) Type | Potential Answer | Variables |
|---|---|---|
| **Knowledge of HIV MTCT**<br><br>(1) Ever heard of AIDS<br>(2) Reduce risk of getting HIV: have one sex<br><br>partner; who has no other partners<br>(3) Reducing risk of getting HIV: always<br>use condoms during sex<br>(4) A healthy-looking person can have HIV<br><br>(5) HIV transmitted during pregnancy<br>(6) HIV transmitted during delivery<br>(7) HIV transmitted by breastfeeding<br>(8) Drugs to avoid HIV transmission to<br>baby during pregnancy<br>(9) Wife justified asking husband to use condom<br>if has sexually transmitted infection<br>(10) Can get HIV by sharing food with person who has AIDS<br>(11) Can get HIV from mosquito bites<br>(12) can get HIV by witch craft or supernatural<br>means | Yes/No | Independent |
| **HIV Information Shared During PNCV**<br><br>(1) During PNCV talked about: HIV transmitted from mother to child<br>(2) During PNVC talked about: things to do to prevent getting<br>HIV<br>(3) During pregnancy talked about: getting tested for HIV | Yes/No | Independent |
| **HIV Testing**<br><br>(1) Ever been tested for HIV<br>(2) Offered HIV test for HIV as part of PNCV<br>(3) Offered HIV test between the time went to | Yes/No | Independent |

*Table 5 continued*

delivery and before baby was born
(4) Received result from last HIV test
(5) Got results of HIV test as part of PNCV
(6) Got results of HIV test when tested before baby was born
(7) Place were HIV test was taken as part of PNCV
(8) Tested for HIV since PNCV.

*Note*. HIV_Info=0.00=No/don't know; 1.00=refers to at least one question answered; 2.00=refers to two questions answered; 3.00= refers to all three questions.

Table 6

*Variables of HIV Testing Coverage and Services*

| Scheme (s) and Value (s) | Potential Answers | Variable Type |
|---|---|---|
| **HIV Testing Coverage and Services** | Yes/No | Independent |
| Know a place to get HIV test | | |
| Know a place for HIV test | | |
| Place of HIV test: Public District Hospital | | |
| Place of HIV test: public referral/specialized hospital | | |
| Place of HIV test: public regional hospital | | |
| Place of HIV test: public health center | | |
| Place of HIV test: public dispensary | | |
| Place of HIV test: public village health post (worker) | | |
| Place of HIV test: religious referral/specialized hospital | | |

*Note*. Nine items were used to measure the variable *Awareness of HIV testing coverage and services*.

**Baseline Descriptive and Demographic Characteristics of the Sample**

Participants included women (15-49 years) living in Tanzania between December 2011 and May 2012. The sample was randomly selected to ensure that each sampling unit of the population has an equal probability of being included in the sample. The sample for this study was based on the criteria of inclusion and exclusion. A sample of 2,061 women with a live birth in the past three years and who participated in PNC were included in the study.

Table 7 displays the distribution of women by sociodemographic characteristics. Women in the age groups 15-24 (34.9%) and 30-39 (32.6%) years were proportionally more likely to complete the survey than those in other age groups; the average age of respondents was 28.07 (*SD*=6.970). A Majority of participants had completed at least primary education (66.4%) though few have higher education (0.2%). The majority of women were married or living with a partner (85.6%) and 83.4% resided in a rural zone.

Table 7

*Sample Distribution of Participants by Sociodemographic Characteristics (N=2061)*

| Variables | *n* | % |
|---|---|---|
| **Maternal Age (Year group)** | | |
| 15-24 | 719 | 34.9 |
| 25-29 | 532 | 25.8 |
| 30-39 | 671 | 32.6 |
| 40-48 | 138 | 6.7 |
| Weighted Total (*N)* | 2060 | 100 |
| **Maternal Education** | | |
| No Education | 398 | 19.3 |
| Primary Education | 1369 | 66.4 |
| Secondary Education | 289 | 14 |

| | | |
|---|---|---|
| *Table 7 continued* | 5 | 0.2 |
| Higher Education | | |
| Weighted Total (*N*) | 2061 | 100 |
| **Marital Status** | | |
| Never Married | 143 | 6.9 |
| Married/Living with Partner | 1764 | 85.6 |
| Divorced/Separated/widowed | 154 | 7.5 |
| Weighted Total (*N*) | 2061 | 100 |
| **Residence** | | |
| Rural | 1718 | 83.4 |
| Urban | 343 | 16.6 |
| Weighted Total (*N*) | 2061 | 100 |
| **Wealth Index** | | |
| Poorest | 390 | 18.9 |
| Poorer | 442 | 21.4 |
| Middle | 438 | 21.3 |
| Richer | 458 | 22.2 |
| Richest | 333 | 16.2 |
| Weighted Total (*N*) | 2061 | 100 |

## Results

I used a quantitative statistical package SPSS for weighting cases to ensure that the population of interest is not over or under-represented (see Table 8 and 9). I weighted the data prior to conducting the statistical analysis to restore the representativeness of the sample. Table 7 depicts the summary of the weighted frequency distribution for the variables. The frequency table of PNCV displays a total of $n$ = 2058, and 69% of women attended three visits, or less and 17% completed four visits or more. The frequency distribution of HIV knowledge indicated that 69.0% of participants have high knowledge

of HIV, 25.4% have a moderate knowledge, and 5.6% demonstrated low knowledge of HIV.

The demographic characteristics show that most of the women were married or living with a partner with a mean age of 28.07. The majority of women (79%) were residing in a rural zone. In this sample population, 40% of women were living in households classified as in the poor wealth index, 39% of women were in the rich wealth index, and 20% were classified in the middle. The percentage of women who completed primary education was 69% compared to 18% of participants who had no education, and 0.4% for high education.

Table 8

*Data Summary of Weighted Frequency*

| Data Weighted Summary | |
|---|---|
| Number of strata | 30 |
| Number of clusters | 545 |
| Number of observations | 2061 |
| Sum weights | 2003366090 |

Table 9

*Weighted Frequency Table*

| Variables | Frequency | Wgt Frequency | % |
|---|---|---|---|
| **PNCV** | | | |
| 4 Visits or more | 308 | 34924885 | 17.4524 |
| 3 Visits or less | 1454 | 1387362058 | 69.3309 |
| 2 Visits or less | 296 | 264476743 | 13.2167 |
| Total | 2058 | 2001073686 | 100 |
| **Marital_Status** | | | |
| Never married | 143 | 166656114 | 8.3188 |
| Married/living with a partner | 1764 | 1681912206 | 83.9543 |
| Divorced/separated/widowed | 154 | 154797770 | 7.7269 |
| Total | 2061 | 2003366090 | 100 |
| **Wealth Index** | | | |
| Poor | 308 | 34924885 | 17.4524 |
| Middle | 1454 | 1387362058 | 69.3309 |
| Rich | 296 | 264476743 | 13.2167 |
| Total | 2058 | 2001073686 | 100 |

*Table 9 continued*

| | | | |
|---|---|---|---|
| **Age Group** | | | |
| 15-24 | 719 | 737932897 | 36.8347 |
| 25-29 | 533 | 521703032 | 26.0413 |
| 30-39 | 671 | 628442005 | 31.3693 |
| 40-49 | 138 | 115288156 | 5.7547 |
| Total | 2061 | 2003366090 | 100 |
| **Type of Residence** | | | |
| Urban | 308 | 410163064 | 20.4737 |
| Rural | 1718 | 1593203026 | 79.5263 |
| Total | 2061 | 2003366090 | 100 |
| **HEL** | | | |
| No education | 398 | 374376572 | 18.6874 |
| Primary | 1369 | 1397880466 | 69.3309 |
| Secondary | 289 | 264476743 | 11.1176 |
| Higher | 5 | 2001073686 | 0.4184 |
| Total | 2061 | 200336090 | 100 |

*Note.* HEL= highest level of education. Wgtd= weighted.

Table 10 displays the frequency of women of reproductive age (15-49) in the study sample who attended their first PNCV. I used the variable timing of first prenatal care as the outcome of interest, which is attendance at PNVC. The sample is 2058 (mean= 4.98; SD= 1.39) as two participants answered “Don’t know”, and one answer

was missing. The frequency table reveals that only 15% of women attended their 1st PNVC in the 1st trimester, but trimester large majority attended in the 2nd.

Table 10

*Frequency and Percentage of First Timing PNVC (N=2058)*

| Variables | | Frequency | Percentage |
|---|---|---|---|
| Trimester | | | |
| 1st Trimester | | 308 | 15 |
| | 1st month | 9 | 0.4 |
| | 2nd month | 48 | 2.3 |
| | 3rd month | 251 | 12.2 |
| 2nd Trimester | | 1454 | 70.7 |
| | 4th month | 459 | 22.3 |
| | 5th month | 540 | 26.2 |
| | 6th month | 455 | 22.1 |
| 3rd Trimester | | 296 | 14.4 |
| | 7th month | 239 | 11.6 |
| | 8th month | 51 | 2.5 |
| | 9th month | 6 | 0.3 |

*Note.* The sample size was 2058 because two women answered "don't know" and one answer was missing in the data set.

Table 11 shows that 12.2% attended of women their 1st PNVC 3rd month, whereas 26.2% attended in the 5th month. The majority of women were aged 15-24 (34.9%), while 32.6% of participants were between 30-39 years old.

Table 11

*Frequency Table of Maternal Age*

| Variables | | Frequency | % | Valid % |
|---|---|---|---|---|
| Respondent's current age | | | | |
| Valid | 15-24 | 719 | 34.9 | 34.9 |
| | 25-29 | 533 | 25.9 | 25.9 |
| | 30-39 | 671 | 32.6 | 32.6 |
| | 40-49 | 138 | 6.7 | 6.7 |
| | Total | 2061 | 100 | 100 |

*Note*. Young=1252 ( 60.7%); old= 809 (39.3%).

In addition to the frequency table of PNCV, the same information is now displayed in the form of pie chart. Figure 5 illustrates the frequencies and percentages for timing first PNCV. Approximately 71% of women attended their first PNCV in the second trimester, and the remaining participants were relatively distributed across the first (15%) and third trimester (14%).

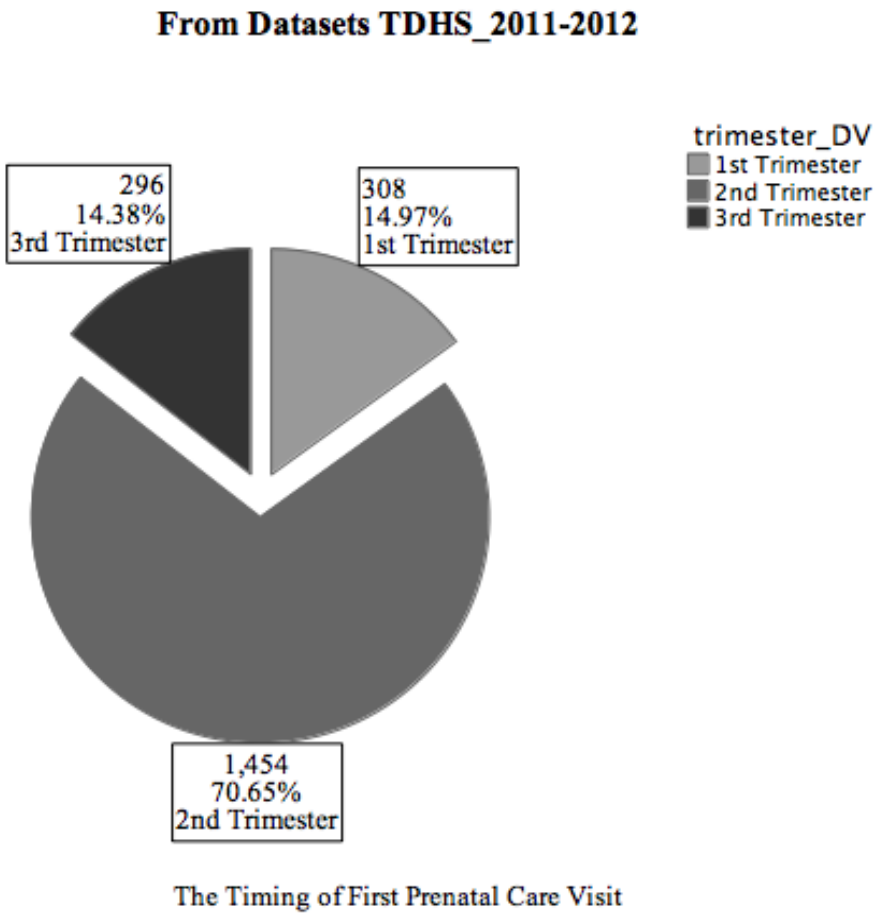


*Figure 5*. Pie chart of timing of first PNCV

Table 12 suggests 58% of women shared the answers to all three questions of HIV information with the health care providers or midwifes. Thus, the participants admitted that during PNCV the health care provider or nurse/midwife talked about (1) HIV MTCT; (2) how to prevent HIV transmission; and (3) HIV testing. Only 11% of

participants did not share the information of HIV/AIDS during their PNCV. The mean was 2.19 (*SD*=1.077) and the median.

Table 12

*Frequency and Percentage of HIV_Information (N=2039)*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 227 | 11 | 11.1 | 11.1 |
| | 1 | 340 | 16.5 | 16.7 | 27.8 |
| | 2 | 276 | 13.4 | 13.5 | 41.3 |
| | 3 | 1196 | 58 | 58.7 | 100 |
| | Total | 2039 | 98.9 | 100 | |

Table 13 presents the frequency score of HIV knowledge. The variable was scored less than 50% for participants with low knowledge; 50%-75% for moderate knowledge, and more than or equal to 75% for high knowledge. Table 14 displays the questions asked to participants as comprehensive knowledge.

Table 13

*Frequency and Percentage of HIV Knowledge Score (N=2061)*

| Variable | Frequency | Percent |
|---|---|---|
| HIV Knowledge | | |
| Low knowledge of HIV/AIDS | 113 | 5.67 |
| Moderate knowledge of HIV/AIDS | 525 | 24.31 |
| High knowledge of HIV/AIDS | 1423 | 70.01 |
| Total | 2061 | 100 |

Table 14

*A Detailed Frequency and Percentage of HIV Knowledge (N=2061)*

| Variables | Frequency | Percentage |
|---|---|---|
| Knowledge of HIV | | |
| Ever heard of AIDS | 2053 | 99.6 |
| Reduce risk of getting HIV: always use condom during sex | | |
| yes | 1468 | 71.2 |
| No | 580 | 28.1 |
| Reduce risk of getting HIV: have 1 sex partner only, who has no otherpartners | | |
| yes | 1784 | 86.6 |
| No | 266 | 12.6 |
| Can get HIV from mosquito bites* | | |
| Yes | 203 | 9.8 |
| No | 1848 | 89.7 |
| Can get HIV by sharing food with person who has AIDS* | | |
| Yes | 1896 | 92 |
| No | 153 | 74 |
| A healthy looking person can have HIV | | |
| Yes | 1655 | 80.3 |
| No | 388 | 18.8 |
| HIV transmitted during pregnancy | | |
| Yes | 1463 | 71 |
| No | 588 | 28.5 |
| HIV transmitted during delivery | | |
| Yes | 1488 | 72.2 |
| No | 563 | 27.3 |
| HIV transmitted during breastfeeding | | |
| Yes | 1834 | 89 |
| No | 218 | 10.6 |
| Can get HIV by witch craft or supernatural means* | | |
| Yes | 373 | 18.1 |
| No | 1674 | 81.2 |

*Table 14 continued*

| | | |
|---|---|---|
| Wife justified asking husband to use condom if has STI | | |
| Yes | 1733 | 84.1 |
| No | 327 | 15.9 |
| HIV_Info | | |
| During PNCV talked about MTCT | | |
| Yes | 1391 | 68.2 |
| No | 649 | 31.8 |
| During PNCV talked about HIV prevention | | |
| Yes | 1331 | 64.6 |
| No | 709 | 34.4 |
| During PNCV talked about: getting tested for HIV | | |
| Yes | 1761 | 85.4 |
| No | 280 | 13.6 |

*Note.* * Participants answered questions by "No" meaning that they have knowledge compared to to other questions .

The descriptive statistics presented in Table 15 and 16 are frequencies of comprehensive knowledge of HIV and HIV_ information shared during PNCV. Most of the participants have comprehensive knowledge about HIV transmission and prevention.

Table 14 shows summaries of univariate analysis (frequency distribution, central tendency, and dispersion or standard deviation) conducted for all variables used in the study. The average mean of timing of 1st prenatal care check was 4.98 (SD 1.395). Thus, approximately 99% of the scores in the sample will fall in the range of 4.98- (3*1.395) to 4.98+(3*1.395) or between 0.795 and 9.165. The average mean of HIV knowledge among participants was 7.5735 (SD 1.62371). of the results suggest that 99% of the scores in the sample will fall between 2.70237 and 12.44.

The average mean of HIV information shared among women of childbearing age was 2.1972. Nearly, 98% of the score sample will fall between 0.04284 and 4.35156.

Table 15

*Descriptive Statistics of Variables*

| | | PNCV Attendance | Knowledge of HIV | HIV_Info | Know a place to get HIV | Tested for HIV as part of PNCV | RCAT4AIDS |
|---|---|---|---|---|---|---|---|
| N | Valid | 2058 | 2028 | 2039 | 2052 | 2042 | 1618 |
| | Missing | 3 | 33 | 22 | 9 | 19 | 443 |
| Mean | | 4.98 | 7.5735 | 2.1972 | 0.97 | 0.83 | 0.84 |
| Median | | 5 | 8 | 3 | 1 | 1 | 1 |
| SD | | 1.395 | 1.62371 | 1.07718 | 0.18 | 0.376 | 0.367 |
| Skewness | | -0.005 | -1.005 | -0.933 | -5.178 | -1.754 | -1.856 |
| Kurtosis | | -0.354 | 1.019 | -0.634 | 24.837 | 1.079 | 1.446 |
| Minimum | | 1 | 1 | 0 | 0 | 0 | 0 |
| Maximum | | 9 | 11 | 3 | 1 | 1 | 1 |

*Note.* SD= standard deviation; RCAT4AIDS=received counseling after tested for AIDS.

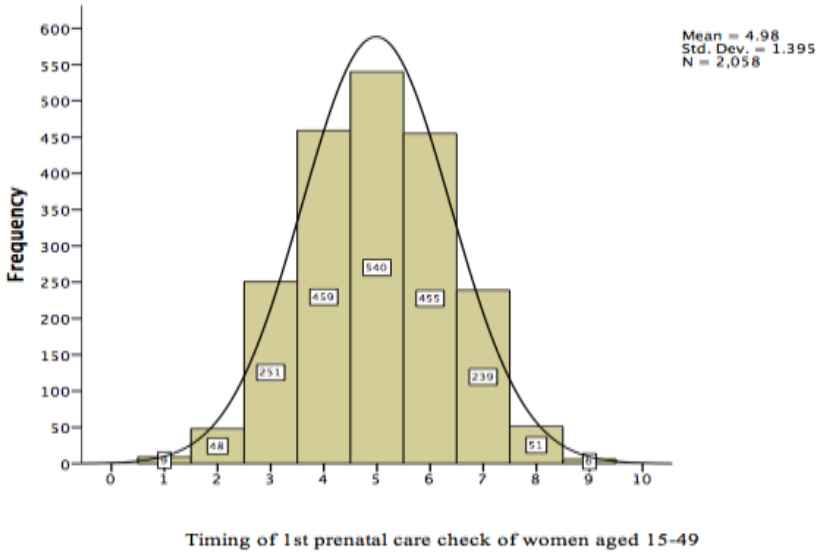


*Figure 6*. Distribution of 1st time PNCV

Figure 6 presents a histogram of the timing of first PNCV, which has a symmetric distribution (normal distribution). The distribution has a skewness of 0, and the mean is almost close to the median, which justifies the normal distribution of the histogram. The kurtosis is close to 0. This histogram suggests that the data is basically symmetrically distributed without many deviations from the normal curve. The kurtosis is mesokurtic.

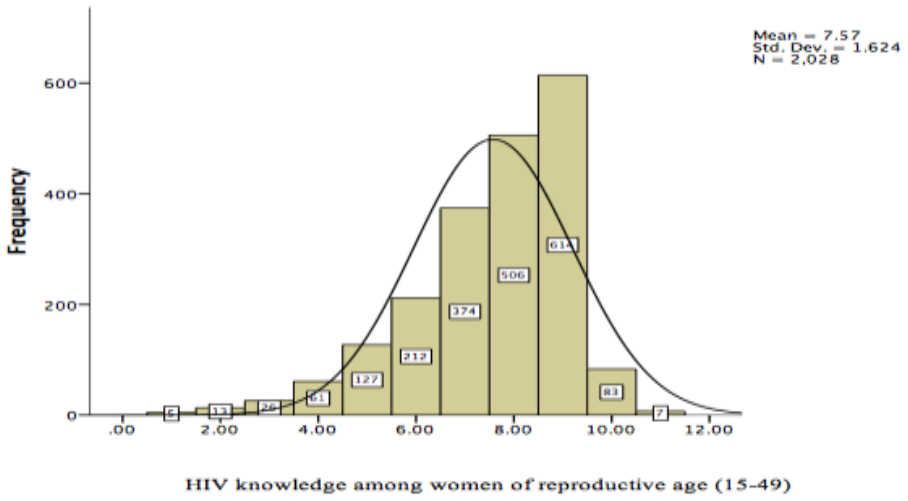


*Figure 7*. Histogram of HIV knowledge

Figure 7 displays a non normally distributed histogram. The observed figure is non normally distributed as some of the bars are not equivalent with the normal shape. The data is proportionately symmetrical distributed around the mean without many massive deviations from the curve, and has negative skewness. There are 614 observations, which corresponded to 9 questions answered by participants, and 7 observations of women who responded to all of the questions of HIV knowledge. There is a positive skewness meaning that the direction is symmetric. During PNCV, participants shared information about HIV transmission from mother to child, how to prevent HIV transmission, and HIV testing. A descriptive analysis shows that 58.7% participants have shared all HIV information with their health care providers or nurses/midwifes while 11.1% did not talk about HIV (Table 16).

Table 16

*Frequency Table of HIV Information*

| Variable | | Frequency | Percent |
|---|---|---|---|
| HIV Information | | | |
| Valid | 0 | 227 | 11 |
| | 1 | 340 | 16.5 |
| | 2 | 276 | 13.4 |
| | 3 | 1196 | 58 |
| | Total | 2039 | 98.9 |
| Missing | | 22 | |
| Total | | 2061 | 100 |

*Note*. Mean=2.19; standard deviation=1.077; zero= no information; 1= shared only info of HIV MTCT; 2=1 and how to prevent HIV; 3= shared 1, 2, and HIV testing.

Table 17 displays a frequency distribution of participants (N=2061) who know the location of testing services. The majority of women (96.2%) were aware of the location.

Table 17

*Frequency Table of Awareness of HIV Testing Coverage Services*

| Variable | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Know place to get HIV test | | | | | |
| Valid | No | 69 | 3.3 | 3.4 | 3.4 |
| | | 1983 | 96.2 | 96.6 | 100 |
| | Yes | | | | |
| | | 2052 | 99.6 | 100 | |
| | Total | | | | |
| Missing | | 9 | 0.4 | | |
| Total | | 2061 | 100 | | |

Table 18 depicts the distribution frequency of HIV testing during PNCV. Approximately 82.2% of participants have been tested for HIV.

Table 18

*Frequency Table of HIV Testing During PNCV (2061)*

| Variable | Tested for HIV as part of PNCV | Frequency | Percent |
|---|---|---|---|
| Valid | No | 348 | 16.9 |
| | Yes | 1694 | 82.2 |
| | Total | 2042 | 99.1 |
| Missing | 9 | 11 | 0.5 |
| | System | 8 | 0.4 |
| | Total | 19 | 0.9 |
| Total | | 2061 | 100 |

Table 19 displays the distribution of participants who attended PNCV and received a posttest counseling. As of 65.9% of women received counseling, and 12.6% have not been counseled during PNCV. Listwise deletion was used to handle missing data as the percentage was more than 5% (21.5%). Missing data might lower the sample size and the results will be less generalizable.

Table 19

*Frequency Table of HIV Post-Counseling*

| Variable | | Frequency | Percent |
|---|---|---|---|
| RCAIDS | | | |
| Valid | No/Don't Know | 259 | 12.6 |
| | Yes | 1359 | 65.9 |
| | Total | 1618 | 78.5 |
| Total | | 2061 | 100 |

*Note.* RCAIDS= received counseling after tested for AIDS

during PNVC; *n*=1618; missing =443 (21.5%); mean=0.84; std. deviation= 0.367.

## Evaluation of Statistical Assumptions

***Multicollinearity*** had been tested by using collinearity analysis regression. The results of multiple collinearity statistics showed the VIF varying between 1.01 to 2 with a minimum tolerance of 0.5.

***Outliers***. The outlier labeling rules have been used for detecting outliers by multiplying the Interquartile Range (IQR) by a factor 1.5 (Hoaglin, Iglewicz, & Tukey, 1986). It was also more accurate to multiply the IRQ by 2.2 as suggested by Hoaglin and Iglewicz (1987), but the previous option was used in this study to test the outlier. These are only applicable to a normally distributed data. The outliers are of particular importance as they might have a considerable influence on the results of a statistical analysis. The outliers have not been identified for the dependent variable (Figure 8). However, some outliers have been determined for the independent variable knowledge of HIV MTCT: A healthy-looking person can have HIV; Can get HIV from mosquito bites, V756 and V754JP, respectively (Figure 9). The outliers have been treated as a missing value and replaced during multiple data imputation process. As the outliers might lead to nonnormality, I also checked the for nonnormality. This assumption had not been covered in the previous chapter, but I suggest that it will be necessary to perform it.

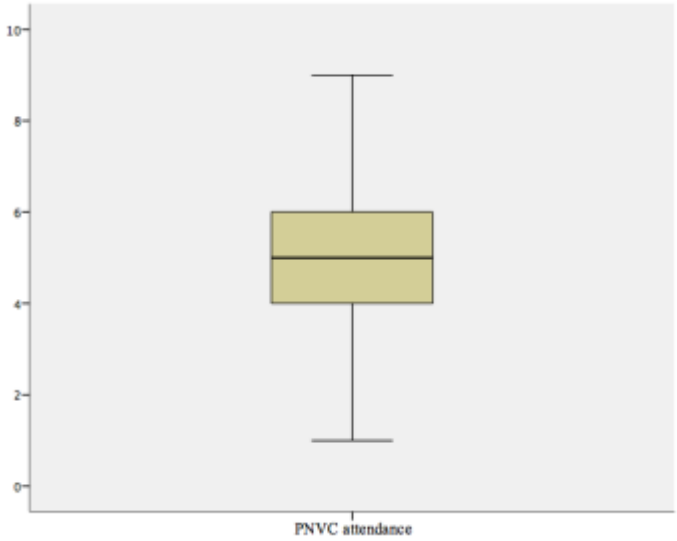


*Figure 8*. The distribution of PNCV Attendance.

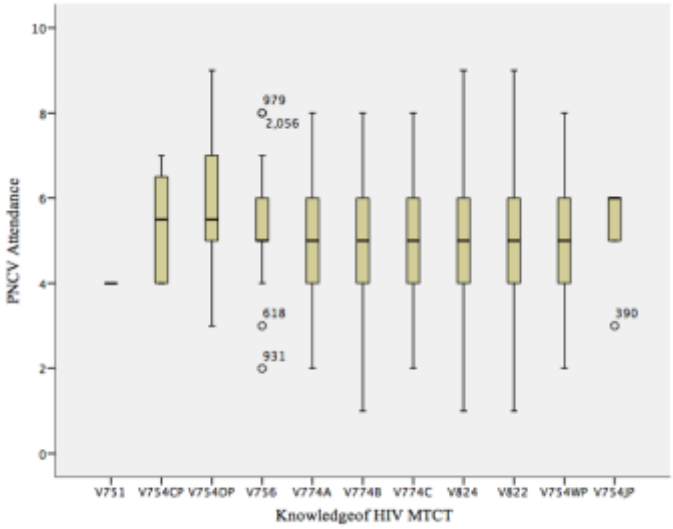


*Figure 9*. The distribution of Knowledge of HIV MCT and PNCV attendance.

***Missing data***. Missing data was detected using descriptive analysis. Missing data less than 5% in variable is acceptable, as it will not have an impact on the results

(Morrow, 2012). I evaluated the missing data by conducting the missing value patterns. Listwise deletion was used for variables with more than 5% missing data.

## Report of Statistical Analysis Findings Organized by Research Questions and Hypothesis

I conducted bivariate and multivariate analyses to evaluate the research questions and test my hypotheses. Crosstabulations and chi-square analyses were conducted to see if any cells are empty as empty cells would have invalidated the results of the ordinal logistic regression. The test of parallel lines was used to determine if the assumption of proportional odds had been violated.

### Research question 1

"*Is there an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care*?"

### Prenatal Care Attendance and Comprehensive knowledge of HIV MTCT

The descriptive analysis showed that 69% of participants attended three prenatal care visit or less compared to 17% of women who have had four or more. Only 13% of women attended less than two visits. Additionally, most of the women (26.2%) attended their first PNCV in the second trimester. Table 20 shows the results of crosstabulations and chi-square analyses. The observed chi-square statistic (Pearson's $\chi^2$ statistic): $\chi^2$ (22, N=2058) =27.595; $p$=0.189, means that there is no statistically significant relationship between PNCV and comprehensive knowledge of HIV MTCT. Therefore, the null hypotheses should not be rejected as there is not enough evidence to support that there is an association between a comprehensive knowledge of HIV MTCT among women aged

15-49 years and attendance of prenatal care. Also, there is a weak relationship between variables (Cramer's V =0.082, *p*=0.189).

Table 20.

*Association Between Prenatal Care Attendance and Knowledge of HVI MTCT: Crosstabulations*

| | Value | *df* | *p*-value |
|---|---|---|---|
| Pearson Chi-Square | 27.595 | 22 | 0.189 |
| Likelihood Ratio | 30.912 | 22 | 0.098 |
| Linear-by-Linear Association | 9.386 | 1 | 0.002 |
| N of Valid Cases | 2058 | | |

Table 21 shows that the significant $\chi^2$ statistic (111.960) with $p < 0.001$ indicates that the final model provides a significant improvement over the baseline model intercept.

Table 21.

*Association Between Prenatal Care Attendance and Knowledge of HIV MTCT: Ordinal Logistic Regression (Model Fitting Information)*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Intercept Only | 3264.847 | | | |
| Final | 3152.887 | 111.96 | 20 | .000 |

*Note*. Link function: Logit.

Table 22 shows the Pearson's $\chi^2$ statistic =4001.901, *p*=0.480. We failed to reject the null hypothesis as the *p* value is large. Thus, we conclude that the data and the model predictors are similar and the model is good. The Pseudo –R-square statistic indicates the

Nagelkerke = 6.7%, means that the knowledge of HIV MTCT explains a relatively small portion of the variation between women in their PNCV attendance.

Table 22

*Association Between Prenatal Care Attendance and Knowledge of HIV MTCT: Ordinal Logistic Regression (Goodness-of-fit)*

| | Chi-Square | *df* | *p*-value |
|---|---|---|---|
| Pearson | 4001.901 | 3998 | 0.480 |
| Deviance | 3152.887 | 3998 | 1 |

*Note*. Link function: Logit.

The parameter estimates table (see Table 23) shows that the coefficient for the variable knowledge of HIV MTCT, the independent variable in the model is 0.897, $p$=0.472. Because of the large observed significance level, the null hypothesis should not be rejected as there is not enough evidence to support that PNCV attendance and knowledge of HIV are associated.

Table 23

*Association Between Prenatal Care Attendance and Knowledge of HIV MTCT: Ordinal Logistic Regression (Parameter Estimates)*

| | | Estimate | Wald | *p* | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | L B | UB |
| Threshold | 3rd Trimester | -2.773 | 11.226 | 0.001 | -4.395 | -1.151 |
| | 2nd Trimester | 0.917 | 1.238 | 0.266 | -0.699 | 2.533 |
| Location | Maternal Age | -0.152 | 8.251 | 0.004 | -0.255 | -0.048 |
| | Wealth_index | 0.386 | 25.484 | 0 | 0.236 | 0.536 |
| | Type of Residence | 0.246 | 0.781 | 0.377 | -0.472 | 0.179 |
| | Married vs. Never Married | 0.014 | 17.016 | 0 | -1.25 | -0.445 |
| | Married vs. Divorced / Separated/ Widowed | -0.848 | 0.018 | 0.893 | -0.386 | 0.336 |
| | No Education vs. Primary | -0.025 | 3.441 | 0.064 | -0.014 | 0.506 |
| | No Education vs. Secondary | -0.147 | 0.005 | 0.944 | -0.373 | 0.401 |
| | (1) Ever heard of AIDS | 0.897 | 0.518 | 0.472 | -1.547 | 3.342 |
| | (2) Reduce risk of getting HIV: have one sex partner; whohas no o/partner | -1.365 | 1.892 | 0.169 | -3.309 | 0.58 |
| | (3) Reducing risk of getting HIV: always use condom during sex | -1.114 | 1.486 | 0.223 | -2.906 | 0.677 |
| | (4) A healthy-looking person can have HIV | -0.614 | 0.511 | 0.475 | -2.298 | 1.07 |
| | (5) HIV transmitted during pregnancy | -0.38 | 0.207 | 0.649 | -2.018 | 1.258 |
| | 6) HIV transmitted during delivery | -0.469 | 0.323 | 0.57 | -2.087 | 1.149 |
| | (7) HIV transmitted by breastfeeding | -0.481 | 0.344 | 0.557 | -2.086 | 1.125 |
| | 8) Drugs to avoid HIV transmission to baby during pregnancy | -0.407 | 0.248 | 0.619 | -2.008 | 1.195 |
| | (9) Wife justified asking husband to use condom if has STI | -0.432 | 0.281 | 0.596 | -2.032 | 1.167 |
| | (10) Can get HIV by sharing food with person who has AIDS | -0.786 | 0.864 | 0.353 | -2.442 | 0.871 |
| | (11) Can get HIV from mosquito bites | 0a | . | . | . | . |
| | [HIV_info=.00] | -0.688 | 16.601 | 0 | -1.02 | -0.357 |
| | [HIV_info=1.00] | -0.456 | 10.721 | 0.001 | -0.729 | -0.183 |
| | [HIV_info=2.00] | -0.03 | 0.039 | 0.843 | -0.323 | 0.263 |
| | [HIV_info=3.00] | 0a | . | . | . | . |

*Note* .CI= confidence interval; HIV_info code (see Appendix F); LB=lower bound; UB= upper bound.

The test of parallel lines shows that the proportional odds assumption appears to have held as the significance of the statistic $\chi^2$ is 0.673, which is >0.05. In the other word, the test signifies that the proportional odds assumption has not been violated (see Table 24). However, multinomial logistic regression was employed for predicting several categories such as no education vs primary, no education vs secondary, married vs never married, married vs divorced/separated/widowed, and other covariates.

Table 24

*Test of Parallel Lines*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Null Hypothesis | 3152.887 | | | |
| General | 3136.191 | 16.696 | 20 | 0.673 |

*Note*. The null hypothesis states that the location parameters (slope coefficients) are the same across response categories

A multinomial logistic regression was executed to model the association between the predictors (knowledge of HIV MTCT) and the outcome (attendance to PNCV) after controlling for covariates (demographic characteristics). For all tests, I employed 0.05 criterion of statistical significance. Thus, addition of the predictors (knowledge of MTCT HIV and HIV information) to a model that comprised the intercept only, significantly improved the fit between model and data, $\chi^2$ (40, N=2061)= 129.191, Nagelkerke $R^2$ =0.077, *p*=0.000 (Table 25). The Goodness-of-Fit has been explored but it was not statistically significant ($\chi^2$ =3995.514, *p*=0.419); thus, the model fits well the data.

Table 25

*Association Between Prenatal Care Attendance Visit and Knowledge of HIV MTCT: Multinomial Logistic Regression (Model Fitting Information)*

| | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|
| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
| Intercept Only | 3264.847 | | | |
| Final | 3135.656 | 129.191 | 40 | 0 |

Table 26 displays that high level of education, married vs. divorced/separated/widowed, and type of residence were not statistically significant. Thus, the null hypothesis is failed to be rejected as there is insufficient evidence to prove that these covariates are associated with the outcome of interest, which is PNCV. However, the table tells that wealth index variable has a significant main effect on PNCV

attendance, $\chi^2$ (2) =26.113, $p$=0.000, also married status interacted with never married status to predict the PNCV attendance, $\chi^2$ (2) =17.225, $p$=0.000. The comprehensive knowledge HIV MTCT was not statistically significant main effect on PNCV after controlling for demographic factors[$\chi^2$ (20)=17.561, $p$=0.616]. These findings show that there is insufficient evidence to fail to reject the null hypothesis (H01) that there is an association between a comprehensive knowledge of HIV MTCT among women aged 15-49 years and attendance of prenatal care after controlling for demographic characteristics. The coefficient model or parameter estimates will show which predictors significantly predict the outcome of interest (see Table 27).

Table 26

*Association Between Prenatal Care Visit Attendance and Knowledge of HIV MTCT: Multinomial Logistic Regression (Likelihood Ratio Tests)*

| | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|
| Effect | -2 Log Likelihood of Reduced Model | Chi-Square | df | Sig. |
| Intercept | 3135.656 | 0 | 0 | . |
| No Education vs. Primary | 3139.415 | 3.759 | 2 | 0.153 |
| No Education vs. Secondary | 3137.107 | 1.451 | 2 | 0.484 |
| Married vs. Never Married | 3152.881 | 17.225 | 2 | 0 |
| Married vs. Divorced/Separated/Widowed | 3136.981 | 1.325 | 2 | 0.516 |
| Wealth Index | 3161.77 | 26.113 | 2 | 0 |
| Maternal Age | 3145.138 | 9.482 | 2 | 0.009 |
| Type of Residence | 3136.789 | 1.133 | 2 | 0.568 |
| knoweldge | 3153.217 | 17.561 | 20 | 0.616 |
| HIV Information | 3162.572 | 26.916 | 6 | 0 |

Table 27 demonstrates the set of coefficients of the model, representing women who have their first PNCV attendance in the third or second trimester of gestation. Thus, the table is divided into two halves to compare pairs of outcome categories. The first

trimester is considered as the reference category. The model shows that the covariates marital status (married vs. never married): Wald $\chi^2$ (1)= 14.114, $p$<0.001; OR=3.754; 95% CI [1.883, 7.486]; wealth Wald $\chi^2$ (1)= 22.851, $p$<0.001; OR=0.511, 95% CI [ 0.388, 0.673]), and maternal age: Wald $\chi^2$ (1)= 7.851, $p$<0.01; OR=1.297; 95% CI [1.081, 1.556]) were statistically significant. Thus, the null hypothesis should be rejected as there is enough evidence to suggest that there is an association between comprehensive knowledge of HIV MTCT and PNVC attendance after controlling for these covariates. The odds of having knowledge of HIV MTCT and attend PNCV decrease significantly with marital status in the third trimester compared to the first trimester. In other words, the odds of married pregnant women having knowledge of HIV MTCT and PNCV attendance in the third trimester is 3. 75 times less than for those who attended in the first trimester. Pregnant women who attend their first PNCV in the between eight and twelve gestational weeks are more likely to attend four or more PNCV based on their health status (standard care or special care). Similarly, the odds of discussing HIV information during PNCV increase by almost 2.4 for women who shared information of MTCT during PNCV in the first trimester compared to the third trimester. The age of pregnant women is significantly confounder whether they had knowledge of HIV MTCT and attended prenatal care visit as scheduled. The odds ratio indicates that as the age of women increases by a unit, the change in the odds of having knowledge of HIV MTCT and PNCV in the third trimester is 1.3 times less than pregnant women who attend in the first or second trimester. The variable type of residence and high level of education were

not statistically significant; thus these covariates are not an intermediate in the causal pathway between exposure and outcome of interest.

The variable knowledge of HIV MTCT in the second set is not statistically significant when adjusted for covariates high level of education (no education vs. primary and no education vs. secondary), and type of residence. Therefore, I failed to reject the null hypothesis that there is no association between knowledge of HIV MTCT and PNCV attendance after controlling for high level of education and type of residence. However, the covariates wealth: Wald $\chi^2$ (1)= 16.119, $p$<0.001; OR=0.687; 95% CI [ 0.573,0.825]), and maternal age Wald $\chi^2$ (1)= 7.616, $p$<0.01; OR=1.218; 95% CI [1.059, 1.401]) were statistically significant. The null hypothesis should be rejected. The OR indicates that as the age changes from younger to older the chance in the odds of having knowledge of HIV MTCT and participating in PNCV in the second trimester compared to the first trimester is 1.21. Thus, the chances of a young pregnant woman attending four PNCV are 1.21 time more than for a mother with advanced age. Also, pregnant women residing in families that fall below the level of poverty is related with lower chances of having knowledge of HIV MTCT as compared to pregnant women residing in the families in the middle and rich wealth index.

Table 27

*Association Between Prenatal Care Visit Attendance and Knowledge of HIV MTCT: Multinomial Logistic Regression (Coefficients of the Model)*

| Trimester_DVa | | Wald | *p* | OR | 95% CI for OR | |
|---|---|---|---|---|---|---|
| | | | | | LB | UB |
| 3rd Trimester | Intercept | 920.71 | 0 | | | |
| | No Education vs. Primary | 3.609 | 0.1 | 0.636 | 0.399 | 1.014 |
| | No Education vs. Secondary | 0.1 | 0.8 | 0.893 | 0.442 | 1.804 |
| | Married vs. Never Married | 14.114 | 0 | 3.754 | 1.883 | 7.486 |
| | Married vs. Divorced / Separated/ Widowed | 0.011 | 0.9 | 1.033 | 0.567 | 1.881 |
| | Wealth | 22.851 | 0 | 0.511 | 0.388 | 0.673 |
| | Maternal Age | 7.851 | 0 | 1.297 | 1.081 | 1.556 |
| | Type of Residence | 0.776 | 0.4 | 1.297 | 0.727 | 2.315 |
| | (1) Ever heard of AIDS | 0 | 1 | 0.216 | 0 | .b |
| | (2) Reduce risk of getting HIV: have one sex partner; who has | 0 | 1 | 1.2E+14 | 0 | .b |
| | (3) Reducing risk of getting HIV: always use condom during s | 216.37 | 0 | 3E+07 | 3031809.6 | 2.98E+08 |
| | (4) A healthy-looking person can have HIV | 474.2 | 0 | 1.3E+07 | 2997095.7 | 57265022 |
| | (5) HIV transmitted during pregnancy | 770.78 | 0 | 7157512 | 2348762.2 | 21811479 |
| | 6) HIV transmitted during delivery | 932.48 | 0 | 8162599 | 2938990.8 | 22670375 |
| | (7) HIV transmitted by breastfeeding | 1069 | 0 | 8496598 | 3264929.8 | 22111404 |
| | 8) Drugs to avoid HIV transmission to baby during pregnancy | 1081.5 | 0 | 7464305 | 2906532.2 | 19169182 |
| | (9) Wife justified asking husband to use condom if has STI | 1128.9 | 0 | 7980583 | 3158049.3 | 20167418 |
| | (10) Can get HIV by sharing food with person who has AIDS | . | . | 1.6E+07 | 15702939 | 15702939 |
| | (11) Can get HIV from mosquito bites | . | . | . | . | . |
| | [HIV_info=.00] | 14.792 | 0 | 3.512 | 1.852 | 6.662 |
| | [HIV_info=1.00] | 11.342 | 0 | 2.386 | 1.438 | 3.958 |
| | [HIV_info=2.00] | 0.043 | 0.8 | 1.054 | 0.643 | 1.727 |
| | [HIV_info=3.00] | . | . | . | . | . |
| 2nd Trimester | Intercept | 1.46 | 0.2 | | | |
| | No Education vs. Primary | 1.335 | 0.2 | 0.794 | 0.537 | 1.174 |
| | No Education vs. Secondary | 0.44 | 0.5 | 1.2 | 0.7 | 2.056 |
| | Married vs. Never Married | 1.943 | 0.2 | 1.525 | 0.843 | 2.759 |
| | Married vs. Divorced / Separated/ Widowed | 0.657 | 0.4 | 0.824 | 0.516 | 1.316 |
| | Wealth | 16.119 | 0 | 0.687 | 0.573 | 0.825 |
| | Maternal Age | 7.616 | 0 | 1.218 | 1.059 | 1.401 |
| | Type of Residence | 0.973 | 0.3 | 1.226 | 0.818 | 1.836 |
| | (1) Ever heard of AIDS | 0.437 | 0.5 | 0.35 | 0.016 | 7.841 |
| | (2) Reduce risk of getting HIV: have one sex partner | 0 | 1 | 6138631 | 0 | .b |
| | (3) Reducing risk of getting HIV: always | 0.121 | 0.7 | 1.691 | 0.088 | 32.435 |
| | (4) A healthy-looking person can have HIV | 0.08 | 0.8 | 1.407 | 0.131 | 15.071 |
| | (5) HIV transmitted during pregnancy | 0.092 | 0.8 | 0.711 | 0.078 | 6.458 |
| | (6) HIV transmitted during delivery | 0.06 | 0.8 | 0.762 | 0.087 | 6.709 |
| | (7) HIV transmitted by breastfeeding | 0.068 | 0.8 | 0.75 | 0.087 | 6.477 |
| | (8) Drugs to avoid HIV transmission to baby during pregnancy | 0.037 | 0.8 | 0.811 | 0.094 | 6.957 |
| | (9) Wife justified asking husband to use condom if has STI | 0.099 | 0.8 | 0.708 | 0.083 | 6.057 |
| | (10) Can get HIV by sharing food with person who has AIDS | 0.031 | 0.9 | 1.226 | 0.128 | 11.746 |
| | (11) Can get HIV from mosquito bites | . | . | . | . | . |
| | [HIV_info=0.00] | 6.638 | 0 | 2.096 | 1.194 | 3.679 |
| | [HIV_info=1.00] | 9.19 | 0 | 1.904 | 1.256 | 2.887 |
| | [HIV_info=2.00] | 0.218 | 0.6 | 0.917 | 0.636 | 1.321 |
| | [HIV_info=3.00] | . | . | . | . | . |

*Note* . a =The reference category is: 1st Trimester;b= Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing;b= floating poitnt overflow occurred while computing this statistic; HIV_info code (see Appendix F).

**Research Question 2**

RQ2 is framed to analyze: "*Is there an association between HIV counseling and testing among women aged 15-49 years and attendance of prenatal care*?".

**Prenatal Care Attendance and HIV Counseling and Testing**

Table 28 displays the association between PNCV attendance and HIV testing. The observed $\chi^2$statistic is: $\chi^2$ (6, N=2061)=30.28, $p$<0.001. There is a statistically significant association between both variables. Therefore, the null hypothesis should be rejected as there is evidence to support the relationship between the variables PNCV attendance and HIV testing. However, there is a weak relationship between these variables as the Cramer's V value is 0.086, $p$<0.001. Table 29 shows that there is a statistically significant association between PNCV attendance and HIV counseling ($\chi^2$.=27.622, $p$<0.001). Thus, the null should be rejected, meaning that there is some association between HIV counseling and PNCV attendance. Cramer's V coefficient has a value of 0.82, with a $p$-value < 0.001, means that the strength of association between PNCV and HIV counseling is very strong. Further analyses were conducted to evaluate these associations, ordinal logistic regression and multinomial logistic after controlling for demographic characteristics.

Table 28

*Association Between Prenatal Care Attendance and HIV Testing: Crosstabulations*

| | Value | *df* | *p*-value |
|---|---|---|---|
| Pearson Chi-Square | 30.28 | 6 | 0.000 |
| Likelihood Ratio | 32.805 | 6 | 0.000 |
| Linear-by-Linear Association | 21.31 | 1 | 0.000 |
| N of Valid Cases | 2061 | | |

Table 29

*Association Between Prenatal Care Attendance and HIV Counseling: Crosstabulations*

| | Value | *df* | *p*-value |
|---|---|---|---|
| Pearson Chi-Square | 27.622 | 6 | 0.000 |
| Likelihood Ratio | 27.958 | 6 | 0.000 |
| Linear-by-Linear Association | 1.557 | 1 | 0.212 |
| N of Valid Cases | 2061 | | |

Table 30 presents the Model Fit-2 likelihood, the significant $\chi^2$ statistic (2619.428) with $p < 0.001$ indicates that the final model provides a significant improvement over the baseline intercept model Only.

Table 30

*Association Between Prenatal Care Attendance and HIV Counseling and Testing: Ordinal Logistic Regression (Model Fitting Information)*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Intercept Only | 2619.428 | | | |
| Final | 2560.298 | 59.13 | 8 | 0.000 |

Table 31 the Pearson's $\chi^2$ statistic =322.581, $p$=0.420. We failed to reject the null hypothesis as the *p*- value is large. Thus, we conclude that the data and the model

predictors are similar, and the model is good. The Pseudo –R-square statistic indicates the Nagelkerke = 0.045 (4.5%), means that the HIV testing and HIV counseling as part of PNCV describe a relatively small portion of the variation.

Table 31

*Association Between Prenatal Care Attendance and HIV Counseling and Testing: Ordinal Logistic Regression (Goodness-of-fit)*

| | Chi-Square | *df* | *p*-value |
|---|---|---|---|
| Pearson | 3229.581 | 3214 | 0.42 |
| Deviance | 2560.298 | 3214 | 1 |

Link function: Logit.

In the parameter estimates table (see table 32) shows that the coefficient for the labeled location "no counseling "is -0.139, $p$=0.347. Based on this observed significance level, the null hypothesis should not be rejected as there is insufficient evidence to indicate that HIV counseling is associated with the attendance of PNCV.

Table 32

*Association Between Prenatal Care Attendance and HIV Counseling and Testing: Ordinal Logistic Regression (Parameter Estimates)*

| | | Estimate | Wald | *p* | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | LB | UB |
| Threshold | 3rd Trimester | -2.121 | 98.449 | 0 | -2.54 | -1.702 |
| | 2nd Trimester | 1.515 | 52.42 | 0 | 1.105 | 1.925 |
| Location | No Education vs. Primary | 0.322 | 4.426 | 0.035 | 0.022 | 0.622 |
| | No Education vs. Secondary | 0.094 | 0.194 | 0.66 | -0.324 | 0.512 |
| | Married vs. Never Married | -0.83 | 14.118 | 0 | -1.264 | -0.397 |
| | Married vs. Divorced / Separated/ Widowed | -0.061 | 0.09 | 0.765 | -0.461 | 0.339 |
| | wealth_index | 0.388 | 23.609 | 0 | 0.232 | 0.545 |
| | Maternal Age | -0.131 | 4.91 | 0.027 | -0.247 | -0.015 |
| | Type of Residence | -0.121 | 0.49 | 0.484 | -0.458 | 0.217 |
| | HIV Tested | 0a | . | . | . | . |
| | No Counseling | -0.139 | 0.884 | 0.347 | -0.429 | 0.151 |
| | Counseling | 0a | . | . | . | . |

*Note.* CI= confidence interval; LB= lower bound; UB= upper bound.

*Test of Parallel Lines*

The test of parallel lines assumes that the relationships between the predictor (HIV testing and counseling) and the logits are the same for all the logits. The Chi-Square has an observed significance level of 0.734, which is more than the *p*-value. Thus, there is not sufficient evidence to reject the parallelism (fail to reject the null hypothesis). The test signifies that the proportional odds assumption has not been violated (See table 33).

Table 33

*Test of Parallel Lines*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Null Hypothesis | | | | |
| General | 2555.082 | 5.216 | 8 | 0.734 |

A multinomial logistic regression was conducted to model the association between HIV testing and HIV counseling and PNCV attendance after controlling for covariates (demographic characteristics). The Model Fit-2 likelihood shows that the significant $\chi^2$ statistic (104.055), $p < 0.001$, denotes that the final model gives a

significant improvement over the baseline intercept only model (Table 34). The Pseudo – R-square statistic indicates the Nagelkerke = 0.062 (6.2%). The Likelihood Ratio Test reveals that HIV Testing and HIV counseling were statistically significant main effect on PNCV after controlling for demographic factors[$\chi^2$ (2)=13.174, $p$=0.001] and [$\chi^2$ (4)=13.232, $p$=0.010], respectively (Table not shown).

Table 34

*Association Between Prenatal Care Attendance Visit and HIV Counseling and Testing: Multinomial Logistic Regression (Model Fitting Information)*

| | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|
| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
| Intercept Only | 3328.276 | | | |
| Final | 3224.221 | 104.055 | 22 | 0.000 |

Table 35 displays the set of coefficients of the model, showing women who have their first PNCV attendance in the third or second trimester of gestation and received posttest HIV counseling. The first model shows that the covariate no education vs. primary education was statistically significant: Wald $\chi^2$ (1)= 4.35, $p$=0.037; OR=0.57; 95% CI [0.336, 0.967]. The null hypothesis indicates that there is no association between HIV counseling and PNCV attendance should be rejected as there is enough evidence to prove it. The odds of receiving posttest HIV counseling in the first-trimester increase significantly with level of education compared with those who attended PNCV in the third trimester. Women with primary education have significantly greater odds of

receiving counseling than women with no education. Covariate married vs. never married was statistically significant: Wald $\chi^2$ (1)= 12.341, $p$<0.001; OR=3.93; 95% CI [1.833, 8.464]. Thus, the null hypothesis should be rejected as there is sufficient evidence to show an association between posttest HIV counseling and PNCV attendance after controlling for marital status. The odds of being married increase significantly the reception of posttest HIV counseling in the first trimester of PNCV attendance compared to the third trimester of first attendance. Starting PNCV in the first trimester of pregnancy will enhance pregnant women to attend the four prenatal visit as recommended by the WHO, especially for mothers who received HIV counseling. Maternal age was statistically significant: Wald $\chi^2$ (1)= 4.187, $p$=0.041; OR=1.235; 95% CI [1.009, 1.513]. In other words, as the age increases, pregnant women become 1.23 times less likely than a younger mother to attend the PNCV in the first trimester as recommended. Wealth index was also statistically significant: Wald $\chi^2$ (1)= 21.198, $p$<0.001; OR=0.50, 95% CI [ 0.376, 0.675].

The second model shows that the null hypothesis that there is no association between HIV counseling and PNCV attendance after controlling for maternal age should be rejected: Wald $\chi^2$ (1)= 4.421, p=0.035; OR=1.174; 95% CI [1.011, 1.363]. The covariate wealth index was statistically significant: Wald $\chi^2$ (1)= 14.642, $p$<0.001; OR=0.693, 95% CI [ 0.575-0.831]. After controlling for wealth index, the null hypothesis should be rejected. Women living in households that is below the characteristics of wealth index (middle and rich) is related with lower odds of being counseled after HIV test compared to women living in the households that is above the level of poverty.

Table 35

*Association Between Prenatal Care Visit Attendance and HIV Counseling: Multinomial Logistic Regression (Coefficients of the Model)*

| Trimester_DVa | | Wald | *p* | OR | 95% CIforOR | |
|---|---|---|---|---|---|---|
| | | | | | LB | UB |
| 3rd Trimester | Intercept | 1.75 | 0.186 | | | |
| | No Education vs. Primary | 4.35 | 0.037 | 0.57 | 0.336 | 0.967 |
| | No Education vs. Secondary | 0.38 | 0.537 | 0.789 | 0.371 | 1.677 |
| | Married vs. Never Married | 12.341 | 0 | 3.939 | 1.833 | 8.464 |
| | Married vs. Divorced / S/W | 0.159 | 0.69 | 1.141 | 0.598 | 2.176 |
| | Wealth Index | 21.198 | 0 | 0.504 | 0.376 | 0.675 |
| | Maternal Age | 4.187 | 0.041 | 1.235 | 1.009 | 1.513 |
| | Type of Residence | 0.45 | 0.503 | 1.231 | 0.671 | 2.258 |
| | Counseling | 0.95 | 0.33 | 1.273 | 0.783 | 2.068 |
| | No Counseling | . | . | . | . | . |
| 2nd Trimester | Intercept | 23.474 | 0 | | | |
| | No Education vs. Primary | 2.443 | 0.118 | 0.708 | 0.46 | 1.091 |
| | No Education vs. Secondary | 0.004 | 0.951 | 1.018 | 0.575 | 1.801 |
| | Married vs. Never Married | 2.965 | 0.085 | 1.771 | 0.924 | 3.394 |
| | Married vs. Divorced / S/W | 0.715 | 0.398 | 0.809 | 0.495 | 1.322 |
| | Wealth Index | 14.642 | 0 | 0.693 | 0.575 | 0.836 |
| | Maternal Age | 4.421 | 0.035 | 1.174 | 1.011 | 1.363 |
| | Type of Residence | 0.552 | 0.458 | 1.169 | 0.774 | 1.767 |
| | Counseling | 0.045 | 0.832 | 0.96 | 0.66 | 1.397 |
| | No Counseling | . | . | . | . | . |

*Note.* a= the reference category is: 1st Trimester; S/W=separated/ widowed; LB=lower bound; UB= upper bound.

Table 36 exhibits the set of coefficients of the model, showing women who have their first PNCV attendance in the third or second trimester of gestation and have been tested for HIV as part of PNCV. The first model shows that the covariate no education vs. primary education was statistically significant confounder of PNCV attendance and HIV

testing: Wald $\chi^2$ (1)= 5.575, $p$=0.018; OR=0.58; 95% CI [0.369,0.912] while no education vs. secondary was not statistically significant confounding variable. Education level was significantly associated with having an HIV test as part of PNCV. The likelihoods of being tested for HIV in third trimester rise significantly with level of education. Thus, the OR indicate that as the level of education increased by a unit, the change in the chances of being tested rather than not tested is 0.58. Women with primary education have significantly more chances of accepting to be tested than women with no education. Covariate married vs. never married was statistically significant confounder variable for HIV testing and PNCV attendance. The chances of being married increase significantly the acceptance of HIV testing: Wald $\chi^2$ (1)= 14.541, $p$<0.01; OR=3.753; 95% CI [1.902,7.407]. The likelihoods of being tested for HIV in the third trimester of gestation compared to the first trimester of gestation is 3.75 times more than for a pregnant married woman. Maternal age was statistically significant: Wald $\chi^2$ (1)= 5.681, $p$<0.017; OR=1.243; 95% CI [1.039,1.486]. Wealth index was statistically associated with having an HIV test as part of PNCV: Wald $\chi^2$ (1)= 21.881, $p$<0.001; OR=0.697, 95% CI [0.599,0.811]. The OR denotes that as the level of wealth increased by unit, the change in chances of being tested during the third trimester rather than in the first trimester is 0.7. Pregnant women are more likely to be tested in the first trimester of pregnancy than not to be tested if they live in the wealthy index level. But a type of residence was statistically insignificant; thus, it might not be effect confounder associated with the outcome of interest and the independent variable. There is not the association between HIV testing and PNCV attendance after controlling for type of residency.

The second model shows that maternal age was statistically significant: Wald $\chi^2$ (1)= 5.866, $p$=0.015; OR=1.185; 95% CI [1.033, 1.360]. Wealth index was statistically significant in the second model: wealth Wald $\chi^2$ (1)= 16.221, $p$<0.001; OR=0.785; 95% CI [0.698, 0.883]. No tested Wald $\chi^2$ (1)= 7.478, p=0.006; OR=1.803, 95% CI [ 1.182, 2.751]. Women residing in families below the level of poverty (poor wealth index) is correlated with lower chances of accepting HIV test in the first trimester (rather second trimester) compared to women residing in the households above the level of poverty based on the wealth index characteristics.

Table 36

*Association Between Prenatal Care Visit Attendance and HIV Testing: Multinomial*

| Trimester_Dva | | B | Wald | *p* | OR | 95% C for OR | |
|---|---|---|---|---|---|---|---|
| | | | | | | L B | U B |
| 3rd Trimester | Intercept | 0.797 | 5.698 | 0.017 | | | |
| | No Education vs.Primary | -0.55 | 5.575 | 0.018 | 0.58 | 0.369 | 0.912 |
| | No Education vs. Secondary | -0.4 | 1.397 | 0.237 | 0.67 | 0.345 | 1.302 |
| | Maternal Age | 0.217 | 5.681 | 0.017 | 1.243 | 1.039 | 1.486 |
| | Type of Residence | -0.11 | 0.185 | 0.667 | 0.894 | 0.536 | 1.491 |
| | Married vs. Never Married | 1.323 | 14.54 | 0 | 3.753 | 1.902 | 7.407 |
| | Married vs. Divorced/ W/S | 0.162 | 0.288 | 0.591 | 1.175 | 0.652 | 2.12 |
| | Wealth Index | -0.36 | 21.88 | 0 | 0.697 | 0.599 | 0.811 |
| | No Tested | 0.86 | 11.92 | 0.001 | 2.362 | 1.45 | 3.848 |
| | Tested | 0b | . | . | . | . | . |
| 2nd Trimester | Intercept | 2.058 | 58.17 | 0 | | | |
| | No Education vs.Primary | -0.28 | 2.127 | 0.145 | 0.753 | 0.514 | 1.103 |
| | No Education vs. Secondary | 0.014 | 0.003 | 0.957 | 1.014 | 0.61 | 1.686 |
| | Maternal Age | 0.17 | 5.866 | 0.015 | 1.185 | 1.033 | 1.36 |
| | Type of Residence | 0.023 | 0.016 | 0.9 | 1.023 | 0.719 | 1.455 |
| | Married vs. Never Married | 0.46 | 2.363 | 0.124 | 1.585 | 0.881 | 2.85 |
| | Married vs. Divorced/ W/S | -0.13 | 0.321 | 0.571 | 0.875 | 0.55 | 1.39 |
| | Wealth Index | -0.24 | 16.22 | 0 | 0.785 | 0.698 | 0.883 |
| | No Tested | 0.589 | 7.478 | 0.006 | 1.803 | 1.182 | 2.751 |
| | Tested | 0b | . | . | . | . | . |

*Note* . a=the reference category is: 1st Trimester; b= this parameter is set to zero because it is redundant; LB= lower bound; UB= upper bound; W= widowed; S= separated.

**Research Question 3**

RQ3 tried to analyze if "*Is there an association between awareness of HIV testing coverage services and attendance of prenatal care*?"

**Prenatal Care Attendance and Awareness of HIV Testing Coverage Services**

As of 2061 participants, approximately 96.7% of women aged between 15-49 were aware of the place of HIV testing coverage services. Table 37 presents the association between PNCV attendance and awareness of HIV testing coverage service. The observed $\chi^2$statistic is: $\chi^2$ (6, N= 2061)= 49.575, $p$<0.001. There is a statistically significant association between both variables, thus, the null hypothesis is rejected as there is sufficient evidence to indicate that both variables are associated. However, there is a weak relationship between both variables as the Cramer's coefficient is 0.110, *p*-value <0.001. Table 38 shows that there is a statistically significant association between PNCV attendance and HIV awareness of HIV testing coverage services ($\chi^2$.=40.334, $p$=0.003). Further analysis has been performed to evaluate these associations, which is an ordinal logistic regression. Multinomial logistic has been conducted to ascertain the predictive strength of the statistically significant predictors after controlling for demographic characteristics such as marital status, high level of education, maternal age, wealth index, and the type of residence.

Table 37

*Association Between PNC Attendance and Awareness of HIV Testing Coverage and Services: Crosstabulations*

| | Value | *df* | *p*-value |
|---|---|---|---|
| Pearson Chi-Square | 49.575 | 6 | 0 |
| Likelihood Ratio | 26.265 | 6 | 0 |
| Linear-by-Linear Association | 10.498 | 1 | 0.212 |
| N of Valid Cases | 2061 | | |

Table 38

*Association Between PNC Attendance and Awareness of HIV Testing Coverage and Services: Ordinal Logistic Regression (Model Fitting Information)*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Intercept Only | 40.334 | | | |
| Final | 28.627 | 11.708 | 2 | .003 |

*Note.* Link function: Logit.

Table 39 displays the Pearson's $\chi^2$ statistic =3.562, p=0.1.69. We failed to reject the null hypothesis as the *p*-value is large. Thus, we conclude that the data and the model predictors are similar; thus, the normal model does provide an adequate fit to the data. The Pseudo –R-square statistic indicates the Nagelkerke = 0.007, means that the HIV testing and HIV counseling as part of PNCV describe a relatively small portion of the variation.

Table 39

*Association Between PNC Attendance and Awareness of HIV Testing Coverage and Services: Ordinal Logistic Regression (Goodness-of-fit)*

| | Chi-Square | *df* | *p*-value |
|---|---|---|---|
| Pearson | 3.562 | 2 | 0.169 |
| Deviance | 4.657 | 2 | 0.097 |

*Note*. Link function: Logit.

The Parameter Estimates table shows that the coefficient for the variable place of HIV test (Yes= aware of the test and services, No= not aware) is - 0.834, *p*=0.001. The level of significance is small, meaning the null hypothesis should be rejected as it shows that there is a relationship between both variables. Therefore, the alternative hypothesis is accepted.

Table 40

*Association Between PNC Attendance and Awareness of HIV Testing Coverage and Services: Ordinal Logistic Regression (Parameter Estimates)*

| | | Estimate | Wald | *p* | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | LB | UB |
| Threshold | 3rd Trimester | -1.818 | 797.339 | 0 | -1.944 | -1.692 |
| | 2nd Trimester | 1.721 | 764.294 | 0 | 1.599 | 1.843 |
| Location | Place of HIV Test=No | -0.834 | 10.339 | 0.001 | -1.342 | -0.325 |
| | Place of HIV Test=Yes | 0a | . | | . | . |

*Note* . CI= confidence interval; LB= lower bound; UB= upper bound.

Table 41 displays the test of parallel lines. The significance of the Chi-Square statistics is 4.657 associated with a *p*-value of 0.097, which is more than 0.05. Thus, we failed to reject the null hypothesis, and conclude that there is not enough evidence to reject the parallelism hypothesis. The test signifies that the proportional odds has not been violated. But, I have performed multinomial logistic regression to adjust for confounders.

Table 41

*Test of Parallelism*

| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
|---|---|---|---|---|
| Null Hypothesis | 28.627 | | | |
| General | 23.97 | 4.657 | 2 | 0.097 |

*Note.* The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

A multinomial logistic regression has been conducted to model the association between awareness of HIV testing coverage and services and PNCV attendance after controlling for covariates (high level of education, marital status, maternal age, wealth index, and type of residence). The Model Fit-2 likelihood shows that the significant $\chi^2$ statistic (86.585), $p< 0.001$, means that the final model gives a significant improvement over the baseline intercept only model (Table 42). The Pseudo –R-square statistic indicates the Nagelkerke = 0.052 (5.2%).

Table 42

*Association Between PNCV Attendance and Awareness of HIV Testing Coverage and Services: Multinomial Logistic Regression (Model Fitting Information)*

| | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|
| Model | -2 Log Likelihood | Chi-Square | *df* | *p*-value |
| Intercept Only | 900.018 | | | |
| Final | 813.434 | 86.585 | 16 | 0.000 |

The Likelihood Ratio Test indicates that the place of HIV testing coverage services was statistically significant main effect on PNCV after controlling for demographic factors[$\chi^2$ (2)=9.220, $p$=0.010] (Table not exhibited). Table 43

demonstrates the set of coefficients of the model, showing women who have their first PNCV attendance in the third or second trimester of gestation and know a place to get HIV test. The first model shows that the covariate no education vs. primary education was statistically significant (Wald $\chi^2$ (1)= 5.814, $p$=0.016; OR=0.573; 95% CI [0.365,0.901). Education level was significantly associated with knowing a place to get HIV test during the gestation period. The null hypothesis that there is no association between awareness of HIV testing coverage and services and PNCV attendance after controlling for maternal level of education should be rejected, and the alternative accepted. The odds of knowing the location of HIV testing coverage and services in first-trimester increase significantly with level of education compared with the third trimester. Women with primary education have significantly greater odds of knowing the services than women with no education. Covariate married vs. never married was statistically significant: Wald $\chi^2$ (1)= 14.385, $p$<0.001; OR=3.723; 95% CI [1.887-7.343]). These findings indicate that the null hypothesis should be rejected as there is sufficient evidence that the confounder variable marital status is associated with awareness of HIV testing coverage and PNCV attendance. The odds of being married increase the awareness of HIV testing coverage services among pregnant women in the first trimester of gestation significantly compared to the third trimester. Maternal age was statistically significant (Wald $\chi^2$ (1)= 5.410, $p$=0.020; OR=1.235; 95% CI [1.034, 1.476). The odds reveal that as the maternal age increase, the change in odds of knowing the place of HIV testing during the first trimester, rather than in the third trimester, is 1.23. Pregnant women in advanced age are more likely to be aware of the place of HIV testing than young mothers. The

wealth index was statistically significantly associated with awareness of HIV testing services during PNCV (Wald $\chi^2$ (1)= 24.391, $p$<0.001; OR=0.684; 95% CI [0.588-0.795]). Thus, the null hypothesis has been rejected, and the alternative accepted as there is enough evidence to indicate that PNCV attendance and awareness of HIV testing services are related after controlling for wealth index.

The second model shows that maternal age was statistically significant: (Wald $\chi^2$ (1)= 5.700, $p$=0.017; OR=1.181; 95% CI [1.030, 1.355]. Women living in households that fall in the poor, middle, and rich wealth index is associated with higher odds of knowing the place of HIV testing coverage services compared to women living in the households that is below in the low level of wealth index (poverty). Wealth index was statistically significant in the second model (Wald $\chi^2$ (1)= 18.112, $p$<0.001; OR=0.775; 95% CI [0.689, 0.872]). Thus, we might reject the null hypothesis as there is enough evidence to indicate that there is an association between awareness of HIV testing coverage services after controlling for maternal age and wealth index. The confounding variables level of education, marital status, and the type of residence do not determine the likelihood of the outcome. Women living in households that fall in the poor wealth index are less aware of HIV testing coverage services in the first trimester than women living above the level of poverty. As the wealth increases, women become aware of HIV testing coverage services more likely to go and attend PNCV as scheduled by the WHO.

Thus, some confounding variables (a type of residence and divorced/separated women) differ between the PNCV attendance and awareness of HIV testing services and are not related to the outcome of interest.

Table 43

*Association Between PNCV Attendance and Awareness of HIV Testing Coverage and Services: Multinomial Logistic Regression (Coefficients of the Model)*

| Trimester_DVa | | B | Wald | *p* | OR | 95% CI for OR | |
|---|---|---|---|---|---|---|---|
| | | | | | | LB | UB |
| 3rd Trimester | Intercept | 0.974 | 8.912 | 0.003 | | | |
| | No Education vs. Primary | -0.556 | 5.814 | 0.016 | 0.573 | 0.365 | 0.901 |
| | No Education vs. Secondary | -0.441 | 1.702 | 0.192 | 0.644 | 0.332 | 1.248 |
| | Maternal Age | 0.211 | 5.41 | 0.02 | 1.235 | 1.034 | 1.476 |
| | Type of Residence | -0.135 | 0.27 | 0.603 | 0.874 | 0.525 | 1.454 |
| | Married Vs. Never Married | 1.315 | 14.385 | 0 | 3.723 | 1.887 | 7.343 |
| | Married vs. Divorced/ W/S | 0.143 | 0.227 | 0.634 | 1.154 | 0.64 | 2.08 |
| | Wealth Index | -0.38 | 24.391 | 0 | 0.684 | 0.588 | 0.795 |
| | Place of HIV Test= No | 1.865 | 5.991 | 0.014 | 6.457 | 1.45 | 28.75 |
| | Place of HIV Test= Yes | 0b | . | . | . | . | . |
| 2nd Trimester | Intercept | 2.169 | 67.503 | 0 | | | |
| | No Education vs. Primary | -0.289 | 2.218 | 0.136 | 0.749 | 0.512 | 1.096 |
| | No Education vs. Secondary | -0.011 | 0.002 | 0.966 | 0.989 | 0.596 | 1.642 |
| | Maternal Age | 0.167 | 5.7 | 0.017 | 1.181 | 1.03 | 1.355 |
| | Type of Residence | 0.016 | 0.008 | 0.929 | 1.016 | 0.715 | 1.445 |
| | Married Vs. Never Married | 0.467 | 2.434 | 0.119 | 1.595 | 0.887 | 2.868 |
| | Married vs. Divorced/ W/S | -0.148 | 0.392 | 0.531 | 0.862 | 0.543 | 1.37 |
| | Wealth Index | -0.255 | 18.112 | 0 | 0.775 | 0.689 | 0.872 |
| | Place of HIV Test= No | 1.526 | 4.394 | 0.036 | 4.601 | 1.104 | 19.173 |
| | Place of HIV Test= Yes | 0b | . | . | . | . | . |

*Note*. a= The reference category is: 1st Trimester; LB= lower bound; UB= upper bound; W=widowed; S= separated.

## Summary

In summary, 69% of respondents have high knowledge of HIV MTCT. As of 82% of women have been tested for HIV, and 65% have received posttest counseling. Most of the participants attended their first PNCV in the second trimester. The findings indicated that the knowledge of HIV MTCT was statistically significant predictor of prenatal care visit attendance among women aged 15-49 years-old. Therefore, the null hypothesis is rejected. However, the association is not statistically significant after controlling for

confounding variables such the high level of education, marital status, maternal age, and wealth index. But, the information of HIV MTCT discussed during PNCV is statistically significant. The independent variable ("tested for HIV as part of PNCV") and HIV post counseling are statistically significantly associated with the PNCV attendance. Thus the null hypothesis is rejected. Awareness HIV testing coverage services and PNCV attendance, as well as with the confounders (high level of education, marital status, maternal age, and wealth) are statistically significant. Therefore, the null hypothesis is rejected.

The statistical analysis results were relevant to prove if there is an association between predictors, outcome, and confounding variable. Chapter 5 contains analysis and interpretation of the findings in the context of the theoretical framework and the literature discussed in Chapter 2. It also includes a discussion of the limitations and implications of the study. Lastly, Chapter 5 includes an outline of recommendations for further research.

# Chapter 5: Discussion, Conclusions, and Recommendations.

## Introduction

The purpose of this study was to determine the importance of prenatal care attendance on comprehensive knowledge of HIV Mother-to-child transmission (MTCT), HIV testing and counseling, awareness of HIV testing coverage services, and information shared during antenatal care visit after controlling for sociodemographic characteristics. The nature of this study is a quantitative cross-sectional survey using secondary data from the Tanzanian Demographic Health Surveys (DHS) conducted in Tanzania from December 2011 to May 2012. Thus, the data were obtained from a nationally representative population survey designed to collect health information for research purposes. The datasets contain responses to questions about knowledge and behavior concerning HIV/AIDS and measures of HIV prevalence among women and men aged of 15-49. The HBM guided this study's consideration of the association of knowledge of HIV/AIDS, acceptance of counseling and testing, and knowledge of services available to PNCV.

Bivariate analysis was used to determine bivariate association between variables. Then, ordinal logistic and multinomial logistic regression analyses were conducted to assess the association between attendance at PNCV (dependent variable) and the independent variables listed previously. The findings of this study support the first hypothesis that women with comprehensive knowledge of HIV MTCT will attend early the PNCV (1st trimester). The second null hypothesis was rejected as there was enough evidence to indicate that women who have been tested during PNCV are more likely to

attend their early visit as well as four or more prenatal care visits. Conversely, no association between women who received counseling after HIV/AIDS testing and the PNCV attendance was observed. The third null hypothesis was rejected as awareness HIV testing coverage services and PNCV attendance was statistically significant. Further, I evaluated the relationship between predictors and criterion after controlling for demographic characteristics.

## Interpretations and Findings

### Descriptive Statistics

The study was conducted to analyze whether there is an association between knowledge of HIV MTCT, HIV testing and counseling, awareness of HIV testing coverage services, HIV information shared during PNCV, and the outcome of interest (PNCV attendance) after controlling for covariates. The results showed that 69% of women attended less than three visits whereas 17% pregnant women completed four PNCV. According to WHO (2015) recommendations, pregnant women should have four PNCVs beginning as early as possible for timely identification of any underlying conditions that might affect the mother and the baby. Thus, the first PNCV should be in the first trimester of pregnancy.

PNCV is vital for pregnant women because it prevents, diagnoses, and treats any conditions that can occur during pregnancy (Lema, Sando et al., 2014). However, the results of this study indicate that only 0.4% of pregnant women had their first prenatal visit in the first month of gestation, 2.3% presented in the second month, and 12.2% in the third month. Overall, 70% of participants received their first PNCV in the second

trimester with the highest number observed in the fifth month (26.2%) while 11.6% presented in the seventh month. These findings are not in compliance with the four-PNC recommended by the WHO: 1st visit between 8-12 weeks; 2nd visit between 24-26 weeks; and 3rd visit between 36-38 weeks of gestation (Licentto, Mothebesoane-Anoh, Gomez, & Munjanja n.d.). This schedule is required for women who need standard care; more visits are recommended for pregnant women with special care including HIV positive pregnant women. Therefore, community-based programs that address PNCV should encourage pregnant women to attend prenatal care as scheduled are needed.

Based on the distribution table 13, 70% of participants demonstrated a high-level of knowledge of HIV while 24% had a moderate knowledge. However, 5.6% of participants showed low knowledge of comprehensive HIV knowledge. The perceived susceptibility construct of HBM should be employed during PNCV to understand how Tanzanian pregnant women might have seen the risk of transmitting the HIV to their unborn child or having a newborn infected with the virus. Byamugisha et al. (2010) stated that it is important for prenatal attendees to have knowledge about HIV MTCT and the prevention of vertical transmission.

The literature revealed that in Sub-Saharan Africa countries, roughly 90% of HIV-infections in infants and children result from perinatal transmission; thus, these countries are facing an epidemic (United Nations International Children's Emergency Funds [UNICEF], 2015; Yogev & Chadwick, 2004). The United Republic of Tanzania had an estimated 250,000 new HIV infections among children aged 0 to 14 years old in 2013 (UNAIDS, 2013) compared to 91,000 in 2015 (UNAIDS, 2016). Thus, the high

proportion of knowledge of HIV MTCT (70%) among pregnant women might have a positive impact on PNCV attendance as the progression of PMTCT may reduce the rate of pediatric infection to less than 1% in the developed countries (Kellerman, Ahmed, Feeley-Summerl et al., 2013). Furthermore, rising awareness of the importance of PNCV among pregnant women is expected to lower vertical transmission.

**Association Between a Comprehensive Knowledge of HIV MTCT and PNCV Attendance**

There was a statistically significant association between knowledge of HIV MTCT and attendance of PNCVs. PNCVs are considered the entry point for preventing MTCT, as well as a critical period in maternal care that is habitually overlooked (President's Emergency Plan for AIDS Relief [PEPFAR], 2010) in the low-income setting. Tanzanian pregnant women with comprehensive knowledge of HIV MTCT might be more likely to seek PNCVs early in the first trimester. Infected, informed pregnant women are more likely to start ARV prophylaxis at 14 weeks of gestation, as recommended by WHO (2010).

This study found that 14.4% of expectant mothers wait until the third trimester to attend their first PNCV, meaning that HIV-infected women have missed the opportunities to initiate ARV prophylaxis early. In 2013, the WHO recommended two approaches for pregnant women who are living with HIV; these are Option B and Option B+ (UNAIDS, 2014; WHO, 2013). However, Tanzanian HIV-infected pregnant women chose Option B+ (life-long ARV treatment, regardless of the CD4 count), and others opted for Option

B (ARV prophylaxis until delivery or breastfeeding) due to stigmatization and discrimination, according to Ngarina et al., 2014.

Comprehensive knowledge of HIV among pregnant women and their approaches on MTCT of HIV could help them to attend more frequently the prenatal care visit (at least four) and health promotion to be informed of HIV transmission and its prevention as well as the importance of being tested and counseled. Similarly, Wangwe, Nyasinde and Charles (2013) stated that knowledge and attitude on PMTCT of HIV have positive effect towards HIV prevention, counseling and testing, as well as adherence to ARV drugs. Wangwe et al. (2013) indicated that the HBM explains health behavior as a function of individuals' sociodemographic characteristics, knowledge, and attitudes. The HBM is important in PMTCT of HIV/AIDS as it assists with understanding the determinants or sociodemographic factors of pregnant women's health-related behaviors and how they might enhance positive behavior changes.

When considering demographic characteristics, the results suggested there was a statistically significant association between PNCV and participants' household wealth index, age, level of education (no education versus primary education), and marital status (married versus never married). However, there was no association between PNCV and participant's place of residence and secondary education. Socioeconomic demographic characteristics (mother's age, education attainment, marital status, and occupation) are the main reported causes of infant and child mortality (es Salaam, 2015). There was a positive association between knowledge of HIV MTCT, high level of education, and

PNCV attendance. Thus, women with high level of education are more likely to present early for PNCV (first month).

Comprehensive HIV knowledge, as well as knowledge of HIV status, permits Tanzanian pregnant women to attend PNCV and participate in the prevention of MTCT services to reduce the risk of perinatal transmission, particularly among HIV-infected mothers. Further, the prevention of perinatal transmission during PNCV improves maternal health and infant HIV-free survival (PEPFAR, 2010), which is related to consistent prenatal care attendance and adherence to ARV treatment for HIV-infected pregnant women. Health behavior might exert critical influence on the decisions of pregnant women to attend PNCV and health promotion about HIV/AIDS knowledge.

The results of this study also suggested that the association between information shared during PNCV and PNCV attendance is statistically significant. I found that 58% of participants had exchanged information with the health care provider during PNCV. Pregnant women who received HIV information attended PNCV on time compared to those who did not share information about HIV/AIDS during their prenatal care visits. These results are similar to those of Asefa and Beyene (2013), which showed that information received during PNCV was associated with women's knowledge. The reverse was also found in that women who have not received information on MTCT or prevention from services providers during PNCV demonstrated a low level of knowledge on the timing of MTCT of HIV. The demographic characteristics, type of residence, highest level of education, household wealth index, and age were also associated with

HIV information shared during PNCV. However, marital status was not associated with HIV information.

Information of HIV shared during PNCV allow pregnant women to be aware of the mode of transmission, prevention, HIV testing, and counseling, as well as the location of HIV testing. According to An et al. (2015), including HIV testing and counseling during maternal health care will reinforce women's exchange of information in their communities, and will also aid in the spread of information about HIV counseling as well as HIV knowledge received during prenatal care visit to others. The HBM predicts that pregnant women will be more likely to follow prenatal care recommendations if they feel susceptible to HIV/AIDS, believe AIDS is a severe illness, perceive barriers to HIV testing and counseling as lower than perceived benefits, have higher self-efficacy for obtaining HIV testing, and receive a cue for action.

**Association Between HIV Counseling and Testing and Attendance of Prenatal Care**

The results of this study demonstrate that the variable tested for HIV as part of PNCV was statistically significant for women who attended their first prenatal visit in the 2nd trimester based on educational level, marital status, maternal age, and wealth index. In this study, 82.2% of women had been tested for HIV, while only 17% had not. An et al. (2015) stated that stigmatization, fear of receiving a positive test, and fear of a breach of confidentiality by the health care provider are some of the factors related to women's reluctance to accept HIV testing and counseling. These might be the barriers to testing for the 17% in my study, although a further examination was outside the scope of this research. Therefore, this situation remains a major problem for public health in most of

the Sub-Saharan countries. However, health care professionals (nurses, midwives, health workers, doctors) should identify and reduce the perceived barriers through reassurance, correction of misinformation, and assistance. The perceived barriers of HBM may act as weaknesses to undertaking recommended behaviors (Glanz, Rimer, & Viswanath, 2008). De Cock, Marum, and Mbori-Ngacha (2003) affirmed that HIV counseling and testing remain the principal entry point of HIV prevention, treatment, and care services. Therefore, it is critical that pregnant women in Tanzania be more informed during PNCV of counseling and testing to allow them to have enough knowledge of HIV to reduce the risk of perinatal transmission.

A study conducted in South Africa demonstrated that women who received their HIV results were more likely to seek medical care and adhere to the drug regimen for HIV positive women (Stadler, Delany, & Mntambo, 2008). Thus, having the HIV results and posttest counseling might motivate pregnant women to attend prenatal care visits and adhere to HIV drugs when the treatment is needed. This dissertation study showed that there was no association between Tanzanian women who received counseling after being tested for HIV/AIDS and the PNCV attendance. Some 65.9% of women received counseling, and 12.6% have not been counseled during PNCV. Thus, the proportion of women who had not been counseled after contracting HIV was quite high as they need information about HIV transmission between mother and child, and how prevention will reduce pediatric infections in Tanzania. Also, women should be counseled about infant feeding and antiretroviral drugs as well as a constant prenatal care attendance.

This finding has significant implications for health care and education in Tanzania and similar countries. According to the 2014 report of UNAIDS, an estimated 87% of 1.5 million of pregnant women were living with HIV in Sub-Saharan Africa countries in 2013 (UNAIDS, 2014). Because 43,000 new pediatric infections per year were reported in Tanzania despite the extensive coverage of PMTCT services (Ngarina et al., 2014; Tanzania, Ministry of Health and Social Welfare, 2012a), it is indispensable to encourage Tanzanian pregnant women for having HIV testing and counseling during prenatal care visit as it already been included the 2002 focused antenatal care model implemented in Tanzania. The important phase to promote prevention of MTCT is to detect early HIV-infected pregnant women at the first PNCV attendance, mostly between 8 to 12 weeks of gestation. Furthermore, it is reasonable to agree with Heemelaar, Habets, Makukula, Roosmalen, and Akker (2015) as they stated that HIV testing of pregnant women and repeated testing every three months during pregnancy and breastfeeding is the recommended policy in the high-prevalence HIV countries. However, this statement will not be applicable for pregnant women who receive their first PNCV in the third trimester. The reason for repeating the test is due to seroconversion, which is high during pregnancy in the countries with high prevalence of HIV (Heemelaar et al., 2015).

The results of this analysis demonstrate a strong positive association between received counseling after being tested for AIDS during PNCV and highest educational level. Comparably, Sagan and Schopflocher (2015) found that women with higher levels of education are more likely to participate in the pretest counseling as they can understand health information and the importance of prevention of mother to child

transmission. Also, maternal age was associated with post-HIV counseling and PNVC attendance, mostly for women aged groups 15-24 and 30-39 years, 36.8% and 31.3%, respectively. However, women aged 40-49 years were less likely to received HIV testing and posttest counseling (5.75%) as a part of PNCV attendance. Thus, all women who attend PNCV should be tested and counseled regardless of their age, as HIV infection can be transmitted at any age. Health care providers, nurses/midwives, and other skilled prenatal care attendants should promote health education of HIV testing and counseling to all ages of women who participate in PNCV. Further, the results show that there is no association between women who received posttest counseling and PNCV attendance after controlling for a place of residence.

HIV testing is crucial during PNCV as it determine the HIV status of a pregnant women. The posttest counseling is necessary as it gives information about the necessity of being tested, the risk of MTCT and prevention, attendance to PNCV, the possibility of adequate HIV treatment, as well as follow-up. Thus, women who have received posttest HIV counseling are significantly more likely to attend the recommended PNCV as scheduled. A pre counseling test will also be beneficial to pregnant women as the health provider will share information about the myth of HIV as well as the prevention.

Future mothers should attend health program with their partner as it is evident, based on the literature review, that women are reluctant to accept HIV testing because of the issue of confidentiality, discrimination, fear of rejection, which are barriers to health prevention. In addition, pre counseling test are beneficial to pregnant women, as the health provider will share information about HIV-related myths as well as factual

information about prevention. In this study, the frequency of women who attended PNCV and received pre counseling of HIV is unknown, as the original dataset did not include a pre counseling questionnaire in the survey.

Future mothers should attend health program with their partner as it is evident, based on the literature review, that women are reluctant to accept HIV testing because of the issue of confidentiality, discrimination, fear of rejection, and so forth. The perceived benefits of HBM might have a positive impact on PMTCT of HIV/AIDS. Because expectant mothers will perceive personal susceptibility to HIV/AIDS as a serious health condition that can lead to a severe outcome, which it is seen as a threat, and will lead to behavior change influenced by their beliefs concerning perceived benefits of multiple actions to decrease the disease risk. Therefore, the perceived benefits are related to mother's knowledge and beliefs that PMTCT interventions are beneficial and efficient to prevent MTCT (Hampanda, 2012; Igumbor, Pengpid & Obi, 2006). Prenatal care offers a chance for integration of routine maternal and child health services with HIV screening and potential HIV treatments or referral to specialized clinics (Turan, Onono, Steinfeld, Shade, Owur, Bukusi, et al., 2015; Washington, Owuor, Turan, Steinfeld, Onono, Shade, et. 2015). Further, pregnant women who have access to prenatal care receive all medical recommendations such as HIV testing and appropriate medical care throughout an operational service integration (Gunn, Ibitola, Asaolu, Center, Gibson, Wightman, et al., 2016).

**Association Between Awareness of HIV Testing Coverage Services and Attendance of Prenatal Care**

The association between awareness HIV testing coverage services and PNCV attendance was statistically significant. The majority of women (96.7%) were aware of the centers of HIV while only 3.3% did know where to get an HIV test. We can assume that the more women are aware of the coverage services, the more they will be informed of their HIV status during prenatal care visit. But, this assumption was not tested in this study. Consequently, women will attend PNCV as recommended by the WHO based on their health conditions. Similarly, it was reported that multiparous and having more than two living children was highly related to HIV testing service awareness, as well as voluntary counseling and testing (Paulin, Blevins, Koethe, Hinton, Vaz, Vergara et al., 2014). However, it will be useful to analyze the parity of women and the awareness of HIV coverage services in this study to agree with the findings of Paulin et al. (2014). Pregnant women voluntary go for testing and counseling if they are aware of the services through PNCV attendance. Further, pregnant women with comprehensive knowledge of HIV MTCT (RQ1) along with awareness of HIV services will contribute to the improvement of the uptake and outcomes of prevention MTCT interventions. Similarly, Anteneh and Beyene (2013) noted that awareness on MTCT HIV, as well as knowledge of its timing, have a direct effect on the utilization of prenatal MTCT services including HIV testing.

In 2012, the policy for providing reproductive health services free of charge was implemented in The United Republic of Tanzania (UNAIDS, 2013). Thus, pregnant

women within the low wealth quintile will benefit from these services without fees. The removal of this barrier might increase the likelihood of HIV testing, though the other barriers against HIV testing such as stigma, discrimination, fear of breach confidentiality from health care worker or fear to be rejected by the family member, may persist and mitigate this effect. A study conducted in rural Mozambique showed that women who have a higher HIV-associated stigma score were less likely to undergo HIV testing (Paulin et al., 2014). Unfortunately, an investigation of the HIV stigma among this study's population was not within the scope of this study.

The findings of this study indicated that wealth index, marry vs. never marry, and no education vs. primary had a statistically significant association with Awareness of HIV Testing Coverage Services and Attendance of Prenatal Care. However, residential setting, secondary education, and divorce status were not statistically significant. I found that 83.4% of pregnant women were living in a rural area and a majority of them were aware of the services compared to those who reside in the urban area.

## Limitations of the Study

I had no control over the study population as this research used secondary data from the TDHS 2011-2012. In addition, four observations (one for HIV knowledge and three for HIV testing) were deleted due to missing values or explanatory variables. These variables are as follows: "Heard of drugs to help HIV-infected people live longer; Tested for HIV at the time went to delivery and before the baby was born; Got results of HIV test when tested before baby was born; Offered HIV test at the time went to delivery and before baby was born". These variables were important to understand if pregnant women

know about the HIV medications, as well as their HIV status at the time of delivery, in particular for those who have not been tested during PNCV or attended their first care visit in the last month of pregnancy. However, others variable with less missing data that have been deleted by SPSS version 21 using multiple imputation, which is a conservative approach, did not affect much the results of the data. Further, the dependent variable was not categorized as expected. For instance, the outcome variable (PNCV) was another limitation for this study. The prenatal care visit attendance was listed from the first month through the ninth month of gestation. Before conducting the descriptive analysis, I divided the variable into three categories: first trimester, second trimester, and third trimester. Therefore, an ordinary logistic model was used to run the statistical analysis to answer all the research questions, and multinomial was used to assess the association between the dependent variable and independent variables after controlling for covariates.

The validity and reliability issues were also a concern as some of the participants misunderstood the questions, which leads to a wrong or irrelevant response. Further, during the survey questionnaire, women are reluctant to answer or provide accurate information in response to sensitive questions such as whether a pregnant woman had been tested for HIV and received results (self-selection bias). Thus, the information collected during the interview was self-reported, which suggests the probability of recall bias as we cannot obtain accurate data on sensitive questions. Another limitation is the fact that this study used a cross-sectional design; therefore, we cannot find a cause-effect association. Also, this design cannot be used to assess behavior of pregnant women who

attended prenatal care visits over a period of time.

## Recommendations for Further Research

Based on these findings and the strengths and limitations of this study, I recommend a cohort study be conducted as groups of participants with common characteristics can be followed over time to determine the incidence of symptoms, disease, or death. For example, a subset of pregnant women could be selected for evaluation based on their exposure and compared with those who have not been exposed (comparison group). Given the limited time of pregnancy, a prospective cohort study is feasible and would be more useful as pregnant women could be followed from the first trimester through the last. Attendance at PNCV, frequency of health promotion efforts, and the outcome of interest, the transmission of HIV from mother to child, could be observed in real-time. The prospective cohort design study would allow the principal investigator to control the data collection process to ensure that the description of the data is correctly organized and information on all variables of interest is available. Future research could employ the concepts of HBM to understand how health beliefs and knowledge influences the behaviors of pregnant women.

Finally, studies should be considered to explore the role of a partner or husband as well as the participation of partner or husband and the availability of health care facility, as neither of these have been adequately addressed to date.

## Implications

Prenatal care is a fundamental component of reproductive health care. An evaluation of the mother's health status during an initial and early visit should be

conducted to determine whether the pregnant women requires standard or more advanced care. Es Salaam (2015) stated that socioeconomic demographic characteristics are the most frequently reported predictive factors for infant and child mortality. In his study, Es Salaam observed that maternal age, education attainment, marital status, and income level were predictors of prenatal care attendance. WHO (2010) recommends pregnant women attend their first prenatal care visit at the early stage (1st trimester) and subsequently attend four goal-oriented visits to reduce pediatric morbidity and mortality. The results of this study suggest that few Tanzanian women meet this goal. Therefore, efforts are needed to increase the availability and desirability of early and frequent PNVC.

**Implications for Positive Social Change**

The study explored the comprehensive knowledge of HIV, testing and counseling, awareness of HIV testing, and PNCV attendance after controlling for sociodemographic characteristics. The priority is to target pregnant women with low education living in a poor wealthy household. The potential social change social is to improve the well-being of reproductive women and infants/children in Tanzania. Promoting health care and HIV prevention for Tanzanian women during pregnancy as an instrument of population health, especially for infected HIV women will be the appropriate strategies. Tanzanian pregnant women should be motivated and have the perceived susceptibility to the severity of the HIV/AIDS to change behavior. Further, the positive social change is to involve expectant mothers to attend the PNCV and reinforce or/and introduce systematic HIV screening along with counseling. Health policy should work in collaboration with the community-based to address the problem of late first PNCV attendance, which might

save live of the mother and child.

### Implications for Professional Practice

The potential practical effects are to encourage pregnant women to attend early PNCV to determine if they need standard (four visits) or special care (more than four recommended visits). Strengthening the PMTCT and early detection and treatment of HIV; repeat HIV testing at the second visit for pregnant women who had a negative result to ensure that there is no seroconversion; offer HIV testing to those who have refused to be tested at the first visit will be a good strategy to reduce perinatal transmission. It is also crucial to follow-up pregnant women at risk or infected HIV pregnant women to avoid poor compliance and lack of PNCV as well as MTCT.

## Conclusions

The government of Tanzania adopted the option A of 2010 WHO guidelines in 2011, which is the use of ARV medications to treat pregnant women and prevent MTCT of HIV. Further, PMTCT policies engaged testing and counseling partners in the health facilities, and the option B and B+ were implemented in 2013 for all HIV-infected pregnant women and breastfeeding mothers. Comprehensive knowledge of HIV/AIDS is a precondition for pregnant women behavior change concerning their PNCV attendance. Having susceptible perceptions toward serious diseases will allow pregnant women to accept a preventive behavior to reduce the risks of prenatal transmission.

The results of this study are intended to help health care providers, nurses/midwives, and health educators to encourage pregnant women to go for HIV testing and counseling and to adhere conscientiously to prenatal care visit. HIV testing

allows pregnant women to be aware of their HIV status and to receive ARV on time, as well as to be compliant with medication by attending prenatal care as scheduled by the health care provider (special care). This study showed that few women attended their first prenatal care in the first month of gestation, which does not comply with the recommendations of the WHO. Consequently, pregnant women who attend their first prenatal care lately in the second or third trimester will be more likely to infect their unborn child if there are not aware of their HIV status.

Early and consistent prenatal care will save life and reduce perinatal transmission. Therefore, health policymakers should approach the issue of pregnant women coming late for their first prenatal care, particularly the third trimester as demonstrated in this study. Lack of PNCV attendance, as well as HIV perinatal transmission, will remain serious public health issues if the government of Tanzania could not address these problems. Public health leaders in Tanzania should continue to work hard with community-based to improve the quality of health of pregnant women, give them opportunities to participate in health promotion of HIV/AIDS, and attend the four recommended PNCV.

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# Appendix A: Data Use Authorization

July 11, 2015

Nkembi Bianda
Walden University

Dear Nkembi:

You are authorized to use all available Tanzania Demographic and Health Survey (DHS) datasets, for your research project titled: **"**The Role of Prenatal Care and Systematic HIV testing in Preventing Perinatal Transmission in Tanzania, 2011-2012**".**

To download the DHS datasets, please login to your user account at:

http://www.dhsprogram.com/data/dataset_admin/login_main.cfm

- The user name is your registered email address: drbianda@gmail.com
- The password is the one you selected during the registration process.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

The DHS datasets must not be passed on to other researchers without the written consent of DHS. You are requested to submit an electronic or hard copy of any reports/publications resulting from using the DHS data files to our office.

Sincerely,

***Bridgette Wellington***

Data Archivist
The Demographic and Health Surveys (DHS) Program

530 Gaither Road, Suite 500 • Rockville, MD 20850 US • +1.301.407.6500 • +1.301.407.6501 fax • icfi.com

Appendix B: DHS Download Account Application

**From:** archive@measuredhs.com
**Date:** July 28, 2015 at 10:11:34 AM EDT
**To:** drbianda@gmail.com
**Subject: DHS Download Account Application**

**See Attached. **

You have been authorized to download data from the Demographic and Health Surveys (DHS) Program. This authorization is for unrestricted countries requested on your application.

The data should only be used for the purpose of the registered research or study. To use the same or different data for another purpose, a new research project request should be submitted. This can be done from the "Create A New Project" link in your user account.

All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey.

The data sets must not be passed on to other researchers without the written consent of DHS. Users are required to submit a copy of any reports/publications resulting from using the DHS data files. These reports should be sent to: archive@dhsprogram.com.

To begin downloading datasets, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm

Once you are logged in, you may also edit your contact information, change your email/password, request additional countries or Edit/Modify an existing Description of Project.

If you are a first time user of DHS Data, please view the following videos on downloading and opening DHS data: http://www.dhsprogram.com/data/Using-DataSets-for-Analysis.cfm#CP_JUMP_14039

Additional resources to help you analyze DHS data efficiently include: http://dhsprogram.com/data/Using-Datasets-for-Analysis.cfm, a video on Introduction to DHS Sampling Procedures - found at: http://youtu.be/DD5npelwh80 and a video on Introduction to Principles of DHS Sampling Weights - found at: http://youtu.be/SJRVxvdIc8s

The files you will download are in zipped format and must be unzipped before analysis.

Following are some guidelines:

After unzipping, print the file with the .DOC extension (found in the Individual/Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition.

Please download the DHS Recode Manual:
http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm

The DHS Recode Manual contains the documentation and map for use with the data. The Documentation file contains a general description of the recode file, including the rationale for recoding; coding standards; description of variables etc. The Map file contains a listing of the standard dictionary with basic information relating to each variable.

It is essential that you consult the questionnaire for a country, when using the data files. Questionnaires are in the appendices of each survey's final report:
http://dhsprogram.com/publications/publications-by-type.cfm

We also recommend that you make use of the Data Tools and Manuals:
http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm

DHS statistics can also be obtained using the STAT compiler tool:
http://www.statcompiler.com

This tool allows users to select countries and indicators to create customized tables. It accesses nearly all of the indicators that are published in the final reports. Authorization is not needed to use the STAT compiler.

For problems with your user account, please email archive@dhsprogram.com.

For data questions, we recommend that users register to participate in the DHS Program User Forum at: http://userforum.dhsprogram.com

The User Forum is an online community of DHS data users and contains discussions about many DHS analysis and dataset topics. Please search the contents of the forum, and if you do not see your question addressed, consider posting a new question for users to discuss.

The Demographic and Health Surveys (DHS) Program
ICF INTERNATIONAL
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Login Email: drbianda@gmail.com
Password: (use the password you entered when you registered)

Appendix C: Notes on DHS Datasets

## NOTES ON DHS DATASETS

DHS process the data in a way that brings information 'down' from each higher analytical level in the data, to the lower levels. Thus household information about water source, toilet facilities, cooking facilities, Wealth Index, are attached to the woman's, men's and children's files; as this household information may have relevance for analysis of the woman, man, or child. Likewise, mother's information such as education, marital status, height and weight, defacto/dejure status, etc., is attached to each of her children, as this is potentially relevant to the analysis of them. In DHS surveys there are multiple units of analysis, and these in turn are interrelated. Great care is taken to assure that these relations and their linkages are complete and correct.

The three core questionnaires in ***DHS*** surveys are: the Household Questionnaire, the Women's Questionnaire, and the Men's questionnaire. There are also several standardized modules for countries with interest in other topics, such as malaria, domestic violence or maternal mortality. All additional modules are incorporated into the Household, Women's, or Man's questionnaires. Since the very beginning of DHS a recode file was designed for the sake of consistency and comparability across surveys. In the first phase of the DHS (DHS-I) the recode was defined only for the Women's Questionnaire. The recode file proved to be very useful and as a result since DHS-II, a recode file was introduced for the Household and the Men's questionnaires.

Recode files are initially created using a hierarchical model and later exported to flat files. There are two physical recode hierarchical data files. The first one includes the Household and Women's Questionnaire and the second one is for the Men's Questionnaire. The hierarchical data file is broken down into a number of records. The records were originally designed to map different sections of the model questionnaires, but because of changes among phases that is not the case anymore. Some of these records are repeating or multiple-occurrence records while others are single-occurrence records. Single records contain simple, single-answer variables. Multiple records are used to represent sets of questions that are repeated for a number of events.

There are special records to keep variables that are not part of the model questionnaires but were included in a particular country. These records are known as country-specific records and they can also be multiple or single depending on whether the question was added to a single or multiple section in the questionnaire.

The **types of datasets** generated for each survey vary by survey design; however there are seven common types of recode data files associated with the core questionnaires. The three questionnaires: the household, the woman's and the men's; from an analytical point of view, contain the analytical units of: household information, household member's information, women's information, children's information (of the interviewed women), and men's information. Further the children's information exists in two groups – basic data for all children of a woman, and more in depth information for children born in the last five years. And then, were possible, individual men and woman are matched into couples. And if an HIV test was done, there are the HIV results. Thus, in practice, there are 8 data files:

- Household file (HR)
- Household members, or persons file (PR)
- Women's file (IR)
- All Births file (BR)
- Children born in the 5 years prior to the interview, or kids file (KR)
- Men's file (MR)
- Couple's file (CR)
- HIV file (AR)

**Household Data - Household Recode (HR)**

This dataset has one record for each household. It includes household member's roster but no information from the individual women/men questionnaires is present in this file. The unit of analysis (case) in this file is the household.

**Household Listing Data - Household Member Recode (PR)**

This dataset has one record for every household member. It includes variables like sex, age, education, orphan hood, height and weight measurement, hemoglobin, etc. It also includes the characteristics of the households where the individual lives. The unit of analysis (case) in this file is the household member.

**Individual Woman's Data - Individual Recode (IR)**

This dataset has one record for every eligible woman as defined by the household schedule. It contains all the data collected in the woman's questionnaire plus some variables from the household. Up to 20 births in the birth history, and up to 6 children under age 5, for whom pregnancy and postnatal care as well as immunization and health data were collected, can be found in the file. The fertility and mortality programs distributed by DHS use this file for data input. The unit of analysis (case) in this file is the woman.

**Man's Data - Male Recode (MR)**

This dataset has one record for every eligible man as defined by the household schedule. It contains all the data collected in the man's questionnaire plus some variables from the household. The unit of analysis (case) in this file is the man.

**Couple's Data - Couple's Recode (CR)**

This dataset has one record for every couple. It contains data for married or living together men and woman who both declared to be married (living together) to each other and with completed individual interviews (questionnaires). Essentially the file is the result of linking the two files previously described based on whom they both declared as partners. The unit of analysis (case) in this file is the couple.

**Children's Data - Children's Recode (KR)**

This dataset has one record for every child of eligible women, born in the last five years. It contains the information related to the child's pregnancy and postnatal care and immunization and health. The data for the mother of each of these children is included. This file is used to look at child health indicators such as immunization coverage, vitamin A supplementation, and recent occurrences of diarrhea, fever, and cough for young children and treatment of childhood diseases. The unit of analysis (case) in this file is the children of women born in the last 5 years (0-59 months).

**Births' data - All Children's Recode (BR)**

This dataset has one record for every child ever born of eligible women. Essentially, it is the full birth history of all women interviewed including its information on pregnancy and postnatal care as well as immunization and health for children born in the last 5 years. Data for the mother of each of these children is also included. This file can be used to calculate health indicators as well as fertility and mortality rates. The unit of analysis (case) in this file is the children ever born of eligible women.

**HIV Test data (AR)**

This dataset has one record for every individual for which blood was drawn for HIV testing. In 2004 DHS began collecting blood for HIV testing but because of the sensitivity of the data instead of merging the results of HIV testing to the individuals a file that is distributed separately was created. This file can be linked to the household members (PR), the women (IR) or men files (MR).

Additionally, there are a number of files that can be associated to the files previously described but because of several reasons they are distributed separately.

**Wealth Index data (WI)**

This dataset has one record for every household . Wealth Index analysis was introduced to DHS by the end of the 90's. When the decision to include the wealth index as part of DHS was made, standard variables were introduced to the recode definition for both the household and individual questionnaires (HV270 and HV271 for households; V190 and V191 for women; and MV190 and MV191 for men). For previous surveys a file containing the score and the quintile variables, was created. Essentially wealth index files were created for all DHS surveys except surveys carried out as part of the first DHS phase. This file can be linked to any of the files described in the previous section.

**Height and Weight data according to WHO (HW)**

This dataset has one record for every child measured for height and weight. In 2007 new child growth standards were introduced by WHO; in the past DHS used the NCHS/CDC/WHO reference. After the decision to adopt the new WHO standards was made, standard recode variables HC70 to HC73 and HW70 to HW73 were introduced to the recode definition to store the standard deviations of the new WHO child growth definition. Essentially all files using the DHS-5 recode structure have these variables. For previous surveys a file containing the same z-scores, was created. In early DHS phases only children of eligible women were measured. Starting with DHS-3 onwards all children under five listed in households interviewed have been measured. This file can be linked to the household members (PR), the children (KR) or the births (BR) files described above if height and weight was taken for children in the households. The file can only be linked to the children (KR) or birth (BR) files when only children of eligible women were measured for early DHS phases.

**Variable naming conventions.** Variables begin with one or two letters followed by one, two, or three digits and in some cases followed by a letter. Following is a list describing the general variable name conventions.

| | |
|---|---|
| HVxxx | Household standard variables |
| Haxx | Anthropometry and anemia for women |
| HCxx | Anthropometry and anemia for children |
| SHxxx | Household, country-specific. |
| Vxxx | Women standard variables |
| Bxx | Birth history |
| Mxx | Pregnancy, postnatal care, and breastfeeding |
| Hxx | Immunization and health |

| | |
|---|---|
| HWxx | Anthropometry for children of eligible women |
| MMxx | Maternal mortality (optional) |
| DVxx | Domestic violence (optional) |
| Sxxx | Women, country-specific |
| MVxxx | Men standard variables |
| SMxx | Men, country-specific |

In this list "xx" represents digits, and the last one could be a letter. There are a handful of variables that do not fully adhere to this scheme (BORD, BIDX, MIDX, HWIDX, etc.), but at least the first letter will indicate where it belongs. The "xx" in the household, women, and men **country-specific** variables correspond to the actual question number in the country questionnaire. The maternal mortality (MMxx) and domestic violence (DVxx) variables will only be present if the modules were applied in the country.

If the calendar was used in the country, variables VCOL and VCAL will be present. These variables are part of a repeating record. VCOL is the calendar column number and VCAL is a string of 80 characters containing the actual calendar information.

The multiple or repeating records are placed one after the other on the record, with the maximum number of occurrences of each section being represented in every case. Each variable in a repeating section is placed immediately after the preceding variable of the same occurrence, such that all variables for occurrence 1 precede all variables for occurrence 2 of a section.

Multiple occurring variables and sections of data represent the main disadvantage to flat files. Each occurrence of every such variable must have its own name because statistical packages do not generally support the use of arrays or subscripts. For example, the third occurrence of the variable named MM11 would be named MM11$03 in SPSS, or MM11_03 in SAS and STATA.

## File Relationship & Matching

It is important to mention that matching files is only necessary when variables required for the analysis are not present in the distributed file but are present in any other file. When merging data files its important to know the type of relationship that exists between the files to be merged as well as the type of output file desired (unit of analysis). There are two types of relationships: The first is that of one entity related to many other entities [1 : 0-N] and the second is that of one entity related to just one other entity [1 : 0-1].

An example of a relationship of one to many entities can be found between households and women or men. There may exist zero or several women or men questionnaires for each household. An example of a relationship of one to one can be found in the relation existent between women and men. In a monogamous country, there may be zero or one man questionnaire for each woman if she is currently married.

## Unique Case Identifiers

One of the advantages of processing complex surveys with CSPro, a software capable of handling hierarchical files, is that it allows to tightly control the case identifiers. DHS guarantees that their files can be matched seamlessly whenever a relationship is possible. To properly manipulate the files, it is necessary to know what the variables or fields that identify the cases are. The following reference table shows those fields.

**Unique Identifiers for Data Files**

| File | ID Variable | Cluster | HH Number | Line Number | Birth Order | Husband/ Wife |
|---|---|---|---|---|---|---|
| Household | HHID | HV001 | HV002 | | | |
| Women | CASEID | V001 | V002 | V003 | | V034 |
| Men | MCASEID | MV001 | MV002 | MV003 | | MV034*i* |
| Children | CASEID | V001 | V002 | V003 | MIDX | |
| Births | CASEID | V001 | V002 | V003 | BIDX | |
| Couples | CASEID | V001 | V002 | V003 | | |
| Household Member | HHID | HV001 | HV002 | HVIDX | | |

| | | | |
|---|---|---|---|
| HIV | HIVCLUST | HIVNUMB | HIVLINE |

## Matching Variables

When merging files, it is generally easier to use the original variables rather than the ID variables. For example, it is not possible to merge the household and women's files using HHID and CASEID because CASEID has three extra characters identifying the women's line number. The files can be more easily merged using variables HV001 with V001 and HV002 with V002.

The following reference table shows the variables required to match different files. In the rows, the base files are listed. In the columns, the secondary files along with the variables

to be used as keys or matching variables are listed. In the cells intersecting the rows and columns, variables from the base files used to match the secondary file are listed.

| Matching Variables | | |
|---|---|---|
| | **Secondary Files** | |
| | **Match variables for Households** | **Match Variables for women** |
| Base | HV001 + HV002 | V001 + V002 + V003 |
| Women | V001 + V002 | |
| Children | V001 + V002 | V001 + V002 + V003 |
| Men | MV001 + MV002 | Couples<br>MV001 + MV002 + MV034*i* |

This table shows that household variables can be appended to women, men and children. Women variables can be appended to their children. They also can be appended to men, to create couples. Notice that there is no relationship between children and men because children come from the birth history, which is asked to women.

With software that requires the variables that are used for merging to have the same name in both files it will be necessary to either rename or to create copies of the matching variables in one file to match the names in the other file being used. For example, to match the household data to the women's data, first rename HV001 to V001 and HV002 to V002, or create a copy of HV001 in V001 and a copy of HV002 in V002 in the household data before merging.

**Reviewing questionnaires**. Familiarize yourself with the questionnaires used to collect the data that you want to analyze. Model questionnaires are used for each survey phase , but each country modifies the core questionnaire slightly to meet their needs. The questionnaires used to collect data for a specific survey are always included at the back of each survey's final report. Use the questionnaires to determine:

a. whether the information you want to analyze was collected in your survey of interest, and
b. who you want to analyze (your unit of analysis).

If the data you want to analyze was collected for everyone listed in the household questionnaire, your unit of analysis is probably household members. On the other hand, if for example you want to analyze data about women's contraceptive use, you will find that the relevant questions were asked in the women's questionnaire, and your unit of analysis is women. The unit of analysis will help you determine which dataset you want to download.

**Downloading datasets**. Follow instructions from the email you received. Once you log in to dhsprogram.com, you will see the country, survey, and list of datasets that you are approved to download. The list of Zip files containing datasets are labeled with brief but meaningful names, such as KEIR41DT. The full description of file naming conventions is here, but briefly:

- The first two letters ("KE") refer to the country – in this case, Kenya. The country code list is here.
- The second two letters ("IR") refer to the data file type. IR is the individual (women's) recode file, MR is the men's recode, HR is the household recode, etc. The complete list of data file types is here. Based on your review of the questionnaires, select the file type you need for your unit of analysis.
- The next two characters ("41") refer to the phase and number of the survey. A complete explanation of this numbering is here. If you are only analyzing one survey, all datasets from that survey will have the same numbering.
- The last two letters refer to the software program you want to use. The DT file contains the Stata (.DTA) data file and associated documentation; The SV file contains the SPSS (.SAV) file; the SD file contains the SAS (.SD2) file; and the FL file contains an ASCII file and dictionaries.

**Opening dataset** in the software you are using for analysis. A note for Stata users: if your memory and maximum number of variables (maxvar) have not been adjusted from the factory settings, you may get an error message when trying to open DHS datasets, which are very large:
Change the memory and maxvar settings. Try

```
set memory 450m
set maxvar 10000
```

to start. You may be able to set these values higher depending on your computer. These settings should allow you to open a DHS dataset.

**Getting to know variables**. When your dataset is open, you will see thousands of variables with confusing names and very short variable labels that briefly describe the contents of each variable. To understand each variable and its contents, get to know the DHS recode manual. Some analysts refer to the recode manual as the "DHS Analysis Bible." Why is the recode manual so important? Here's an example:

In your dataset (assuming you are using an IR, BR, KR, or MR file) check the label of v107 (mv107). The label says "highest year of education." If you analyze this variable assuming it is the respondent's highest year of education, you will have highly misleading results. Why? Because the variable label needs to be short, and so cannot give complete information about every variable included in the dataset. Download the DHS recode manual and look through it to find v107. See that v107 is the highest year of education at the level recorded in v106. Had you analyzed v107 as the highest years of education, you

would have seriously underestimated the level of education in the country you are studying. This is just one example of why it is important to use the DHS recode manual.

**Using sample weights**. DHS sample weights are used in almost every tabulation in DHS final reports. The few unweighted tables are clearly labeled. Sample weights are described fully in the Guide to DHS Statistics but briefly, weights are used in all analyses to make sample data representative of the entire population. There are different weights for different sample selections/units of analysis:

| **Sample weights in DHS datasets** | |
|---|---|
| **Unit of analysis** | **Variable** |
| Households | hv005 |
| Household members | hv005 |
| Women or children | v005 |
| Men | mv005 |
| Domestic Violence | d005 |
| HIV test results | hiv05 |

like other variables in DHS datasets, decimal points are not included in the weight variable. Analysts need to divide the sampling weight they are using by 1,000,000. Examples:

In Stata:
generate wgt = v005/1000000
tab var [weight=wgt]
In SPSS:
COMPUTE WGT = V005/1000000.
WEIGHT by WGT.

In SPSS:
WTVAR=V005/1000000
WEIGHT BY WTVAR

**Considering special values**. As you analyze, make sure to account for missing values and other exceptions. If you're trying to replicate tables in the DHS final report, check the notes here or the FAQs. To produce some of the more complex DHS indicators, the Guide to DHS Statistics (or the online Guide to DHS Statistics) is an invaluable resource, and like all DHS publications, is free to download and use.

In addition, the MEASURE DHS User Forum is an online user community where DHS data users worldwide post and answer questions, discuss analysis and data use issues, and search for information. Search the contents of the forum or consider posting a question if you need additional help.

If you're having a problem using DHS data, and you've done all of the following:

1. Made sure you're using the correct data file
2. Made sure you're using the correct weights
3. Checked the questionnaire to make sure the question was asked in the way you think it was in your survey
4. Checked the DHS Recode Manual
5. Checked the DHS Guide to Statistics
6. Searched the contents of the DHS Program User Forum and posted a question for users to answer and posted a question for users to answer.

# Appendix D: IRB Approval

Dear Ms. Bianda,

This email is to notify you that the Institutional Review Board (IRB) confirms that your doctoral capstone entitled, "The Role of Prenatal Care and Systematic HIV testing in Preventing Perinatal Transmission in Tanzania, 2011-2012," meets Walden University's ethical standards. Since this project will serve as a Walden doctoral capstone, the Walden IRB will oversee your capstone data analysis and results reporting. Your IRB approval number is 08-10-16-0375309.

This confirmation is contingent upon your adherence to the exact procedures described in the final version of the documents that have been submitted to IRB@waldenu.edu as of this date. This includes maintaining your current status with the university and the oversight relationship is only valid while you are an actively enrolled student at Walden University. If you need to take a leave of absence or are otherwise unable to remain actively enrolled, this is suspended.

If you need to make any changes to the project staff or procedures, you must obtain IRB approval by submitting the IRB Request for Change in Procedures Form. You will receive confirmation with a status update of the request within 10 business days of submitting the change request form and are not permitted to implement changes prior to receiving approval. Please note that Walden University does not accept responsibility or liability for research activities conducted without the IRB's approval, and the University will not accept or grant credit for student work that fails to comply with the policies and procedures related to ethical standards in research.

When you submitted your IRB materials, you made a commitment to communicate both discrete adverse events and general problems to the IRB within 1 week of their occurrence/realization. Failure to do so may result in invalidation of data, loss of academic credit, and/or loss of legal protections otherwise available to the researcher.

Both the Adverse Event Reporting form and Request for Change in Procedures form can be obtained at the IRB section of the Walden website: http://academicguides.waldenu.edu/researchcenter/orec

You are expected to keep detailed records of your capstone activities for the same period of time you retain the original data. If, in the future, you require copies of the originally submitted IRB materials, you may request them from Institutional Review Board.

Both students and faculty are invited to provide feedback on this IRB experience at the link below:

**http://www.surveymonkey.com/s.aspx?sm=qHBJzkJMUx43pZegKlmdiQ_3d_3d**

Sincerely,
Libby Munson
Research Ethics Support Specialist
Office of Research Ethics and Compliance
Email: irb@waldenu.edu

## Appendix E: Defining Variable and Coding

The variables were identified from the TDHS 2011-2012 Women Individual questionnaire, and based on the literature review. The questions concerning HIV in pregnancy were administered to women who had a pregnancy in the past six years prior the survey. The datasets include variables on HIV/AIDS knowledge, HIV testing and counseling, PNVC attendance, timing of first PNCV check, health facilities for HIV testing and coverage, educational attainment, marital status, wealth quintile, and residence. The variable PNCV is grouped into three categories using the integer values 1-3 to characterize the following visits categories: four visits or more, three visits or less, and two visits or less. The timing of first prenatal care visit (prenatal care attendance) was defined as the time participant have had their first visit within the first trimester or later. The HIV comprehensive knowledge was analyzed as dichotomous binary variable (yes or no answer). This variable was measured using twelve items generating as follows: (1) Ever heard of AIDS, (2) Reduce risk of getting HIV: have one sex partner; who has no other partners; (3) Reducing risk of getting HIV; always use condoms during sex; (4) A healthy-looking person can have HIV; (5) HIV transmitted during pregnancy; (6) HIV transmitted during delivery; (7) HIV transmitted by breastfeeding; (8) Drugs to avoid HIV transmission to baby during pregnancy; (9) Wife justified asking husband to use condom if has sexually transmitted infection; (10) Can get HIV by sharing food with person who has AIDS; (11) Can get HIV from mosquito bites; (12) can get HIV by witch craft or supernatural means (Table 4). These dichotomous variables have only two

possible responses. The responses options are coded “yes” or “no”, and having HIV knowledge was answered by “yes” for the items 1 through 9.

The items 10 through 12 were answered “no” as having HIV knowledge. These dichotomous variables have only two possible responses. The answers options are coded as dichotomous variable “yes” or “no”, and having HIV knowledge was answered by “yes” for the items 1 through 11. The questions 10 through 12 were answered “no” as having HIV knowledge. A correct answer was scored "1" and "0" was attributed to a wrong answer for each of the score of 1 for the correct answer and 0 for the wrong answer was assigned to each of the first nine items. Participants who responded to the last three questions were scored "1" if the answer was "no" and "0" otherwise. The scores were summed up to generate an overall score for each respondent and grouped into three categories: “low knowledge of HIV” for respondents with a score ≤ 50%, “moderate knowledge of HIV” for those with a score > 50% then < 75%, and “high knowledge of HIV” for those with score ≥ 75%.

Another variable was created and named HIV_info, which was measured using three items generating” yes” or “no” response to the following: whether during PNCV talked about HIV transmitted from mother to child (1); thing to do to prevent getting HIV (2); and getting tested for HIV (3). HIV_info was coded 0.00, which refers to responding “no/don’t know to all three questions. One relates to responding “yes” to at least one question, 2.00 to responding “yes” to two of the three questions, and 3.00 responding to all three questions (Table 4). This variable was a knowledge of MTCT of HIV/AIDS shared between a woman and a health care provider during PNCV.

The variable HIV testing was measured by using eight items as follows: (1) Ever been tested for HIV; (2) Offered HIV test for HIV as part of PNCV; (3) Offered HIV test between the time went to delivery and before baby was born; (4) Received result from last HIV test; (5) Got results of HIV test as part of PNCV; (6) Got results of HIV test when tested before baby was born; (7) Place were HIV test was taken as part of PNCV; (8) Tested for HIV since PNCV.

The variable HIV counseling was measured by using only one item: whether received counseling after testing for AIDS during PNCV, "yes" indicated that women had received counseling, otherwise "no". The variable HIV testing coverage and services was measured by using nine items as follows: (1) know a place to get HIV test; (2) know a place for HIV test; (3) place of HIV test: Public District Hospital; (4) Place of HIV test: public referral/specialized hospital; (5) Place of HIV test: public regional hospital; (6) Place of HIV test: public health center; (7) Place of HIV test: public dispensary; (8) Place of HIV test: public village health post (worker); (9) Place of HIV test: religious referral/specialized hospital.

Demographic variables were used as potential confounders. The variable AgeGrp is simply age grouped into four categories. This categorical variable uses the integer values 1 through 4 to represent the following age categories (in years): 15-24, 25-29, 30-39, and 40-49. The variable marital_status, which is marital status item, was sorted into three groups as never married (coded 1), married/living with partner (coded 2), or divorced/separated/widowed (coded 3). Maternal education was classified as no education, primary, secondary, and higher. The residence was classified as urban (coded

0) and rural (reference category, coded 1) based on the preexisting variable for home location in the datasets. For the variable wealth index, a descriptive analysis was conducted on a categorical version of the variables with five categories ranging from poorest quintile to highest quintile. Further, the same variable was grouped into three categories (poor, middle, rich) where poorest and poor were merged (coded 1), equally richer and richest (coded 3). The middle category was coded 2.