RISK FACTORS ASSOCIATED WITH HIV INFECTION AMONG CHILDREN OF PMTCT CLINIC ATTENDEES IN FCT – ABUJA

BY

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ABSTRACT

Elimination of Mother-to-child transmission (MTCT) of HIV is possible. Despite this, MTCT of HIV accounts for more than 90% of paediatric HIV cases. Few studies have examined the factors associated with the transmission of HIV within the primary health care delivery structure. This study was designed to investigate the factors associated with MTCT of HIV within the primary health care delivery structure of the FCT – Abuja.

Five of the 6 Area Councils in the FCT were selected for this study, purposive sampling was used to select 12 of the 603 primary health care facilities in the FCT. A facility based unmatched case-control study was conducted among all HIV-exposed infants, a mixed method approach was adopted for data collection. A record review was used to determine the prevalence of MTCT of HIV in HIV-exposed infants. The exposures of interest studied were pharmacological interventions by the mother and infant, feeding options practiced, place of delivery, maternal age at index pregnancy, marital status, maternal literacy status, maternal employment status, maternal religion and parity.

In-depth interviews were conducted with ten women whose infants tested positive to HIV to explore factors that may have increased the risk of MTCT of HIV.

SPSS version 22.0 was used for analysis. The prevalence of MTCT of HIV was calculated, descriptive statistics were used to summarize quantitative variables, qualitative variables were summarized by proportions. Odds ratios and their 95% confidence intervals were calculated for independent variables; chi-square test was used to test for significance between variables. A p-value <0.05 was considered statistically significant. Variables that were significant in bivariate analyses were entered into a multiple logistic regression model. Audio recordings were transcribed; transcripts were analysed thematically.

One hundred and twenty-eight (128) of one thousand, four hundred and seventy-one (1471) HIV-exposed infants were positive (period prevalence – 8.7%), mean age of mothers was 27.6 ± 5.5 years, 60.7% were between 21 – 30 years. At multivariate analysis, the non-use of ARV by infants [AOR 5.3 (95% CI 2.1 – 13.0)], ever breastfed [AOR 14.5 (95% CI 3.8 – 54.2)], been married at index pregnancy [AOR 0.2 (95% CI

0.04 – 0.6)], non-use of ARV by the mother [AOR 14.1 (95% CI 6.0 – 33.5)], home delivery [AOR 4.8 (95% CI 1.6 – 14.3)] and CD4+ count less than 350 cells/mm^3 [AOR 20.7 (95% CI 9.1 – 46.7)] were predictors of MTCT of HIV.

Amongst the in-depth interview participants' inadequate hospital service delivery hours and non-disclosure was cited as factors impeding the use of PMTCT interventions.

PMTCT within the Primary Health Care structure is capable of reducing the risk of MTCT of HIV. In 402 mother – infant pairs studied in the Federal Capital Territory - Abuja, breastfeeding, home delivery, unmarried status, CD4+ count less than 350, non-use of ARV by mother or/and infant were determined to be predictors of MTCT of HIV. Non-disclosure and inadequate hospital service delivery hours impedes the use of PMTCT services.

Government should provide personnel to increase the uptake of PMTCT services such as hospital delivery. Health authorities should encourage HIV testing in male partners to address non-disclosure, which was central to the non-use of PMTCT interventions.

Keywords: MTCT, Primary Health Care, Mixed methods

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Certification Page

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ABBREVIATIONS

AOR	–	Adjusted odds ratio
AIDS	–	Acquired immunodeficiency syndrome
ANC	–	Antenatal Clinic
ART	–	Antiretroviral treatment
ARV	–	Antiretroviral
AZT	–	Zidovudine
CD4	–	Cluster of Differentiation 4
COR	–	Crude odds ratio
DBS	–	Dried blood sample
DNA	–	Deoxyribonucleic Acid
EID	–	Early Infant Diagnosis
EFZ	–	Efavirenz
FCT	–	Federal Capital Territory
HAART	–	Highly Active Antiretroviral Treatment
HIV	–	Human immunodeficiency virus
IDI	–	In-depth interview
MCH	–	Maternal and child health
MTCT	–	Mother-to-Child-Transmission
NACA	–	National Agency for the Control of AIDS
NVP	–	Nevirapine
PCR	–	Polymerase Chain Reaction
PEPFAR	–	President's emergency plan for AIDS relief
PMTCT	–	Prevention of Mother to Child Transmission
RNA	–	Ribonucleic Acid
VCT	–	Voluntary Counseling and Testing
WHO	–	World Health Organization
3TC	–	Lamivudine

CHAPTER ONE
INTRODUCTION

1.1 Background

Mother-to-Child-Transmission (MTCT) of Human Immunodeficiency Virus (HIV) is the commonest cause of HIV infection in children accounting for 90% of all paediatric HIV infections (Falnes et. al., 2010; Iloh et. al., 2015; Nkwo, 2015; Tudor Car et. al., 2012). There were 2.3 million people newly infected with HIV in 2012 with an estimated 1,000 new HIV infections occurring in children daily (Bucagu et. al., 2013; Koye and Zeleke, 2013). Sub-Saharan Africa accounts for 90% of the burden of paediatric HIV infection (Anoje et. al., 2012; Torpey et. al., 2012; Tudor Car et. al., 2012), Nigeria with an estimated 440,000 children less than 15 years living with HIV ranked second to South Africa in burden of the disease but first with an estimated 60,000 preventable annual HIV positive births (Federal Ministry of Health, 2014; Iregbu et. al., 2014; Iwelunmor et. al., 2014; Nkwo, 2015). The prognosis is poor as without treatment, half of infected infants will die before the age of two (Hampanda, 2013; Kazembe, 2010).

The baseline risk of MTCT of HIV ranges from 15% - 30% with an estimated 70% of these infections occurring in-utero, the rest could occur as the unborn infant transverses the birth canal during delivery as well as during breastfeeding, which increases the baseline risk of MTCT of HIV by an estimated 20% (Anabwani et. al., 2010, 2010; Charurat et. al., 2009; Ezegbe and Stephenson, 2012; Okafor et. al., 2014; Torpey et. al., 2010).

High maternal HIV plasma viral load, virus type (HIV-1), advanced disease, low maternal CD4+ lymphocyte cell count, HIV infection acquired during pregnancy, breastfeeding, sexual transmitted infections, malaria, vaginal deliveries, rupture of membranes for more than 4 hours, prolonged labor, prematurity, first of multiple deliveries, breast disease and prolonged breastfeeding are some known risk factors for MTCT of HIV (Anabwani et. al., 2010, 2010; Charurat et. al., 2009; Inyang, 2015; NACA, 2010; Okafor et. al., 2014; Peckham and Gibb, 2010).

The prevention of mother-to-child transmission (PMTCT) programme was created in 1999 with the goal of reducing the risk of MTCT of HIV (United Nations General Assembly Special Session on HIV and AIDS, 2010; Logie et. al., 2008). The Federal Ministry of Health initiated the National PMTCT programme in 2001 with the goal of reducing MTCT of HIV in Nigeria. The package of services offered during the period under review included HIV testing and counselling services, linkage with facilities providing PMTCT when applicable, early diagnosis and treatment of sexually transmitted diseases, ARV prophylaxis for mother and child, cotrimoxazole prophylaxis for mother and child, infant feeding counselling and support, reproductive health services, early HIV diagnostic testing at 6 weeks and HIV testing after the cessation of breastfeeding (NACA, 2010).

MTCT of HIV still occurs in spite of the availability proven interventions for PMTCT and considerable funding to effectuate them. A high HIV prevalence, non-disclosure and cultural practices coupled with an inadequate health delivery structure have been adduced as reasons for the persistence of MTCT of HIV.

Abuja, the Federal Capital Territory with a HIV prevalence of 5.8% (95%CI 4.5% – 7.2%) ranks eight amongst states in order of prevalence. The HIV prevalence ranges from 1.7% to 15.4% within the North Central region where the FCT is situated (Ministry of Health, 2014). Sentinel surveys of pregnant women attending antenatal clinics have revealed a HIV prevalence of 10.2% in 2001 and 5.8% in 2014. The prevalence in this group has been consistently higher than the national average (Bashorun et. al., 2014; Ministry of Health, 2014). The high HIV prevalence added to a total fertility rate of 4.5 births per woman, crude birth rate of 39 per 1000 population and the cultural practice of prolonged breastfeeding/mixed feeding (National Population Commission, 2013) make MTCT an important route of spread of HIV in Abuja, hence the need to investigate the risk factors of HIV infection in infants amongst pregnant women in the FCT.

1.2 Problem Statement

In Nigeria, Mother-to-child transmission of HIV accounts for 22% of new HIV infections, a proportion more than that caused by anal and casual heterosexual sex combined, with anal and casual heterosexual sex each contributing 8% to the body of new infections (National Agency for Control of AIDS, 2014). The Country estimate of the risk of MTCT of HIV is presently put at 30% with an estimated 60,000 (50,000 – 80,000) preventable HIV-positive births. Nigeria currently accounts for 30% of all maternally acquired paediatric infections of HIV globally (Ministry of Health, 2014; Sagay, 2013). MTCT of HIV has been eliminated in Cuba and Thailand, in developed countries the risk of transmission ranges from 1% - 3% (The Lancet, 2015). In 2010, it was estimated that 34 million people were living with HIV worldwide up from 17% in 2001 with Sub-Saharan Africa accounting for 90% of the burden of HIV. In Nigeria, women constitute an estimated 59% of the 3.4 million people living with HIV and approximately 1.4 million HIV-1 positive women become pregnant each year. Sagay (2013) reports that in Nigeria, annual estimates for 2012 show there are two hundred and twenty-nine thousand, four hundred and eighty HIV-exposed infants at risk of MTCT of HIV. Nigeria has the highest rate of MTCT of HIV globally and the second highest burden of MTCT of HIV infections globally.

The mortality rates associated with paediatric HIV is high, paediatric HIV associated mortality rates of 34% by 1 year, 50% by the 2nd year and 75% by the 5th to the 7th year of life have been documented (Hampanda, 2013; Kazembe, 2010). The high mortality rates associated with paediatric HIV if left unchecked could erode the gains made by the country in reducing childhood mortality. Biological risk factors such as high maternal HIV plasma viral load, virus type (HIV-1), advanced disease, low maternal CD4+ lymphocyte cell count, HIV infection acquired during pregnancy, breastfeeding, sexual transmitted infections, malaria, vaginal deliveries, rupture of membranes for more than 4 hours, prolonged labour, prematurity, first of multiple deliveries and breast disease are some known risk factors for MTCT of HIV. Socioeconomic risk factors such as prolonged breastfeeding, lack of male partner involvement, are also known to influence

the risk and consequently the prevalence of MTCT of HIV (Anabwani et. al., 2010, 2010; Charurat et. al., 2009; Inyang, 2015; John-stewart, 2012; Morfaw et. al., 2013; National Agency for Control of AIDS, 2010; Okafor et. al., 2014; Peckham and Gibb, 2010). A decrease in prevalence has been observed in countries where interventions that target these specific risk factors such as viral load, CD4+ count and drug resistance testing, the use of ARVs during pregnancy, labor and breastfeeding, avoiding obstetric procedures that increase risk of MTCT of HIV, treatment of sexually transmitted infections and breast diseases are readily available. The risk of MTCT of HIV in these setting ranges from 1% – 6%, figures that mirror clinical trial results (Anigilájé et. al., 2015; Azcoaga-Lorenzo et al., 2011; Gartland et al., 2013; Kohler et al., 2014; Stringer et. al., 2008; Tubiana et. al., 2010). In Nigeria, these interventions have achieved varying levels of success with centers reporting transmission risks ranging from 1% - 33.7% (Iloh et al., 2015; Okechukwu and Abdulrahaman, 2008). Although factors known to enhance transmission have been identified, MTCT of HIV still occurs in spite of the availability of interventions proven to eliminate the risk of MTCT of HIV.

1.3 Justification

Although the elimination of MTCT of HIV is possible through HIV testing during pregnancy, use of ARVs, skilled delivery and avoidance of breastfeeding, new HIV infections still occur and Nigeria accounts for 30% of the global burden of MTCT of HIV (Sagay, 2013). To prevent MTCT of HIV and keep mothers alive, a comprehensive package of interventions, including provision of appropriate HIV treatment, and care and support services were scaled up across the 6 area councils in the FCT-Abuja. The persistence of MTCT of HIV despite the availability and scale up of these life-saving interventions may make the goal of an AIDS-free generation; a generation in which all infants are born HIV-free and remain so for the first two decades of their lives i.e. from birth through their teenage years is unattainable, hence the need to investigate factors associated with incident infections in infants of mothers who obtained PMTCT, the identification of modifiable risk factors that affect transmission is urgent.

There are both programmatic and scientific reasons to evaluate the determinants of MTCT of HIV in FCT – Abuja as this is critical for the monitoring, evaluating and reviewing of preventive strategies. The main justification for this study is to produce information that will assist the PMTCT programme identify modifiable biological and socioeconomic factors in this setting nullifying efforts to reduce the MTCT of HIV and contribute to a greater understanding of the interplay between these factors that increase the risk of MTCT of HIV.

The findings from this study may be used by policy makers and clinicians to fashion out interventions that specifically address factors identified to be predictors of MTCT of HIV. The findings of this study will help attain the goal of an AIDS-free generation; a generation in which all infants are born HIV-free and remain so for the first two decades of their lives i.e. from birth through their teenage years is the ultimate goal.

1.4 Research Questions

1. What is the proportion of HIV-exposed children that acquire the infection from their mothers?
2. What are the factors associated with the MTCT of HIV amongst attendees of primary health care facilities in FCT - Abuja?

1.5 General Objective

To determine the prevalence and identify risk factors associated with HIV infection among children of mothers of PMTCT Clinics in Abuja

1.6 Specific Objectives

1. To determine the prevalence of HIV among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja
2. To identify biological factors associated with HIV infection among HIV-exposed children of attendees of PMTCT clinics in FCT – Abuja
3. To identify socioeconomic factors associated with HIV infection among HIV-exposed children of attendees of PMTCT clinics in FCT – Abuja

CHAPTER TWO
LITERATURE REVIEW

2.1 An Overview of HIV and AIDS

The HIV/AIDS pandemic remains a serious health challenge confronting the global community today with an unequal burden been placed on women and children who experience higher rates of new infections and HIV-related morbidity and mortality (NACA, 2010). HIV/AIDS is a disease of the immune system caused by infection with the human immunodeficiency virus. Non-specific symptoms such as fever, muscle pain, headache, nausea, vomiting, diarrhoea, night sweats, weight loss and a rash may be experienced by the infected individual when the virus gains access to the body. These symptoms are usually misdiagnosed and present within 2 – 4 weeks after infection and abate after a few days. Individuals infected then experience an asymptomatic period although persistent lymphadenopathy is prevalent in this phase. The onset of symptoms marks the clinical stage with progressively worsening symptoms as immunosuppression worsens. The virus is transmitted primarily through unprotected sexual intercourse, contaminated blood transfusions, unsterilized hypodermic needles and from an infected mother to child during pregnancy, labour and breastfeeding (Anabwani et. al., 2010, 2010).

2.2 Epidemiology of HIV/AIDS in Nigeria

An estimated 34 million people lived with HIV in 2011 worldwide with Sub Saharan Africa accounting for 68% of the HIV/AIDS burden. Sub Saharan Africa contributes approximately 70% of the 2.6 million new infections and 72% of the 1.8 million deaths reported in 2009 and 90% of the burden of paediatric HIV infection. Nigeria ranks 2nd in the global burden of HIV with approximately 3.4 million people living with HIV, 70% of HIV infections are concentrated in 12 + 1 out of the 36 states. Rivers state with a prevalence of 15.2% ranks 1st in order of prevalence. In Nigeria, there were an estimated 270,000 new infections in 2012 of which 58% occurred in women in the reproductive age group, Nigeria with an estimated 440,000 children less than 15 years living with HIV ranked second to South Africa in burden of the paediatric HIV but first with an estimated 60,000 preventable annual HIV-positive births. The global epidemiology of paediatric

HIV reflects that of HIV in women as 90% of paediatric HIV infections are maternally acquired (National Agency for Control of AIDS, 2010; Sagay, 2013).

The high burden of MTCT in the region compared to the rest of the world has been attributed to higher rates of heterosexual transmission, the higher prevalence of HIV in women of reproductive age, high fertility rate, prolonged breastfeeding culture and poor access to PMTCT interventions (NACA, 2010; National Population Commission, 2013).

2.3 Mother-to-Child Transmission of HIV

Transmission of HIV from an infected mother to her infant, a process referred to as mother-to-child transmission of HIV is the major route of acquisition of HIV infection by children and accounts for approximately 90% of all paediatric HIV infections. An estimated twenty to forty percent of HIV-exposed infants become infected in utero, during labour/delivery, or through breastfeeding. In non-breastfeeding populations, 50% of all infections occur towards the end of pregnancy or during labour and delivery, whilst in a breastfeeding population the larger proportion of infants are infected postnatally via breastfeeding. MTCT rates among untreated HIV infected women vary, in Europe fifteen to twenty-five percent of HIV-exposed infants borne to untreated mothers will become infected, in Africa and Asia twenty to forty percent. In Nigeria, MTCT rates in HIV-positive women who did not receive any intervention has been reported to be as high as 45%.

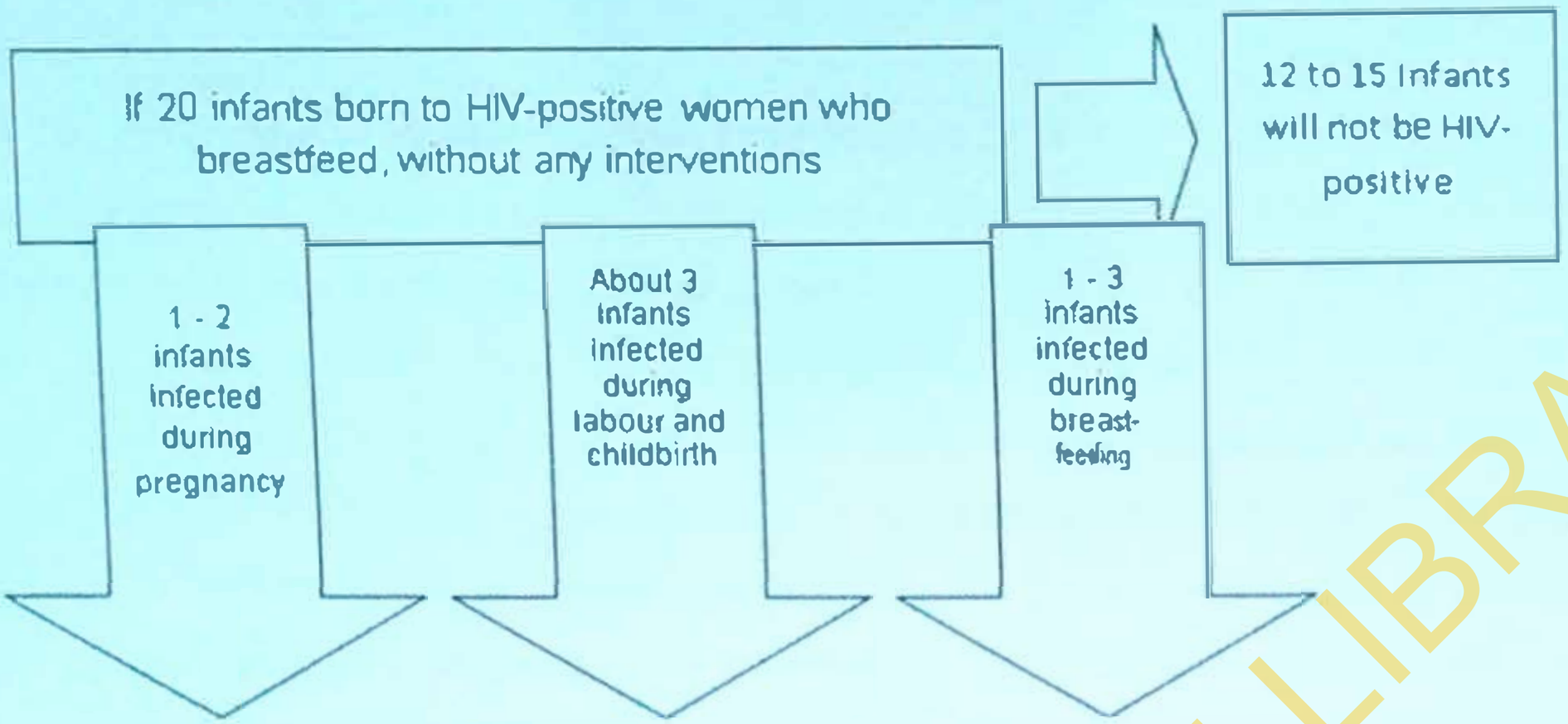

Figure 2.1Flow chart showing the likely HIV outcome for the infant if the mother does not take any precautions to limit the transmission of the virus

The natural history of HIV disease in children varies in significant ways from that seen in adults. In Children, the immune system is less functional rapidly leading to higher plasma and tissue viral loads. The developing organs are also more vulnerable to virally mediated damage, particular organ conditions such as encephalopathy and cardiomyopathy are commoner in children. In children, the immune system has less effective innate and specific immune responses to prevalent viral and bacterial pathogens, frequent bacterial infections are common especially with encapsulated organisms such as *Streptococcus pneumoniae*, *Haemophilus influenza*, and non-typhoid serotypes of *Salmonella*. At least 2 bacteriologically confirmed systemic infections (bacteremia, meningitis, osteomyelitis, septic arthritis, pneumonia, or abscess of organ or body cavity) are AIDS-defining for children. In adults, AIDS-defining illnesses are usually the result of reactivation of past infections such as cytomegalovirus disease, CNS toxoplasmosis, histoplasmosis and tuberculosis. Toxoplasmosis, histoplasmosis and tuberculosis are not as prevalent in children as they are in adults (Anabwani et. al., 2010, 2010; Violari et. al., 2008). The prognosis is poor as 50% of infected infants do not mark their 2nd birthday (Sagay, 2013).

2.4 The Prevention of Mother-to-Child Transmission (PMTCT) of HIV in Nigeria

The Prevention of Mother -to-Child Transmission of HIV programme (PMTCT) is a key HIV prevention intervention and has 4 components.

The primary prevention of HIV infection among women of childbearing age. The HIV uninfected woman, pregnant or otherwise has been identified as a target to prevent MTCT of HIV and primary prevention of HIV has been described as a cost effective strategy in preventing vertical transmission of HIV. The primary prevention of HIV in pregnant uninfected women is especially important as their risk of acquiring the infection is doubled owing to their gravid state and an increased risk of MTCT of HIV (Kanshana et. al., 2010).

The prevention of unintended pregnancies among women living with HIV is also another component of the PMTCT program as unintended pregnancies are associated with an increased risk of poor pregnancy outcomes when compared to intended pregnancies. A standard procedure that requires service providers consider certain situations with possible preventive has been prescribed, If the woman has no desire to get pregnant, she should be referred to the family planning unit/provider. If she desires to become pregnant, she should be made aware of the interventions available to minimize the risk of MTCT and if in a serodiscordant union, this should cover the prevention to the partner as she tries to become pregnant. If she is already pregnant, and has no intention of discontinuing the pregnancy, antiretroviral medications should be made available to her to prevent MTCT and if indicated, for her own health. If pregnant and has no intention of continuing the pregnancy, she should be referred for a safe abortion and offered postpartum contraception until such a time she desires to become pregnant (Leach-lemens, 2010).

WHO has prescribed a package of interventions for HIV positive women who become pregnant to prevent HIV transmission from mothers living with HIV to their infants. These interventions work towards lowering the risk of transmission to their infants and include the provision of ARVs, safe obstetric procedures, counseling and support on infant feeding options. PMTCT starts during antenatal care when pregnant women are tested to ascertain their HIV serostatus. The WHO recommendation in sub-Saharan Africa is for the pregnant woman to take ARVs through the period of pregnancy, labor

and the post-partum period if she decides to exclusively breastfeed. The infant also undergoes repeated HIV testing, if he/she is breastfeeding is also expected to take ARVs to prevent HIV infection transmissible through breastmilk.

The fourth prong covers the provision of postpartum HIV related services for the mother-infant pair when this is indicated. It covers psychosocial support and counseling targeting behavioral change and adherence to treatment for mother and child. The primary focus of PMTCT interventions is largely preventing MTCT as against maternal health. The health needs of the family should be given due priority and be met through the establishing of a continuum of care.

2.5 Prevalence of Mother-to-child Transmission of HIV

Numerous factors determine the prevalence of MTCT of HIV and an interplay of these factors are often behind the observed difference in transmission rates. The higher burden of MTCT of HIV witnessed in Sub-Saharan Africa has been attributed to higher heterosexual transmission rates resulting in a higher HIV prevalence in women of reproductive age. A high total fertility rate (5.5 births per woman), a prolonged breastfeeding culture (the mean and median duration of breastfeeding is 18.2 and 18.3 months respectively) and poor access to PMTCT services are also factors said to increase the prevalence (National Population Commission, 2013; Nigeria, 2010).

Studies carried out to determine the rates of MTCT of HIV have reported varying results. The transmission risk in exclusively breastfed infants in a descriptive observational study of HIV-EID activities in Plateau state was 8.1% by 6 months of age, in comparison, an intervention cohort study conducted in KwaZulu-Natal, South Africa of exclusively breastfed infants reported a risk of HIV infection of 14.1% and 19.5% at 6 weeks and 6 months respectively, twice that observed in the Plateau study. Both studies used the prescribed treatment at the time of these studies, which was single dose nevirapine to mother and infant (Charurat et. al., 2009; Coovadia et. al., 2007). It was suggested the dissimilarities in transmission rates could be as a result of duration of breastfeeding or other factors not identified in the study.

The reported rates of MTCT in the Federal Capital Territory differ. Ireghu et. al (2014) following a retrospective study conducted at the National hospital, Abuja reported an

overall prevalence of 7% with the highest prevalence of 16.1% occurring amongst children in the 6 – 18 months' age group, the prevalence was 1.3% when both mother and child received ARV, 4.6% when only the mother received, 20% when only the child received and 66.7% when neither the mother nor the child received ARV. A prospective study of HIV-exposed infants attending the Paediatric Outpatient Special Treatment Clinic of the University of Abuja Teaching Hospital observed an overall transmission rate of 33.7%, varying from 6.7% in infants who participated in the PMTCT programme to 68.6% in infants not involved in the programme (P<0.001). Amongst those who participated in the programme, the rates differed by level of participation in the programme varying from 2.7% to 25% (P<0.05) in those said to have fully participated in the programme compared to those who were only partially involved respectively. The dissimilarities in observed prevalence's between the may be as a result of the study periods covered. The retrospective study covered the period 1st January 2011 to 31st December 2012, a start date at least 3 years after the University of Abuja prospective study findings were published. These studies were conducted in tertiary centers where the full complement of PMTCT services e.g. counselling services and access to caesarean sections are available, the transmission risk and consequently the prevalence in the population that use the primary health care structure is yet to be fully explored.

2.6 Identify biological factors associated with HIV infection among HIV-exposed infants of attendees of ANC clinics in FCT - Abuja

A number of factors are known risk factors for MTCT; these could be grouped into *maternal, viral, placental and obstetric factors*. Maternal factors include CD4+ count, maternal viral load, primary infection, stage of the disease, poor adherence to anti-retroviral medication, anaemia, the presence of sexually transmitted diseases especially in labor, maternal co-infections and disease conditions associated with the breasts during breastfeeding such as mastitis (Anabwani et. al., 2010, 2010; Tubiana et. al., 2010).

Virus characteristics known to be risk factors for MTCT are resistance to anti-retroviral drugs, a high viral load and the virus type; the risk of transmission of HIV 1 is higher than for HIV 2 (Anabwani et. al., 2010, 2010; Charurat et. al., 2009; Inyang, 2015).

Placental disorders causing ante or intra partum haemorrhage or that compromise the integrity of the placenta may increase the probability of materno-fetal blood mixing and predispose to MTCT (Anabwani et. al., 2010, 2010).

Obstetric procedures such as external cephalic version, instrumental deliveries, application of foetal scalp electrodes and episiotomies may also increase the risk of MTCT by facilitating materno-fetal blood mixing (Anabwani et. al., 2010, 2010; Torpey et. al., 2010).

2.6.1 CD4+ cells and association with MTCT of HIV

T-helper cells (CD4+ cells) are a class of white blood cells that activate the body's immune system when they detect viruses or bacteria. HIV attacks CD4+ cells and uses the machinery of the cell for its own replication. The CD4+ count ranges from 500 cells/mm^3 – 1200 cells/mm^3 in healthy individuals. There is a correlation between the CD4+ count and perinatal transmission risk – Low CD4+ counts (CD4+ < 350) are associated with a higher mother to child transmission risk (Delicio et. al., 2011), some studies have reported a CD4+ < 200 as the critical level (Ngwende et. al., 2013). The correlation between CD4+ count and perinatal transmission is related to the fact that the CD4+ count correlates with the clinical stage of the disease and the more advanced the disease the higher the probability of the virus been transmitted (National Agency for Control of AIDS, 2010).

2.6.2 Viral load and association with MTCT of HIV

The viral load refers to the amount of HIV in a sample of blood from an infected individual, the viral load test measures the number of HIV particles (or copies) in a milliliter of blood. The viral load is said to be undetectable if there are less than 50-copies/ml. The maternal viral load has been identified as the strongest predictor of MTCT of HIV. The risk of mother to child transmission shows a positive correlation with maternal viral load levels (Ngwende et. al., 2013), studies have not established enough evidence of a critical value at which perinatal transmission is zero as MTCT of HIV and shedding of HIV-1 in the genital tract has been observed in women on ART with low or undetectable viral load (Delicio et. al., 2011; Hoffman et. al., 2010; Tubiana et. al., 2010). A study has documented a zero transmission risk of MTCT of HIV when maternal viral

load was below 1000 copies/ml (Damania, et. al., 2010). Prolonged control of viral load with ART may reduce HIV-1 genital shedding and hence risk of perinatal transmission. Initiation of ARV prior to pregnancy and strict viral load control throughout pregnancy has been shown to be associated with a reduced perinatal transmission risk. The maternal viral load, similar to the CD4+ counts is related to the clinical stage of the disease with higher maternal viral load levels seen in advanced stages of the disease.

2.6.3 HIV type and association with MTCT of HIV

It has been observed that the MTCT risk for HIV-1 is higher than that for HIV-2. A prospective cohort study in Ivory coast observed a perinatal transmission rate of 1.2% for HIV-2 and 24.7% for HIV-1, findings similar to that observed in the Gambia where the rate of mother to child transmission of HIV-1 was 24.4% and HIV-2 was 4%. The lower infectivity seen for HIV-2 was attributed to lower plasma RNA levels as after adjusting for viral load, the transmission rates were not dissimilar (Caimpbell-yesufu and Gandhi, 2011). Studies have observed rates of perinatal transmission of HIV-2 as low as 0% and 4% in the presence and absence of interventions respectively (CDC, 2015). Women who are doubly infected with HIV 1 & 2 are more likely to transmit HIV-1 to their infants than HIV-2 (Anabwani et. al., 2010, 2010).

2.6.4 Seroconversion in pregnancy and association with MTCT of HIV

Seroconversion in pregnancy has been linked with an increased rate of MTCT of HIV. Following seroconversion, the viral load is known to be higher in the first few weeks and may remain so for 3 – 4 months after infection as a result of rapid viral replication, further increasing this risk is the increasing maternal blood the fetus is exposed to as pregnancy progresses (Dinh et. al., 2015; Drake et. al., 2014; Egbe et. al., 2016). This increased risk of MTCT of HIV has also been observed in breastfeeding women who seroconvert while breastfeeding, the pathophysiology is also mediated through an increased viral load associated with recent seroconversion. The viral load remains the most important predictor of perinatal transmission though transmission has been known to occur at undetectable levels (Lockman and Creek, 2009).

2.6.5 The use of antiretroviral drugs and association with MTCT of HIV

Antiretroviral drugs reduce the risk of MTCT in utero, intra and postpartum through different mechanisms. Administration of antiretroviral drugs prior-to and in pregnancy limits virus replication thus reducing the viral load. These drugs cross the placenta during labor and in addition to the provision of post exposure prophylaxis administered to the infant protects against the virus that gets into the circulation or that came into contact with the mucosa of the newborn as he/she passed through the birth canal (Anabwani et. al., 2010, 2010). The mode of action is multifactorial as there is a reduction in the risk of MTCT in women with low viral load. Studies have indeed confirmed that the use of antiretroviral drugs and viral load are independently associated with risk of transmission. The risk of MTCT in mother-baby pairs who received ARV prophylaxis was found to be significantly lower than in mother-baby pairs in which one or both did not receive any ARV prophylaxis (Anabwani et. al., 2010, 2010; Anoje et. al., 2012).

The choice of antiretroviral drugs has evolved from the Zidovudine (AZT) regimen used in the Paediatric Aids Clinical Trials Group 076 (PACTG 076) that involved the administration of the drug in a single period to a cocktail of ARVs administered in 3 periods, for the mother; antepartum from 14 weeks and during labour and to the infant for 6 weeks after birth (Anabwani et al., 2010). Regimens that involve the administration of the drugs over different periods have been shown to be more efficacious that those administered in one, e.g. during labour. This is also the case with combination drug regimens; they have been shown to be of greater efficacy than single drug regimens (Delicio et. al., 2011; Hoffman et. al., 2010). HAART administered over a longer period was found to be associated with a reduced perinatal risk of transmission when compared with HAART administration over a shorter period (Hoffman et. al., 2010)

2.6.6 Genital tract infections and association with MTCT of HIV

Genital tract infections increase infant exposure to HIV in genital secretions from the mother during parturition thereby increasing the intrapartum risk for MTCT (Hoffman et. al., 2010; King et. al., 2013). Co-infections such as bacterial vaginosis, vulvovaginal candidiasis, trichomoniasis, herpes simplex virus type 2 and cervicitis are associated with an increased HIV load in the genital tract. The commonest cause of genital ulcer disease

is Herpes Simplex virus type 2 (HSV2), it is argued it has a significant effect on HIV infection as HSV2 ulcers contain high levels of HIV RNA, possibly from the homing of activated T-cells and it also provides a breach in the mucosa that increases infant exposure to HIV or infected cells beneath the epithelium (Cowan et. al., 2008; King et. al., 2013). Some studies have suggested that the mechanism might also be through a reduction of plasma viral load as increased MTCT of HIV has been seen with asymptomatic cases. Additionally, the genital lesions associated with HSV2 increase in severity and frequency in HIV-1 co-infected states leading to a possible situation where each infection propagates the other (Cowan et. al., 2008).

The prevalence of syphilis ranges from 0.4% to 3% (Olokoba et. al., 2009; Olowe et. al., 2014; Taiwo et. al., 2007), some studies have not found it to be a risk factor for perinatal transmission of HIV (Cowan et. al., 2008) a study conducted in Ukraine observed that mothers who had syphilis were 4.5 times more likely to infect their infants with HIV when compared to mothers who did not have syphilis, this is similar to a secondary data analysis of a prospective cohort study finding in Malawi where mothers were 2.6 times more likely to transmit the virus to their infants when compared to mothers who did not have syphilis (Mwapasa et. al., 2006; Thorne et. al., 2008). The mechanism of transmission is believed to be by placental compromise secondary to infection with *T. pallidum* (Mwapasa et. al., 2006).

2.6.7 Maternal systemic infections and association with MTCT of HIV

Maternal systemic infections may trigger HIV replication and increase the viral load in plasma and consequently in the genital tract and breast milk.

Hepatitis B virus (HBV) infection is prevalent in HIV-infected persons worldwide, 90% prevalence has been reported. Studies have not conclusively shown it to be independently associated with an increased risk of MTCT of HIV but co-infected women are significantly more immunosuppressed than HIV mono-infected women, immunosuppression is an independent risk factor for MTCT. A study conducted in India did not find any significant perinatal transmission risk of HIV associated with HBV (Mave et. al., 2014).

Malaria and HIV infection are prevalent with co-infection states a frequent occurrence (Brahmbhatt et. al., 2008). A number of studies have shown an association between maternal malaria infection and MTCT of HIV (Panos Institute Southern Africa (Institute/Organization), 2012), the observed associations between malaria and MTCT of HIV it has been postulated are due to an increase in maternal HIV load as malaria has been shown to be associated with a transient increase in HIV replication and plasma HIV load (King et. al., 2013). This observed association might be independent of maternal viral load (Brahmbhatt et. al., 2008). A retrospective cohort study in Kenya did not find any significant association between malaria and MTCT of HIV (Gallagher et. al., 2005; Naniche et. al., 2008). A cohort study conducted in Dar es Salaam did observe that Malaria in pregnancy was a significant predictor of MTCT of HIV at 6 weeks for mothers with at least two malaria episodes when compared with infants of mothers who were never diagnosed with malaria in pregnancy (Ezeamama et. al., 2014). The Rakai Community Cohort Uganda study found placental malaria to be a risk factor for MTCT of HIV, this risk was there regardless of maternal viral load, which is known to be a predictor of MTCT of HIV (Brahmbhatt et. al., 2008). A study in Kenya found that placental malaria reduced the risk of MTCT of HIV at low levels (<10,000 parasites/ml) and increased the risk at high levels (>10,000 parasites/ml) (Ayisi et. al., 2004; King et. al., 2013). The differences in study findings might be as a result of the differing epidemiology of malaria in the study areas that may impact on maternal immunity and methods used in the study as the sensitivity of placental histology is higher for the detection of placental malaria than placental or peripheral blood film (Brahmbhatt et. al., 2008; King et. al., 2013). A high risk of MTCT of HIV has also been observed in peak rainy seasons with higher malaria transmissions, suggesting an increase in MTCT of HIV with higher rates of malaria in pregnancy (Ayisi et. al., 2004; Brahmbhatt et. al., 2008).

A few studies have described placental conditions that may increase the risk of in-utero HIV infection of the foetus such as placental inflammation, increased CC-chemokine production, a shift in cytokine production from Th2 to Th1-type responses, and increased expression of the CCR5 HIV co-receptor on placental macrophages (Gallagher et. al., 2005; King et. al., 2013).

2.6.8 Maternal anaemia and association with MTCT of HIV

Maternal anaemia has been found to be a predictor of MTCT of HIV (Damania et. al., 2010), possible mechanisms by which this may occur include non-specific immune deficiency associated with iron deficiency and an increased shedding of HIV in blood, breast milk and/or vaginal secretions (Bucagu et. al., 2013; S Mehta et. al., 2008; Naniche et. al., 2008). A few studies have estimated the prevalence of anaemia in pregnancy at 11.5% and found anaemia in pregnancy to be significantly higher in HIV-positive pregnant women, this may increase the risk and consequently the prevalence of MTCT of HIV (Okeudo et. al., 2014).

Hepatitis C virus (HCV) co-infections are not as prevalent as HBV co-infections with prevalence rates of 30% reported. With regards to its role in the MTCT of HIV, studies have reported disagreements. Like HBV co-infection, HCV co-infection is associated with severe immunosuppression, a risk factor for MTCT of HIV (King et. al., 2013).

Cytomegalovirus (CMV) co-infection in HIV-infected adults is virtually 100%. In vitro studies have shown that CMV has the capacity to increase the risk of MTCT of HIV (Delicio et. al., 2011), current hypothesis states that both viruses are interrelated and each virus makes the carrier susceptible to infection by the other (King et. al., 2013).

Human Herpes Virus-8 (HHV-8) is prevalent in Sub-Saharan Africa, infection often acquired in childhood via exposure to contaminated saliva from caregivers. Studies have reported conflicting findings with a study in Italy reporting increased HIV-1 shedding in the genital tract that may increase the risk of MTCT of HIV. A cross-sectional study in Zambia did not support this finding (King et. al., 2013).

HIV and tuberculosis are prevalent in the reproductive age group and tuberculosis has been found to be an independent risk factor for the perinatal transmission of HIV (Gupta et. al., 2011; Pillay et. al., 2004). The highest documented in-utero rate of transmission of 19% has been attributed to tuberculosis (Pillay et. al., 2004). Immune activation and rapid viral replication has been suggested as the pathway by which tuberculosis facilitates perinatal transmission of HIV. Maternal immune activation may increase HIV compartmentalization in breast milk escalating maternal infectiousness, maternal immune

activation may also increase infant susceptibility by making the infant's CD4-expressing immune cells prone to infection (Gupta et. al., 2011; Pillay et. al., 2004).

Toxoplasmosis is a parasitic disease caused by the protozoon *Toxoplasma gondii*, with a prevalence of 25%-30% worldwide. Studies have observed a higher risk of perinatal HIV infection for HIV-infected women who have maternal neurotoxoplasmosis during pregnancy and infants with congenital toxoplasmosis respectively (Delicio et. al., 2011; Fernandes et. al., 2009). The seroprevalence of toxoplasmosis in pregnant women has been estimated at 44.4% (Uttah et. al., 2013).

Helminth infections are prevalent in Africa and are known to affect immune homeostasis, which may increase the risk for MTCT of HIV. Indeed, studies have found that HIV-infected women co-infected with helminth infections had a higher risk of MTCT of HIV and randomized clinical trials have shown an increase in CD4+ T lymphocyte counts in HIV-infected persons co-infected with some helminthes. A randomized controlled trial found no benefit of anti-helminthic treatment for reducing rate of MTCT of HIV (Gallagher et. al., 2005; King et. al., 2013).

2.6.9 Mode of delivery and association with MTCT of HIV

Vaginal deliveries have been found to be significantly associated with an increased risk of perinatal transmission of HIV compared to elective cesarean birth, this risk rises if obstetric procedures such as external cephalic version, prolonged rupture of membranes, instrumental deliveries, application of foetal scalp electrodes and episiotomies are performed as they may increase materno-fetal blood mixing (Anabwani et. al., 2010, 2010; Ayisi et. al., 2004; Chanrat et. al., 2009; Inyang, 2015; Okafor et. al., 2014; Peckham and Gibb, 2010). In a cohort study in Canada, prolonged rupture of membranes was not associated with perinatal transmission of HIV and no difference in risk was seen in HIV-positive women who had received HAART and delivered vaginally when compared to women who had undetectable viral loads and had elective cesarean births (Mark et. al., 2012). A secondary data analysis of a prospective cohort study conducted in Malawi found mode of delivery to be an insignificant predictor of MTCT of HIV (Mwapasa et. al., 2006). The difference in finding might be as a result of the study design

as the primary objective of the study was not to determine if the mode of delivery was a predictor of MTCT of HIV.

2.6.10 Infant factors associated with MTCT of HIV

Diarrhea is known to cause increased intestinal permeability; infections that present with diarrhea have the capacity to increase the risk of MTCT of HIV to HIV-exposed infants. The increased intestinal permeability following the ingestion of tainted liquids and foods has been proposed as the biological explanation for the increased risk of MTCT of HIV.

Oral candidiasis following exposure to *Candida* during vaginal delivery results in inflammation of the infant's oral mucosa and gastrointestinal tract, a condition which has been observed to be significantly associated with an increased risk for MTCT of HIV (King et. al., 2013). Bhadra (2015) postulates that the infant's gastrointestinal mucosa plays a role in the increased transmission of MTCT of HIV. The increased risk arises as a result of damage to mucosal surfaces of the mouth and/or intestine as may be seen in oral thrush. Cell-associated or cell-free HIV is capable of crossing the submucosa if the virus attaches itself to immature dendritic cells of the gastrointestinal tract, these dendritic cells then ferry the virus to the enterocytes.

Placental disorders causing ante or intra partum haemorrhage or co-infections that compromise the integrity of the placenta may increase materno-fetal blood mixing and predispose to MTCT. In pregnant HIV-infected women not taking ARVs, the placenta serves as a receptacle for HIV multiplication, though it may provide a barrier to HIV transmission, preventing transmission to up to 90% of exposed infants. The structure and function of the placenta evolves during gestation finally generating a barrier that divides the maternal and fetal circulations through which HIV must negotiate either via endocytosis or by a compromised villous surface, a condition that can be brought about by chorioamnionitis. Chorioamnionitis may be caused by several different microorganisms, such as bacterial vaginosis-associated bacteria, *Neisseria gonorrhea*, *Chlamydia trachomatis*, *Trichomonas vaginalis*, or *Group B Streptococcus*. Chorioamnionitis may directly increase the risk of MTCT by disrupting the placental barrier allowing HIV-infected maternal lymphocytes into the amniotic cavity or indirectly

as it is associated with preterm labor and premature rupture of the membranes. The protective capacity of the placenta is also brought about by the production of soluble factors and receptors such as cytokines, chemokine's and MHC class I molecules. The local expression of these factors may be altered by co-infections affecting the placenta (Anabwani et. al., 2010, 2010; King et. al., 2013).

2.7 Socioeconomic factors and determinants of outcomes in HIV-exposed infants

Health outcomes such as MTCT of HIV are now known to be influenced largely by environmental factors rather than by individual behavior as socio-cultural characteristics of a population such as family and peer dynamics, local beliefs and values, cultural norms and practices and political and economic factors influence the population risk of MTCT. A number of theories and constructs such as the individual level theories and constructs, which includes planned behavior and empowerment theories, constructs of attitude, perceived norms and personal agency and interpersonal theories and constructs help throw light on PMTCT utilization and invariably factors that increase the risk of MTCT of HIV. A few perceived barriers to PMTCT that increase the risk of MTCT of HIV and consequently the prevalence of the disease include low risk perception; lack of motivation/self-efficacy; poor health status; family relationships; non-disclosure of HIV status; lack of social support; absence of social networks; fear of knowing one's own status; stigma and discrimination of HIV status being disclosed to partner and/or family or the community; opposition of the male intimate partner, health and religious beliefs, gender roles and an unfavorable policy environment (Busza et. al., 2012; Hampanda, 2013).

2.7.1 Low risk perception and association with MTCT of HIV

A low risk perception has been identified as a factor promoting none or late presentation for HIV testing as the perceived association of HIV with promiscuity, extra-marital sex and sex with high risk groups such as sex workers' may generate a false sense of security and hinder optimal use of PMTCT interventions known to reduce the risk of MTCT of HIV (Busza et. al., 2012).

2.7.2 Lack of motivation/self-efficacy and association with MTCT of HIV

Pregnant women, though concerned about their HIV serostatus may lack the motivation or self-efficacy to present themselves for testing especially if they have to travel long distances or may have to explain their absence from home. The fear of knowing one's HIV serostatus is known to deter women from getting tested (Busza et. al., 2012; Hampanda, 2013).

2.7.3 Health status and association with MTCT of HIV

The mental and/or physical health of the pregnant woman has been identified as a factor affecting healthcare seeking behavior as ill-health may result in missed appointments and it is also known to lower adherence to ARV. Non-adherence to ARV is known to increase the risk of MTCT of HIV (Busza et. al., 2012)

2.7.4 Health facility accessibility and association with MTCT of HIV

Geographical inaccessibility characterized by long distances to facilities and unaffordable costs of transportation negatively affect health-seeking behavior and uptake of PMTCT interventions. Non-use of PMTCT interventions is a known determinant of MTCT of HIV (Busza et. al., 2012)

2.7.5 Perceived stigma and association with MTCT of HIV

Perceived stigma has been shown to be negatively associated with adherence to PMTCT interventions. The adherence to PMTCT intervention is known to be significantly associated with MTCT of HIV (Busza et. al., 2012).

2.7.6 Religious beliefs and cultural norms associated with MTCT of HIV

Cultural norms are known to determine the health-seeking behavior of pregnant women and may influence the uptake of PMTCT services and MTCT of HIV. If illnesses such as HIV are attributed to supernatural forces, healthcare services may be sought from unorthodox alternatives. The traditional practices associated with pregnancy, delivery and breastfeeding are known to interact with guidance and counselling offered by health care

workers thus affecting PMTCT recommendations that could decrease the risk of MTCT of HIV (Busza et. al., 2012).

2.7.7 Health policies associated with MTCT of HIV

Health outcomes such as MTCT of HIV are known to be associated with the provision of social welfare, functional health system, economic and political stability and availability of health insurance scheme (Busza et. al., 2012). A similar observation has been made in resource-limited settings where MTCT continues as a public health problem in spite of human and material investments made and the presence of interventions demonstrated to be effective in the prevention of MTCT. In developed countries where the HIV seroprevalence is low and HIV positive women have access to antenatal care, skilled delivery and risk factors are targeted methodically; effectiveness mirrors efficacy results obtained in clinical trials. In developing countries where the risk factors for MTCT remain the same but the HIV seroprevalence is high, HIV positive pregnant women do not have ready access to antenatal and hence PMTCT services such as skilled attendance at birth or caesarean sections, and highly active antiretroviral therapy (HAART), in these settings, MTCT rates upwards of 15% have been reported (Gartland et. al., 2013; Stringer et. al., 2008). This is not always the case as Cuba; a developing nation became the first country in the world to receive validation from W.H.O for eliminating MTCT.

2.7.8 Breastfeeding practices and their association with MTCT of HIV

The type of infant feeding option adopted influences the risk of MTCT of HIV significantly, in a breastfeeding population the risk of MTCT may be higher than that observed in a non-breastfeeding population. In a non-breastfeeding population without PMTCT interventions, the baseline risk of MTCT ranges from 15% - 30%. An estimated 70% of these infections occurring in-utero, the rest occurring as the unborn infant transverses the birth canal during delivery.

In a breastfeeding population without PMTCT interventions, breastfeeding increases the baseline risk of MTCT by an estimated 20%, the risk in these populations may be as high as 50% (Ahoua et. al., 2010; Anabwani et. al., 2010, 2010; Anoje et. al., 2012; Azcoaga-Lorenzo et. al., 2011; Federal Ministry of Health, 2014; Iliff et. al., 2005; Iloh et. al., 2015; Iregbu et. al., 2014; Mofenson, 2010; Nkwo, 2015; Torpey et. al., 2010; Zgenah et

al., 2004). Advanced maternal disease, low maternal CD4 count, high maternal viral load, mastitis and mixed feeding are factors that increase the risk of breastfeeding MTCT of HIV (Bhadra, 2015). Early lactation is said to be the period of greatest risk as colostrum, which is passed at this stage contains higher viral loads than milk expressed in the latter stages of lactation. The perinatal risk is present throughout the lactation period (Anabwani et. al., 2010, 2010).

In a breastfeeding population practicing exclusive breastfeeding, the MTCT of HIV is not eliminated as studies have observed that exclusive breastfeeding for up to 6 months is associated with an estimated three to four-fold increase in the risk of MTCT of HIV when compared with women who never breastfeed (Bhadra, 2015).

The practice of mixed breastfeeding has been established as significantly associated with an increased risk of MTCT of HIV. The pathophysiology is said to be linked with milk stasis in the breast following temporary gaps in breastfeeding leading to breast engorgement and a consequent risk of mastitis. Mastitis leads to the presence of inflammatory cells such as HIV-infected lymphocytes that may increase the transmission risk. Clinical mastitis is rare, nevertheless subclinical mastitis accounts for an estimated 50% of all HIV transmission associated with breastfeeding. Subclinical mastitis is associated with an increase in milk sodium, potassium and inflammatory cytokines. These elevated electrolyte levels arise from deranged cell membranes that also lead to an increase in HIV in breast milk. The roles of cell-free and cell-associated in breast milk associated transmission of HIV is poorly understood, it is believed that both are associated with an increased risk of MTCT of HIV. Cell-free HIV is suppressed by ARVs but this effect is not seen with cell-associated HIV, it is believed that this may explain the transmission that occurs during breastfeeding that is seen in breastfeeding mothers on ARVs (Bhadra, 2015).

2.7.9 Maternal nutritional status and association with MTCT of HIV

The maternal nutritional status has been associated with breastfeeding MTCT of HIV. Vitamin A is known to be essential for reinforcing the immune system's defense against infection via the transformation of lymphocytes. A study in Malawi observed a MTCT of

HIV rate of 32.4% in breastfeeding HIV-infected women with reduced vitamin A concentrations compared to 7.2% in breastfeeding HIV-infected women with normal vitamin A levels (Bhadra, 2015). This observation has not been consistently seen as a meta-analysis of RCTs concluded that vitamin A had no significant association with MTCT of HIV (Bhadra, 2015; Wiysonge et. al., 2011).

2.7.10 Breast milk substitutes and association with MTCT of HIV

Replacing breast milk with substitutes erases the risk of MTCT via breastfeeding. Replacement feeding is not without risks, in areas where water supply is unsafe or the economic conditions are unfavorable, it increases infant mortality from diarrhoea and malnutrition (Horvath et. al., 2010). In addressing these replacement feeding risks, WHO prescribes replacement feeding as an option only when it is affordable, feasible, acceptable, safe and sustainable (AFASS). In Nigeria, this yardstick is hardly ever met even in settings where breast milk substitutes are provided for free. This may lead to mixed feeding, mixed feeding carries an increased infant mortality as it compounds the risk of breastfeeding associated MTCT with that associated with replacement feeding (Anigilájé et. al., 2015). Research has produced mixed results regarding the overall benefit of replacement feeding when the AFASS criteria is met as studies conducted in Botswana (9.3% versus 4.9% p = 0.003), Kenya (11% versus 9%) and South Africa (15.1% versus 6.1%) all reported a significantly higher all-cause mortality rate in women who chose replacement feeding when compared to those who exclusively breastfeed. These findings suggested a lack of protective immunity in formula fed infants, findings consistent with the benefits put down to maternal mucosal protective immunity transferred by breastfeeding (Anabwani et. al., 2010, 2010).

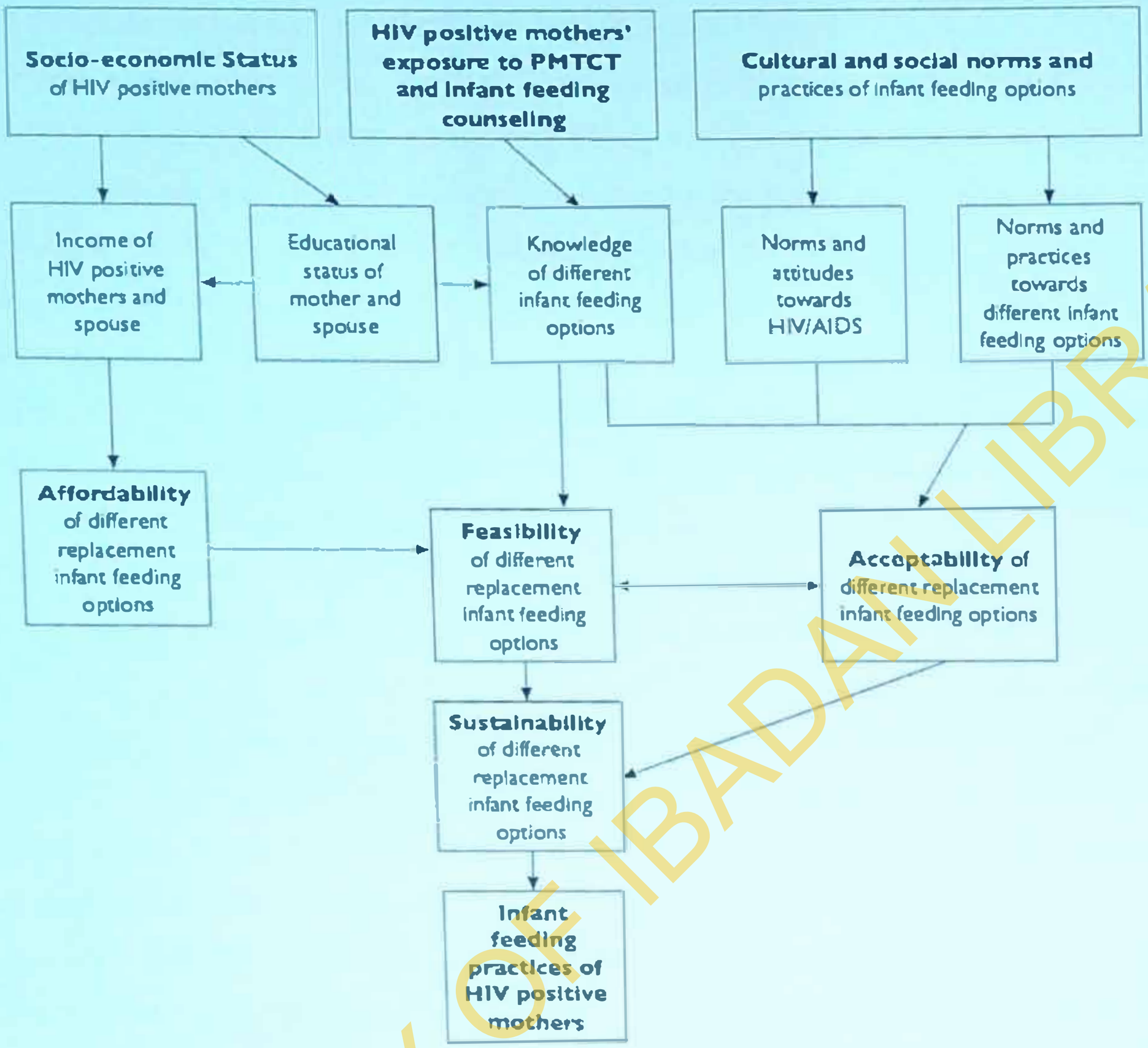

Figure 2.2 Factors affecting infant feeding practices of HIV positive mothers (Laar and Govender, 2013)

2.7.11 Maternal age and association with MTCT of HIV

Maternal age at delivery was significantly associated with an increased rate of MTCT of HIV in a descriptive observational study of HIV-EID activities in Zambia. Probable causal links adduced for this observation relate to the belief that mother's age may influence uptake of best practices such as adherence to ARV regimen and exclusive breastfeeding offered during PMTCT interventions (Torpey et. al., 2012). This finding is not consistent with that reported in studies conducted in Ethiopia, Nigeria and South Africa that found no significant association between maternal age at delivery and MTCT of HIV (Coovadia et. al., 2007; Sagay, 2013). The difference in study findings may relate to dissimilarities in gender roles in the study settings.

2.7.12 Availability of support systems and association with MTCT of HIV

The support of HIV-positive women by family and community members has been described as the first and best line of support. The position of the woman in the family has been identified as a factor that influences the pregnant woman's access to PMTCT, a determinant of MTCT of HIV. Inequities in the distribution of resources may place the woman in a position of dependency where others decide if she accesses PMTCT or not. It has been established that some women refuse some PMTCT interventions fearing their partners' reproach (Busza et. al., 2012). WHO (2009) reported that in some countries, an estimated 75 percent of women said their husbands alone make health decisions for their families.

2.7.13 Disclosure and association with MTCT of HIV

Support by family and community systems is consequent upon disclosure. Family and community support are positively associated with adherence to antiretroviral treatment and exclusive breastfeeding or replacement feeding. Male attendance at ANC and HIV testing was found to be associated with a decreased infant HIV infection and increased HIV free survival (Aluisio et. al., 2011). A prospective cohort study did not find any significant any significant difference in MTCT of HIV between pregnant women who disclosed and those who did not (Jasseron et. al., 2013).

2.7.14 Domestic violence and association with MTCT of HIV

Domestic violence describes a range of intentional abusive behaviors carried out in the context of a family or intimate relationship. It includes but is not limited to physical, sexual, emotional, economic and psychological (Fawole et. al., 2005; Gyuse and Ushie, 2009; Iliyasu et.al., 2011). The receipt of domestic violence has been associated with non-condom use, reduced uptake of PMTCT and non-adherence to ARV medication for the purpose of PMTCT, all risk factors for MTCT of HIV (Hampanda, 2016; Macphail et. al., 2014)

2.7.15 Place of delivery and association with MTCT of HIV

Traditional birth attendants' account for 60% of all deliveries in Nigeria, they enjoy acceptance because they are regarded as been knowledgeable in local customs and practice and may be the only option (Abiodun et. al., 2015). Urban and rural women patronize traditional birth attendants' because they have comparable cultural and socioeconomic attributes (Iwelunmor et. al., 2014). Traditional birth attendants' knowledge and practice have been determined to be low (Madhivanan et. al., 2015; Mobolanle and Kofo, 2010; Ofili and Okojie, 2005), a retrospective record review carried out in Ethiopia found that HIV-exposed infants delivered by a traditional birth attendant were 3 times more likely to be HIV-positive when compared with HIV-exposed infants delivered by skilled birth attendants (Amare et. al., 2014). An unmatched case-control study in Ethiopia did not find any association between place of delivery and MTCT of HIV (Burusie and Deyessa, 2015). The dissimilarities in study findings could be as a result of differences in cultural practices and traditional birth attendants' knowledge and practice.

CHAPTER THREE

METHODS

3.1 Study Area

This study was conducted in the Federal Capital Territory – Abuja (FCT), it officially became Nigeria's capital on December 12, 1991. Kaduna, Nassarawa, Kogi and Niger states border the FCT on the North East, East, South and North West respectively. The FCT has a landmass of 7,753.9 sq.km and it is divided into 6 area councils namely: Abuja municipal area council, Bwari area council, Kwali area council, Gwagwalada area council, Abaji area council and Kuje area council. The FCT had a population of 1,406,239 in the 2006 census, the growth rate is estimated at 9%, and the estimated population of the FCT as at 2015 was 3,421,848 with 752,807 women of childbearing age (National Population Commission, 2010). The territory is made up of urban, urban slums and rural areas. The HIV prevalence is 5.8% (95%CI 4.5% – 7.2%) (Ministry of Health, 2014).

The Public Health Department of the Federal Capital Territory Administration provides PMTCT services. There are seven hundred and ninety-three health facilities within the FCT, six hundred and three primary health care facilities, one hundred and eighty-five secondary health facilities and three tertiary health care institutions. Primary, secondary and tertiary health care centers in the territory provide varying levels of PMTCT/health care services. The Primary Health Care system is the main channel of providing Maternal, Newborn and Child health services. These sites are supported by PEPFAR and adopted the 'Option B' where "All pregnant and breastfeeding women infected with HIV should initiate triple ARVs (ART), which should be maintained at least for the duration of mother-to-child transmission risk, women meeting treatment eligibility criteria should continue lifelong ART" (Sagay, 2013), (Appendix 4).

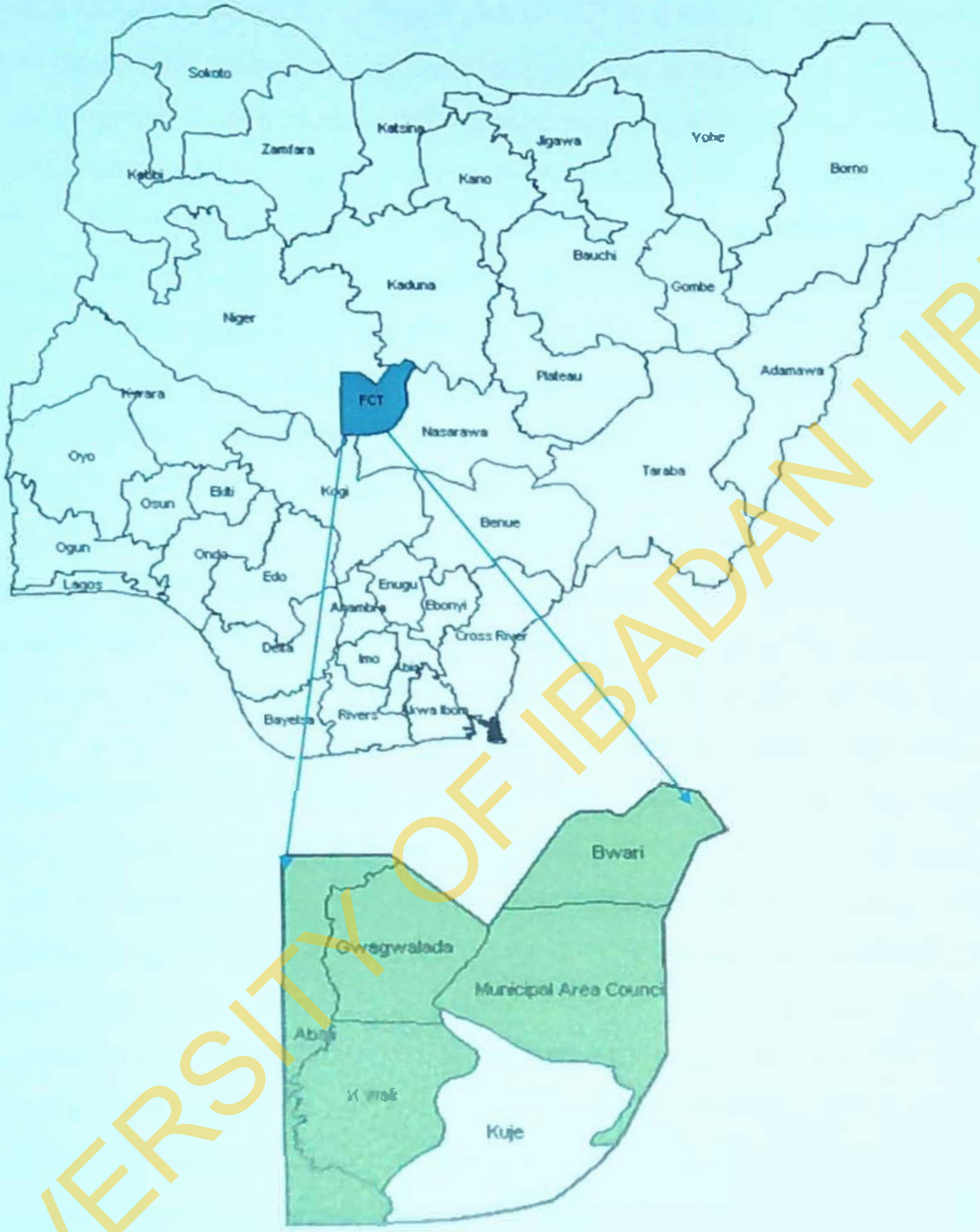

Figure 3.1 Map of Nigeria showing the Federal Capital Territory (Abuja) and the six Area Councils

3.2 ANC/PMTCT client flow

Pregnant women registered for antenatal care (ANC) in these facilities and made repeated visits at frequencies determined by their care provider until delivery. At the first ANC visit, all pregnant women received HIV testing and counselling. Group counselling was done using the 'opt out' method, this method made routine HIV testing but gave the pregnant woman the option of refusing to be tested if she so desired, the testing rates using this method averaged 95%. Results were delivered immediately using the request and result form (Appendix 7) and post-test individual counselling was given. Pregnant women who presented in labor for the first time were tested, pregnant women were able to enter the PMTCT programme at any gestational age of their pregnancy or even immediately after delivery. Antenatal clinic clients who tested positive were referred to the PMTCT clinic using the 'client referral form' (Appendix 10) where they were provided with information about the options to prevent MTCT of HIV. Pregnant women enrolled in the PMTCT programme were counselled to deliver in a health center attended by a skilled professional but they were free to deliver at a place of their choice. The PMTCT programme promoted exclusive breastfeeding with early cessation of breastfeeding at six months or replacement feeding. The 'HIV Counselling and Testing: Client Intake Form' (Appendix 6) where available was used to facilitate the HIV counselling sessions. The test results were recorded in the PMTCT testing and counselling register and the Daily labor and delivery registers (Appendix 11). Pregnant women who tested positive to HIV were evaluated using the 'Adult Initial Clinical Evaluation Form' (appendix 8). The Adult Initial Clinical Evaluation Form was used to collect socio-demographic variables, medical history, obstetric history, risk factors, immunologic markers, history of previous ARV exposure, adherence to ARV (if previously exposed), disclosure status, history of side effects to ARVs, physical examination, staging of HIV disease and to plan for further laboratory investigations and ARV therapy. Laboratory investigations were done to establish the baseline level of biological markers such as full blood count, CD4+ count, VDRL and the functional status of the kidneys and liver, these tests were carried out periodically using the 'laboratory order and results form' (Appendix 12). The data collected on the Adult Initial Clinical Evaluation form was used to fill/update the Care/ART Card (Appendix 9), these forms

were subsequently used to fill the Pre-ART, ART registers (Appendix 13). The Pre-ART and ART registers were updated periodically based on recent data.

Pregnant women who tested positive to HIV began a first line highly active antiretroviral therapy (HAART) regimen that consisted of Zidovudine (AZT) plus Lamivudine (3TC) and either Nevirapine (NVP) or Efavirenz (EFZ). The choice of the regimen was guided by the presence of contra-indications to any of the drug options. These women received a set of adherence counselling sessions (at least 3) before initiating HAART, adherence counselling sessions were repeated on every drug refill visit. Pregnant women who presented in labor and tested positive to HIV were commenced on HAART, they were counselled to take their medications up to a week after cessation of breastfeeding. HIV-exposed babies were placed on Nevirapine for 6 weeks within the first seventy-two hours.

HIV-exposed infants were subsequently screened for HIV using the National EID algorithm (Appendix 5), which requires that a DNA PCR test should be performed on all HIV-exposed infants at 6 weeks of age or as soon as possible afterwards. Cotrimoxazole prophylaxis was initiated at this time with caregivers informed to come back for the DNA PCR test results. Dried blood samples (DBS) were packaged and sent to a testing facility with 'Infant HIV PCR (DBS) laboratory Request/Report forms (Appendix 14). If the tests returned positive, infants were linked to the HIV care and treatment services, while those who returned negative but were been breastfed were advised to repeat the HIV testing six weeks after the complete discontinuation of breastfeeding.

3.3 Study Design

A facility based unmatched case-control study was conducted using mixed methods for data collection. To estimate the odds of MTCT of HIV, an unmatched case-control study was conducted employing record review of results of infant DNA PCR virology tests, maternal ANC history and paediatric clinical history. A record review over a period from January 2009 to December 2015 was used to determine the period prevalence of MTCT of HIV infections in the HIV-exposed infants.

In-depth interviews with mothers of infants who tested positive to HIV were conducted to obtain qualitative descriptions of herself, this qualitative description covered factors that influenced place of delivery, breastfeeding practices, adherence to medications, disclosure to partner, family and community members.

3.4 Study Population

The population sampled for this study included HIV positive women and their newborn infants who presented for early infant diagnosis (EID) testing.

3.5 Case-definitions

Case – A case was defined as a HIV-exposed child who tested positive to HIV at final testing, which was done before or at 2 years of age using DNA PCR or Elisa.

Control – A control was defined as a HIV-exposed child who tested negative to HIV at final testing, which was done before or at age 2 years of age using DNA PCR or Elisa.

3.6 Sample Size Determination

$$N = \left\{\frac{r+1}{2 \cdot r}\right\} * \left\{\frac{2 \cdot (Z_\alpha + Z_\beta)^2 \cdot p \cdot (1-p)}{(P_0 - P_1)^2}\right\}$$

$$p_1 = \frac{P_0 \cdot OR}{\{1 + P_0 \cdot (OR-1)\}}$$

$$p = \frac{r \cdot P_0 + P_1}{r+1}$$

Where P_0= Proportion of HAART use prior to conception - 31% (Aniji et. al., 2013)

$Z\beta = 0.84$

$Z\alpha = 1.96$

$r = 3$ (1case:3control)

Odds ratio = 2

Therefore $P1 = \frac{0.31 \cdot 2}{(1 + 0.31 \cdot (2-1)} = 0.473$

$$P = \frac{3 \cdot 0.31 + 0.473}{3+1} = 0.351$$

$$n = \left\{\frac{3+1}{2 \cdot 3}\right\} * \left\{\frac{2 \cdot (1.96+0.84)^2 \cdot 0.351 \cdot (0.649)}{(0.31-0.473)^2}\right\}$$

$$n = \frac{4}{6} * \frac{2 \cdot (7.84) \cdot 0.351 \cdot 0.649}{(-0.163)^2}$$

$$n = \left(\frac{4}{6}\right) * \left(\frac{3.57188832}{0.026569}\right)$$

$n = 89.6254613 = 90$

therefore, number of cases = 90 and number of controls is 270

3.7 Sampling Method

Multistage

Stage 1 – selection of 5 area councils (Bwari, Kwali, Gwagwalada, Bwari, AMAC and Abaji)

Stage 2 – purposive sampling of 12 primary health care facilities offering PMTCT

Stage 3 – recruitment of study participants using the EID register and the paediatric HIV register.

The cases selected were prevalent cases, the controls were selected on a ratio of 3:1; 1 case: 3 controls per health facility, this criterion was kept where the number of controls were sufficient. In a few centers where the number of controls were not sufficient to meet this criterion, controls from subsequent health care facilities sampled were selected to ensure the case-control ratio was met. Cases were recruited consequently from facility registers until the sample size was achieved.

Table 3.1 List of health facilities used for this study

S/No	Names of facilities
1	Comprehensive health center, Dabi Bako
2	Basic health center, Kwali
3	Rhema health center, Kwali (Private health facility)
4	Leleyi Gwari Primary health care center
5	Bako Primary Health Care Center
5	Township clinic, Gwagwalada
6	Comprehensive health center, Dagiri
7	Comprehensive health center, Ayaura
8	Abaji Primary Health Care Center
9	Comprehensive health center, Deidei
10	Dutse Primary Health Care Center
11	Comprehensive health center, Gidan Mangoro
12	Karu Primary Health Care Center

3.8 Study Instruments

A proforma was used to collect quantitative data, an in-depth interview guide was used to facilitate the in-depth interview sessions (Appendix 1).

3.9 Validation of study instruments

To ascertain the content validity of the study instruments, the proforma and questionnaire were reviewed by academic supervisors of the department of Epidemiology and Medical Statistics, University of Ibadan. The proforma/questionnaire were also reviewed by program supervisors of the Nigeria Field Epidemiology and Laboratory Training Program. The feedback received from academic and program supervisors were used to improve the proforma and questionnaire and to ensure the proforma/questionnaire addressed the research questions adequately. To ensure the study instrument was reliable,

the proforma and questionnaire were pre-tested at a primary health care facility in Abuja Municipal Area Council.

3.10 Training of Research Assistants

Research assistants were recruited from health care workers who were involved in the management of the study population. In preparation for the study, the research assistants were briefed about its objectives and given extensive training in qualitative and quantitative methods, the research assistants were trained for 3 days. The training included conducting and recording IDIs and the transfer of skills required to identify and extract the relevant data from the paper based antenatal/PMTCT case notes, laboratory reports and monthly summary registers. The research assistants maintained regular contact with the investigator that enabled follow-up and retraining where the need arose.

3.11 Data Collection

Health care workers at laboratory units of primary health care facilities routinely collected dried blood spots (DBS) for PCR tests for all babies that were perinatally exposed to HIV. They completed PCR requisition forms (Appendix 14) to accompany the DBS samples. Information on any PMTCT service offered – e.g. type of ARV regimen received by mother and baby and whether the infant had ever received breast milk or not was also recorded on the PCR requisition form. Research assistants using the DBS PCR requisition forms, populated the proforma (Appendix 1) with data from paper-based antenatal case files, adult initial clinical evaluation form (Appendix 8), care/ART card (Appendix 9), pharmacy cards, laboratory reports (Appendix 12) and national registers (Appendix 11). The client information collected included, maternal age, maternal literacy status, marital status, maternal employment status, feeding method, type of ARV regimen given to mother and/or baby, mode of delivery, place of delivery, CD4+ count and hemoglobin level.

A total of 10 in-depth interviews were conducted in secluded indoor places at primary health care facilities with women whose children tested HIV-positive at EID or final HIV testing. IDIs were conducted face to face in English and Pidgin English, by trained

interviewers between April 2016 and June 2016. Verbal informed consent was obtained from all participants prior to interview (Appendix 2). Interviews took approximately 1hr, all interviews were audio-recorded and transcribed verbatim. An IDI guide (Appendix 1) was used to explore client's experiences in relation to socio-cultural/religious factors that influence the uptake or otherwise of PMTCT interventions. The questions included factors affecting who decides when and why a woman should attend ANC, facility delivery, promotes disclosure to partner and breastfeeding and the motivations for patronizing TBAs. The discussions were recorded using a digital recorder and notes were also taken by the interviewer.

3.12 Data Management

3.12.1 Independent Study Variables

The exposures of interest studied include pharmacological interventions by the mother and infant, breastfeeding, place of delivery, age of the mother at index pregnancy, maternal marital status at index pregnancy, maternal literacy status, maternal employment status, maternal religion and parity.

3.12.2 Dependent Study Variable

Children were regarded as HIV-positive if DNA/PCR was positive and HIV-negative if DNA/PCR/Elisa was negative.

3.13 Data Analysis

Data was entered using Epi_Info, the data was exported to Excel and imported to SPSS. Data was analysed using SPSS version 22.0 (IBM, USA). The prevalence of MTCT of HIV was calculated, the numerator was the number of children who tested positive at final testing and the denominator was the number of HIV-exposed children. Descriptive statistics were used to summarize quantitative variables (age), while qualitative variables (occupation, marital status, baby's sex, mode of delivery, DNA PCR status) were summarized by proportions. Odds ratios and their 95% confidence intervals were

calculated for independent variables; chi-square test was used to test for significance between variables. A p-value <0.05 was considered statistically significant. All reported p-values were two-sided. Variables that were significant at a p-value <0.05 in bivariate analyses were entered into a multiple logistic regression model, in the final multivariate models factors that did not include 1 in its confidence interval of Adjusted Odds Ratio (AOR) were considered significantly associated with MTCT of HIV.

The transcripts were analysed thematically, using deductive (informed by study objectives and literature) coding. First, audio recordings were transcribed, second, transcripts were read repeatedly for data familiarisation and to build an overall picture of participants' lives and provide context. Third, thematic coding, using a matrix for each case to document awareness of availability of PMTCT services, barriers limiting the use of PMTCT services and factors limiting disclosure to partner. Microsoft word was used to colour code themes.

Table 3.2 Summary of objectives and variables

Objectives	Variables	Analysis
Prevalence of MTCT of HIV	Numerator – HIV-positive infants Denominator – HIV-exposed infants	Proportion
To determine the association between socioeconomic factors and HIV infection among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja	Age, literacy, marital status, employment status, religion, number of children	Univariate – frequencies & proportions Bivariate – (odds ratio)
To determine the association between risk factors and HIV infection among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja	CD4+ count, anaemia, HAART use, place of delivery	Univariate – frequencies & proportions Bivariate – (odds ratio)

3.14 Ethical Considerations

Ethical clearance to carry out the study was sought and received from the research ethics committee of the Federal Capital Territory, Abuja with study reference number FHREC/2016/01/28/25-04-16 (Appendix 15). At each facility, permission was sought from the management of each study site and informed verbal consent was obtained from all participants of the in-depth interviews.

Confidentiality of data

The data was collected by health care givers who were aware of the HIV serostatus of the study participants, the names of the mothers and infants were not collected to ensure that anonymity was maintained and remained at data collectors level, consequently there was no risk of breach in confidentiality by the investigator or others who had potential access to a completed proforma. The data collected was encrypted.

Beneficence to participants

The relevant committees of the Federal Capital Territory, Abuja will be informed of the findings of this study as this is critical for the monitoring, evaluating and reviewing of preventive strategies.

Non-Maleficence to participants

No harm was done to the participants as a result of the conduct of this research. The conduct of the interviews with the mothers did not interfere with the routine clinical visit of the participants

Right to decline

Respondents were informed about the nature of the study and their right to withdraw at any point in time during the interview with no consequences of doing so.

CHAPTER FOUR

RESULTS

Results

A total of one thousand, four hundred and seventy-one (1,471) HIV-exposed infants were identified. From the above total, 402 infants were selected for this study. With controls to cases ratio of 3:1, 300 controls versus 102 cases were compared by the independent variables. The mean age of mothers was 27.6 years ± 5.5 years with 244 (60.7%) falling within the 21 years to 30 years' age bracket. Half of the mothers, 207 (51.5%), were employed with Christians making up 256 (63.7%) of the mothers of the infant. A larger proportion of the mothers, 373 (92.8%) were married at the time of the index pregnancy and 185 (46%) were carrying their first pregnancy. For literacy, 306 (76.1%) could read and write (Table 4.1). The record review showed that 128 (8.7%) of the one thousand, four hundred and seventy-one (1,471) HIV-exposed infants tested HIV-positive.

Table 4.1 Socio-demographic characteristics of mothers of cases and controls, FCT - Abuja

Characteristic	Cases n=102 (%)	Controls n= 300 (%)
Age of respondent at last birthday		
<20	13 (13)	30 (10)
21 – 25	37 (36)	75 (25)
26 – 30	16 (16)	116 (39)
31 – 35	27 (26)	56 (19)
36 – 40	9 (9)	21 (7)
>40	0 (0)	2 (0)
Marital status		
Single	15 (15)	14 (5)
Married	87 (85)	286 (95)
Religion		
Islam	50 (49)	123 (41)
Christian	52 (51)	177 (59)
Educational status		
Literate	70 (69)	236 (79)
Non-literate	32 (31)	64 (21)
Occupational status		
Employed	45 (44)	162 (54)
Unemployed	57 (56)	138 (46)
Number of children alive (if any)		
0	49 (48)	136 (45)
1 – 5	53 (52)	164 (55)

The children were composed of 218 males (54.2%) and 184 (45.8%) females. Table 4.2 summarizes the characteristics of the children.

Table 4.2 Socio-demographic characteristics of children (cases and controls)

Characteristics	Cases n=102 (%)	Controls n=300 (%)
Sex of infant		
Male	62 (61)	156 (52)
Female	40 (39)	144 (48)
Feeding option practiced		
Ever breastfed	96 (94)	230 (77)
Never breastfed	6 (6)	70 (23)

Table 4.3 shows the association between the use of ARVs by infants, infant feeding option and MTCT of HIV. There was a statistically significant association between the use of ARVs by infants and MTCT of HIV at bivariate analysis ($p<0.05$). The association between infant feeding option and MTCT of HIV was statistically significantly ($p<0.05$)

Table 4.3 Association between use of ARV by infants and feeding option practiced

Factor	Cases (%)	Controls (%)	Crude odds ratio (Confidence interval)	p-value
Use of ARVs by infants				
No	79 (77)	57 (19)	14.6 (8.5 – 25.3)	0.0001
Yes	23 (23)	243 (81)	1	
Feeding option practiced				
Ever breastfed	95 (93)	230 (77)	4.8 (2.0 – 11.5)	0.0001
Never breastfed	7 (7)	70 (23)	1	

Table 4.4 shows the association between sex and MTCT of HIV among infants of attendees of PMTCT clinic. There was no statistically significant association between MTCT of HIV and sex of the infant ($p>0.05$).

Table 4 Sex of infant and MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Odds ratio (Confidence Interval)	X^2	p-value
Sex of Infant					
Female	40 (39)	144 (48)	0.7 (0.4 – 1.1)	2.366	0.124
Male	62 (61)	156 (52)	1		

The association between mother's literacy status and MTCT of HIV was statistically significant ($p<0.05$). There was a statistically significant association between the mother's marital status and MTCT of HIV ($p<0.05$). Table 4.5 demonstrates the association between mother's literacy status, marital status and MTCT of HIV.

Table 4.5 Association between mothers' literacy status, marital status and MTCT of HIV

Factor	Cases (%)	Controls (%)	Crude odds ratio (Confidence interval)	p-value
Literacy				
Not literate	32 (31)	64 (63)	1.7 (1.1 – 2.8)	0.040
Literate	70 (69)	236 (37)	1	
Marital status				
Married	87 (85)	286 (95)	0.3 (0.1 – 0.6)	0.001
Single	15 (15)	14 (5)	1	

The association between MTCT of HIV and selected socio-demographic variables is shown in Table 4.6. There was no statistically significant association between the mother's age and MTCT of HIV ($p>0.05$), The association observed between mother's parity and MTCT of HIV was not statistically significant ($p>0.05$). There was no statistically significant association between mother's employment status at index pregnancy and MTCT of HIV ($p>0.05$).

Table 4.6 Table showing none significant association between socio-demographic variables and MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	X^2	P-value
Age					
≤30	66 (65)	221 (74)	0.7 (0.4 – 1.1)	2.993	0.084
>30	36 (35)	79 (26)	1		
Employment					
Unemployed	57 (56)	138 (46)	1.5 (0.9 – 2.3)	2.976	0.085
Employed	45 (44)	162 (54)	1		
Parity					
Multiparous	53 (52)	164 (55)	0.9 (0.6 – 1.4)	0.224	0.636
Nulliparous	49 (48)	136 (45)	1		

The association between the use of ARVs by the mother and MTCT of HIV was statistically significant ($p<0.05$). Table 4.7 demonstrates the association between the use of ARV by the mother and MTCT of HIV.

Table 4.7 Association between mothers' use of ARVs and MTCT of HIV

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	X^2	P-value
Use of ARV by mother					
Did not use ARV	68 (67)	88 (29)	4.8 (3.0 – 7.8)	44.678	0.000
Used ARV	34 (33)	212 (71)	1		

The association between the place of delivery and MTCT of HIV is shown in Table 4.8. There is a statistically significant association between place of delivery and MTCT of HIV ($p<0.05$).

Table 4.8 Association between place of delivery and MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	X^2	P-value
Place of delivery					
Home	90 (88)	121 (40)	11.1 (5.8 – 21.1)	70.039	0.000
PMTCT facility	12 (12)	179 (60)	1		

Table 4.9 shows the association between the mother's CD4+ count and MTCT of HIV. The association between mother's CD4+ count and MTCT of HIV was statistically significant ($p<0.05$).

Table 4.9 Association between mothers CD4+ count and MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	X^2	P-value
CD 4 count					
<350	75 (74)	39 (13)	18.6 (10.7 – 32.3)	137.272	0.000
≥350	27 (26)	261 (87)	1		

Table 4.10 shows the association between the anaemia in mothers and MTCT of HIV. There was a statistically significant association between anaemia in mothers and MTCT of HIV ($p>0.05$).

Table 4.10 Association between anaemia in mothers and MTCT of HIV

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	X^2	P-value
PCV					
ANAEMIC (≤30)	54 (53)	126 (42)	1.554 (1.0 – 2.4)	3.685	0.055
NOT ANAEMIC (>30)	48 (47)	174 (58)			

Binary Logistic Regression Analysis of Infant Factors Associated with MTCT of HIV

After adjusting for confounding between infant factors, infant feeding option and the use of ARV by infants remained significantly associated with MTCT of HIV (Table 4.13). The use of ARVs by the infants was significantly associated with MTCT of HIV as infants who did not receive ARVs were five times more likely to test positive to HIV compared to HIV-exposed infants who received ARVs (AOR 5.3, 95% CI, 2.9 – 23.9, $p<0.05$). Infants who were ever breastfed were four times more likely to acquire the virus when compared to infants who were never breastfed (AOR 4.0, 95% CI 1.6 – 10.3, $p<0.05$). Table 4.11 demonstrates the association after adjusting for confounding between selected infant factors and MTCT of HIV.

Table 4.11 Logistic regression of infant factors associated with MTCT of HIV, FCT-Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	P-value	Adjusted Odds Ratio (CI)	P-value
Infant feeding option						
Ever breastfed	95 (93)	230 (77)	4.8 (2.0 – 11.5)	0.000	4.0 (1.6 – 10.3)	0.004
Never breastfed	7 (7)	70 (23)	1		1	
Infant took ARV						
No	79 (77)	57 (19)	14.6 (8.5 – 25.3)	0.000	5.3 (2.9 – 23.9)	0.000
Yes	23 (23)	243 (81)	1		1	

Binary Logistic Regression Analysis of Maternal Factors Associated with MTCT of HIV

Table 4.12 shows the association after adjusting for confounding between selected maternal factors and MTCT of HIV. After adjusting for confounding between maternal factors, marital status, use of ARV by mother, place of delivery and CD4+ count remained significantly associated with MTCT of HIV (Table). Mothers who were married at index pregnancy were four times less likely to transmit the virus to their infants compared to women who were unmarried (AOR 0.2, 95% CI 0.1 – 0.7, $p<0.05$). The use of ARVs by mothers was significantly associated with MTCT of HIV as mothers who did not receive ARVs were fourteen times more likely to transmit the virus to their infants when compared to mothers who used ARVs (AOR 14.1, 95% CI 5.9 – 33.5, $p<0.05$). The place of delivery remained significantly associated with MTCT of HIV as women who delivered at home were eleven times more likely to transmit the virus to their infants compared to women who delivered in health care facilities (AOR 13.9 95% CI 6.0 – 32.3 $p<0.05$). The immunological status of the mother as assessed by the CD4+ count was the strongest predictor of MTCT of HIV as women who had a CD4+ count<350 were twenty times more likely to transmit the virus to their infants compared to women who had a CD4+ count>350 (AOR 18.6, 95% CI (10.7 – 32.3, $p<0.05$).

Table 4.12 Logistic regression of maternal factors and MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	p-value	Adjusted Odds Ratio (CI)	p-value
Literacy						
Not literate	32 (31)	64 (21)	1.7 (1.0 – 2.8)	0.040	0.8 (0.4 – 1.7)	0.064
Literate	70 (69)	236 (79)	1		1	
Marital status						
Married	87 (85)	286(95)	0.3 (0.1 – 0.6)	0.001	0.2 (0.08 – 0.7)	0.010
Single	15 (15)	14 (5)	1		1	
Use of ARV						
Did not use	68 (67)	88 (29)	4.8 (3.0 – 7.8)	0.000	9.7 (4.6 – 20.2)	0.000
Used ARV	34 (33)	212 (71)	1		1	
Place of delivery						
Home	90 (88)	121 (40)	11.1 (5.8 – 21.1)	0.000	13.9 (6.0 – 32.3)	0.005
PMTCT facility	12 (12)	179 (60)	1		1	
CD 4 count						
<350	75 (74)	39 (13)	18.6 (10.7 – 32.3)	0.000	18.6 (9.0 – 38.0)	0.000
≥350	27 (26)	261 (87)	1		1	

Binary Logistic Regression Analysis of Factors Associated with MTCT of HIV

After adjusting for confounding, marital status, use of ARV by mother, use of ARV by infant, breastfeeding, place of delivery and CD4+ count remained significantly associated with MTCT of HIV (Table 4.13). Marital status was significantly protective for infants as infants born to women who were married were six times less likely to acquire the virus from their mothers when compared to infants who were born to unmarried women at the index pregnancy (AOR 0.165, 95% CI 0.048 – 0.567, $p<0.05$). The use of ARVs by the infants was significantly associated with MTCT of HIV as infants who did not receive ARVs were five times more likely to test positive to HIV compared to HIV-exposed infants who received ARVs (AOR 5.278, 95% CI, 2.138 – 13.031, $p<0.05$). Infants who were ever breastfed were fourteen times more likely to acquire the virus when compared to infants who were never breastfed (AOR 14.456, 95% CI 3.857 – 54.179, $p<0.05$). The use of ARVs by mothers was significantly associated with MTCT of HIV as mothers who did not receive ARVs were fourteen times more likely to transmit the virus to their infants when compared to mothers who used ARVs (AOR 14.123, 95% CI 5.955 – 33.495, $p<0.05$). The place of delivery remained significantly associated with MTCT of HIV as women who delivered at home were eleven times more likely to transmit the virus to their infants compared to women who delivered in health care facilities (AOR 4.82, 95% CI 1.626 – 14.284, $p<0.05$). The immunological status of the mother as assessed by the CD4+ count was the strongest predictor of MTCT of HIV as women who had a CD4+ count<350 were twenty times more likely to transmit the virus to their infants compared to women who had a CD4+ count>350 (AOR 20.654, 95% CI 9.128 – 46.733, $p<0.05$).

Table 4.13 Logistic regression of factors associated with MTCT of HIV, FCT - Abuja

Factor	Cases	Control	Crude Odds ratio (Confidence Interval)	p-value	Adjusted Odds Ratio (CI)	p-value
Literacy						
Not literate	32 (31)	64 (21)	1.7 (1.0 – 2.9)	0.040	1.1 (0.5 – 2.5)	0.786
Literate	70 (69)	236 (79)	1		1	
Marital status						
Married	87 (85)	286 (95)	0.3 (0.1 – 0.6)	0.001	0.2 (0.04 – 0.6)	0.004
Single	15 (15)	14 (5)	1		1	
Use of ARV						
Did not use	68 (67)	88 (29)	4.8 (3.0 – 7.8)	0.001	14.1 (6.0 – 33.5)	0.001
Used ARV	34 (33)	212 (71)	1		1	
Infant ARV						
No	79 (77)	57 (19)	14.6 (8.5 – 25.3)	0.001	5.3 (2.1 – 13.0)	0.001
Yes	23 (23)	243 (81)	1		1	
Infant feeding choice?						
Ever breastfed	95 (93)	230 (77)	4.8 (2.0 – 11.5)	0.001	14.5 (3.8 – 54.2)	0.001
Never breastfed	7 (7)	70 (23)	1		1	
Place of delivery						
Home	90 (88)	121 (40)	11.1 (5.8 – 21.1)	0.001	4.8 (1.6 – 14.3)	0.005
PMTCT facility	12 (12)	179 (60)	1		1	
CD 4 count						
<350	75 (74)	39 (13)	18.6 (10.7 – 32.3)	0.001	20.7 (9.1 – 46.7)	0.001
>350	27 (26)	261 (87)	1		1	

4.0 Respondent's Characteristics

A total of 10 participants were interviewed. The Mothers who were interviewed had a median age of 29 with ages ranging from 25 years to 36 years, 6 (60%) were residents of Kwali Area council and 4 (40%) resided in Gwagwalada at the time of the interview. 80% of the interviewees were Christians and all were self-employed. 90% of the mothers could read and write and had children. Table 4.14 demonstrates the socio-demographic characteristics of respondents.

Table 4.14 Socio-demographic characteristics of in-depth interview participants, FCT – Abuja (n=10)

Characteristic	Frequency	Percentage
Age of mother at last birthday		
25 – 30	7	70
31 – 36	3	3
Marital status		
Single	0	0
Married	10	100
Religion		
Islam	2	20
Christian	8	80
Educational status		
Literate	9	90
Non-literate	1	10
Occupational status		
Employed	9	90
Unemployed	1	10
Number of children alive (if any)		
0	1	1
1 – 5	9	90
Husband's occupation		
Trader/self-employed	6	60%
Police officer	1	10%
Driver	3	30%

4.1 Awareness of Availability of PMTCT Services

This study examined participants' awareness, knowledge of MTCT of HIV and availability of PMTCT services. The awareness of PMTCT services in health facilities was known to all as interviewees demonstrated that they knew services was available.

"It is always announced on radio that pregnant women should go to the hospital to get tested for HIV when they are pregnant" (31-year-old, trader, literate).

"dem talk am for health talk say e good make woman wey get belle go hospital make dem look after am... ...dem dey test for HIV for hospital, the test na free" (29-year-old, Trader, literate).

They all believed that testing for HIV, regular ANC visits, use of ARVs, hospital delivery and avoidance of breastfeeding could prevent mother to child transmission of HIV.

"When she get belle, do as doctor talk ... ...take her medicine, born for hospital, the pikin fit no go get the disease" (28 year old, cleaner, literate).

"The nurse said so, that if I take my medicine everyday and eat nutritious foods and give my child only breast milk for 6 months, my child won't get the disease" (31-year-old, trader, literate).

4.2 Barriers Limiting the use of PMTCT Services

Interviews with mothers revealed possible reasons why some failed to reveal their statuses to partners and extended families and practices that may have promoted non-adherence and non-delivery in hospitals. All participants reported having experienced unintended stigmatization while accessing PMTCT services

Disclosure

Non-disclosure to partner was widely reported, reasons given for non-disclosure to partner was the fear of abandonment/violence

"(shakes her head) ...when nurse tell me say I get HIV, she say make I tell my Oga... ...I never tell am, him fit pursue me..." (28 year old, cleaner, literate).

"...that one go hard o, wetin I wan tell am? ...I never want make dem pursue me for house... (29-year-old, Trader, literate).

Fear of accusation of infidelity

The fear of accusation of infidelity was also cited as a reason for non-disclosure to partner

"...where I wan tell am say e come from?... (26-year-old, hairdresser, literate)

One woman did not want to disclose her HIV serostatus so as not to burden her partner with the knowledge that he might be carrying the virus

"...my husband does not have the heart: the news will kill him before the virus does..." (31-year-old, trader, literate).

Factors influencing adherence to ARVs

Non-adherence to ARVs was reported by respondents who admitted they missed doses of their medication. The reasons for not taking ARVs as prescribed varied; forgetfulness, failure to travel with medications and a busy schedule were cited as reasons for not taking medications as prescribed.

"...I busy that period...that day, work no gree me do any other thing..." (29-year-old, trader, literate).

"It happened that time I told you I travelled, I didn't travel with my medicine, I was at home for 2 weeks and didn't use it throughout" (25-year-old, teacher, literate).

Factors influencing place of delivery

Home delivery was reported by respondents, the reasons given varied and include hospital not open at night, mother-in-law (cultural) influence, belief in spiritual protection and perceived low risk to complications that may arise during delivery

"...nobody is in the hospital at night..." (29-year-old, housewife, literate).

"...my mother-in-law refused me coming to the hospital..." (25-year-old, teacher, literate).

"...madam nurse born my pikin for me...na she look after me when I get belle..." (28 year old, cleaner, literate).

"...there was no problem, there was no need to go to the hospital..." (26-yearold, hairdresser, literate).

"...God is in control..." (25-year-old, salesgirl, literate)

Infant feeding option adopted

Breastfeeding was universal among the respondents, all respondents reported having mixed-fed their infants at one point in time. The reasons adduced for mixed feeding varied.

Pressure from husband

The failure to disclose HIV serostatus to the partner was reported to have played a role in children been breastfed after 6 months when household foods had been introduced. A father who had not been informed of the need to avoid mix-feeding administered herbal preparations to the child.

"...my husband asked me why I didn't want to breastfeed his child... ...my husband fit suspect..." (29-year old, trader, literate).

"...My husband bought some herbal medicines, I didn't know how to tell him not to give the medicine..." (25-year-old, salesgirl, literate).

Unintended pressure from extended family/friends

For women who had disclosed to their partners the need to avoid disclosing their HIV serostatus to extended family or friends promoted mix-feeding. The unavailability of a child's preferred meal was also reported to have influenced the mother's decision to mix-feed in unfamiliar settings.

"...my child dey cry, I no wan make people start to dey ask me question, I give am small breast..." (28-year-old, cleaner, literate).

"I traveled to the village...my child did not like the food and was crying, I had to breastfeed..." (25-year-old, teacher, literate).

"...e get as e dey make I just stop to dey breastfeed, people go dey ask me why I stop quick quick..." (25-year-old, salesgirl, literate).

Pressure from mother-in-law

The woman's mother-in-law was reported to have influenced mix-feeding, this was brought about by non-disclosure to the mother-in-law.

"...my mother-in-law was around and said I should breastfeed her child, I couldn't say no" (25-year-old, salesgirl, literate).

"...before I come back, my mother-in-law don give am akamu..." (29-year-old, housewife, literate).

Mix-feeding as a result of ill-health

For one participant who had disclosed, not been able to exclusively breastfeed was attributed to feeling unwell and not been around when the child was mixed fed

"...I was not well and was admitted in hospital..." (36-year-old, civil servant, literate).

CHAPTER FIVE
DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

This study determined the prevalence of MTCT of HIV amongst infants of attendees of PMTCT clinics in the Federal Capital Territory – Abuja. Specifically, sociodemographic characteristics and risk factors associated with MTCT of HIV were explored using qualitative and quantitative methods for data collection. The prevalence of MTCT of HIV was estimated at 8.7%. The variables significantly associated with MTCT of HIV include the use of ARVs by mothers and infants, marital status, breastfeeding, place of delivery and the CD4+ count.

5.1.1 Prevalence of MTCT of HIV

The prevalence of HIV infection among HIV-exposed infants in this study was 8.7%, which is lower than the spectrum modeled National MTCT of HIV rate of 30% (Sagay, 2013). This prevalence was facility based and may explain the difference observed with the spectrum modeled rate. It is also lower than 33.7% observed from a previous study carried out in the University of Abuja teaching hospital (Okechukwu and Abdulrahaman, 2008). It is comparable to 9.1% obtained from a retrospective study conducted at the National hospital Abuja (Iregbu et. al., 2014) that is within the same geographic area as the University of Abuja teaching hospital study and higher than 1% observed in a prospective study conducted in Enugu (Iloh et. al., 2015). A difference in study population may be responsible for the differences observed as the University of Abuja serves as a referral center within the FCT and also receives patients from neighboring states. This study covered a time period similar to that of the National hospital study and improving trends in the Nigerian PMTCT protocol within this period may account for the variation in prevalence's as the University of Abuja was conducted in a different time period when a different PMTCT protocol was in place. While lower than the modeled rate, the estimate may not be an accurate representation of the true prevalence as it was

based on some results that could not be determined to be the final testing carried out at 18 months or after the cessation of breastfeeding.

5.1.2 Identify biological factors associated with HIV infection among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja

The use of HAART by mothers was significantly associated as those who did not use ARVs were 14 times more likely to transmit HIV to their children than those who did, a finding observed in several studies such as the review of program data and cohort studies in Zambia that concluded that the use of ARV in pregnancy significantly reduced the risk of MTCT of HIV (Gartland et. al., 2013; Torpey et. al., 2010). Hurtado (2015) in a case-control study further stratified the use of HAART by duration of use and found that the risk of MTCT of HIV decreased with a longer duration of use. Hoffman (2010) observed that no MTCT of HIV occurred when the mother took HAART for at least 32 weeks during pregnancy and the risk of transmission was duration dependent with longer durations associated with a decreased risk of MTCT of HIV, every additional week of therapy reduced the risk of transmission by 7%. This finding contrasted with that of the European Collaborative study where HAART use failed to reach significance. The likely explanation for the difference between the European study and this study could be due to the small number of infections in infants as this study was conducted in the HAART era when nearly 50% of women in the study where already on HAART prior to becoming pregnant (Thorne et. al., 2005).

This study observed the CD4 count of the mother to be a predictor of MTCT of HIV as mothers with a CD4+ count less than 150 cells/mm^3 were 20 times more likely to transmit HIV to their children. A possible explanation for this observation could be related to the fact that the CD4+ count correlates with the clinical stage of the disease and the more advanced the disease the higher the probability of the virus been transmitted. Maternal CD4+ count has been used as an indicator to assess eligibility for antiretroviral treatment and prophylaxis for pMTCT. This observation is in disagreement with the prospective cohort study conducted in Maputo South Africa, Rwanda that observed that

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This study observed the CD4 count of the mother to be a predictor of MTCT of HIV as mother's who had a CD4+ count less than 350 cells/mm^3 were 20 times more likely to transmit HIV to their children, a possible explanation for this observation could be related to the fact that the CD4+ count correlates with the clinical stage of the disease and the more advanced the disease the higher the probability of the virus been transmitted. Maternal CD4+ count has been used as an indicator to assess eligibility for antiretroviral treatment and prophylaxis for PMTCT. This observation is in disagreement with the prospective cohort study conducted in Muhima health centre, Rwanda that observed that

the CD4+ count was not a predictor of MTCT of HIV [AOR 3.82 (95% CI 0.92 – 15.94)] (Bucagu et. al., 2013). The difference in study findings is unclear but one cohort study reported inconsistent virologic and immunologic responses in individuals on ARV as raised CD4+ counts had been observed in individuals with a high viral load and conversely, CD4+ counts failed to rise in individuals with undetectable plasma HIV RNA (Burusie and Deyessa, 2015).

This study found the administration of ARV to the infant to be a predictor of MTCT of HIV as infants who did not receive ARVs where 5.3 (95% CI 2.1 – 13.0) times more likely to become infected with HIV, this is similar to the findings of a case-control study conducted in Western-Kenya where infants who did not receive ARV were 3.92 (95% CI 1.13 – 13.59) times more likely to acquire HIV from their mothers (Onono et. al., 2015). Koye and Zeleke (2013) made a comparable observation where they observed that HIV-exposed infants who did not receive ARV prophylaxis were 13 (95% CI 6.86 – 24.6) times more likely to acquire HIV infection from their mothers when compared to HIV-exposed infants who received ARV prophylaxis. A likely explanation for this may be consequent upon the fact that post-exposure prophylaxis has been shown to be effective in non-infant populations and its effectiveness has also been demonstrated in the newborn especially when commenced within the 1st twenty-four hours of life. This benefit has been observed even in situations where the mother did not receive ante or intra partum ARV intervention (Anabwani et. al., 2010, 2010).

This study observed that breastfeeding was significantly associated with increased MTCT of HIV as ever breastfed infants were 15 (95% CI 3.857 – 54.179) times more likely to become infected compared to those who were never breastfed. This association has been observed in several studies, Iregbu et. al. (2014) observed a prevalence of 3.6% and 9.1% in infants who had never and were ever breastfed respectively (Fisher's exact=0.016). In Zambia, Torpey (2012) from a descriptive observational study reported a protective effect between breastfeeding and MTCT of HIV as children who had never been breastfed had a 73% reduction in the risk of acquiring HIV from their mothers compared to those who had ever been breastfed [AOR 0.27 (95%CI 0.19 – 0.40)]. This study observed through

interviews with mothers of HIV-positive that all mix-fed their infants at a point in time, the commonest reason proffered for this was non-disclosure. A number of studies have determined that mixed feeding carries the highest risk of MTCT of HIV, Iloh et. al. (2015) in a prospective cohort study in Enugu observed that HIV-positive infants were found only among those who were mix-fed when compared to those who were either exclusively breastfed or practiced replacement feeding ($p<0.001$). Anoje et. al. (2012) observed that the MTCT of HIV rates for infants who had been mix-fed was significantly higher when compared to exclusively breastfed or formula fed infants, the age-specific MTCT of HIV rates for infants who were formula fed changed little over time when compared to infants who had been exclusively breastfed or mixed fed. Interestingly, Anigilaje et. al. (2015) observed that though replacement feeding was significantly protective of MTCT of HIV [AOR 0.382 (95% CI 0.175 – 0.832)] when compared to babies who were exclusively breastfed, cumulative transmission rates of MTCT of HIV at 3rd and 18th months were 0.2% and 4.3% respectively in the group who were formula-fed, concluding that though mothers were provided with clean water and infant formula, they still breastfed their infants effectively mix-feeding their infants. The replacement of breastmilk with infant formula eliminates breastfeeding associated HIV transmission, nonetheless studies have reported an increased morbidity and mortality in formula-fed infants'. This increased morbidity and mortality was seen in settings where replacement feeding was not acceptable, feasible, affordable, sustainable and safe (Horvath et. al., 2010). Prevalence of exclusive and prolonged breastfeeding could not be determined in this study; these are factors reported to increase the risk of MTCT of HIV.

The PCV level of the mother at presentation was not significantly associated with MTCT of HIV. This is in agreement with a prospective cohort study conducted in Muhima health centre where the hemoglobin level was not a predictor of MTCT of HIV [AOR 1.73 (95% CI, 0.65 – 4.62)] (Bucagu et. al., 2013) and a retrospective study conducted in Benue state, Nigeria where the mothers PCV level was seen to be insignificantly associated with MTCT of HIV (Anigiláje et. al., 2015). It is in contrast to a study conducted in 4 sites in 3 African countries assessing nutritional indicators associated with MTCT of HIV that found anaemia to be a predictor of MTCT of HIV (Saurabh Mehta et.

al., 2009) and another study by Naniche et. al., (2008) in southern Mozambique where it was observed that women with anaemia at the time of delivery were found to be 4 times more likely to transmit the virus to their infants when compared to women who were not anemic at delivery (P=0.018). The reason for the difference in findings is unclear.

5.1.3 Identify socioeconomic factors associated with HIV infection among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja

The place where the delivery of the baby was conducted had a significant association with MTCT of HIV, as babies delivered at home where 4.8 times more likely to become infected compared to those born in health facilities. A case-control study in Western Kenya made a similar observation as infants delivered at home were 2.42 (95% CI 1.01 – 5.80) times more likely to acquire the virus from their mothers (Onono et. al., 2015). This is also in agreement with an institution based retrospective follow up study conducted in Gondar University referral hospital PMTCT clinic where infants delivered at home were 2.82 (95% CI 1.2 – 6.64)] times more likely to acquire the virus from their mothers compared to those delivered in facilities (Koye and Zeleke, 2013). Home deliveries in rural settings are conducted by traditional birth attendants who are largely unskilled in infection prevention and control practices and may explain the possible association seen. Bucagu et. al. (2013) reported a dissimilar finding as he found home delivery not to be associated with MTCT of HIV [OR 2.21 (95% CI 0.33 – 14.88)]. A possible explanation could be the low number of home deliveries recorded in this study, as only 20 (2.9%) of the cohort delivered at home. Interviews with mothers of HIV-positive children revealed that health facilities not opening at night, mother-in-law (cultural) influence, belief in spiritual protection and perceived low risk to complications that may arise during delivery were factors that influenced the choice of place of delivery.

This study found marital status to be significantly associated with MTCT of HIV as children borne to married HIV-positive women had an 80% ($p<0.05$) reduction in the risk of acquiring HIV compared to children born to mothers who were not married at the index pregnancy, a finding in disagreement to that observed in a prospective cohort study

in Rwanda [OR 1.55 (95% CI 0.49 – 4.90)] (Bucagu et. al., 2013). Anigilaje et. al., (2015) in a retrospective study conducted in Makurdi, Benue state Nigeria did not observe any significant association between the marital status and MTCT of HIV (P=0.796). Sociocultural characteristics of the communities may have played a role in the dissimilar findings observed from these studies as studies have observed that in Nigeria, unmarried status carried a higher risk of undisclosed HIV status that as a mediator was associated with a higher risk of MTCT (National Population Commission, 2013).

This study found maternal age at delivery not to be a predictor of MTCT of HIV. This finding is similar to that observed by Sagay et. al., (2015) in a retrospective observational study of HIV-infected women in Jos, Nigeria in which no significant association between maternal age and MTCT of HIV was observed (P=0.23), Burusie and Deyessa (2015) made a similar observation in a case-control study conducted in Ethiopia in which no statistically significant association was found between maternal age and MTCT of HIV [OR 1.22 (95%CI 0.76 – 1.97)]. Bucagu et. al., (2013) from a prospective cohort study conducted at Muhima health centre in Kigali, Rwanda made a similar observation to that seen in this study in which no statistically significant association was seen between maternal age and MTCT of HIV [OR 1.43 (95% CI 0.53 – 3.89)]. A possible explanation may be that in this settings, maternal age does not confer independence as decisions including health related ones are usually taken by the man. A descriptive observational study in Zambia reported a dissimilar observation as women who were less than 30 years of age were 1.35 (95% CI 1.15 – 1.58) times more likely to transmit the virus to their infants, it is believed that the age of the mother in this setting influenced adherence to ARV regimen and might explain the association observed in the study (Torpey et. al., 2012).

The maternal employment status was not significantly associated with MTCT of HIV, a finding similar that to reported by a retrospective cohort study in Brazil (Lemos et. al., 2013). This finding may be consequent upon the observation that the woman's contribution to decision making is minimal irrespective of employment status in some settings.

Maternal literacy at index pregnancy was not significantly associated with MTCT of HIV, this finding is similar to those observed in studies conducted in program settings in Nigeria and South Africa (Bucagu et. al., 2013; Coovadia et. al., 2007; Sagay et. al., 2015). This finding may follow from the different communication methods employed in the dissemination of health related messages.

Maternal parity at index pregnancy was not significantly associated with MTCT of HIV, a finding similar to that obtained from reports of a retrospective study in Uganda (Ahoua et. al., 2010; Hoffman et. al., 2010). Bucagu et. al., (2013) in a prospective study conducted in Muhima health centre Rwanda, also observed that parity was not significantly associated with MTCT of HIV [OR 2.33 (95% CI 0.84 – 6.41)]. Maternal parity

The sex of the infant was not significantly associated with MTCT of HIV in this study, a finding similar to that observed by Koye and Zeleke (2013) in an institution based retrospective follow-up study conducted in Ethiopia where the sex of the infant was not significantly associated with MTCT of HIV [0.97 (95% CI 0.54 – 1.73)]. This was also observed by Sagay et. al., (2015) in a study conducted in Jos, Nigeria where the sex of the infant was not significantly associated with MTCT of HIV [0.98 (95%CI 0.19 – 4.89)]. Anoje et. al. (2012) reported a similar observation from a retrospective study conducted in South-south Nigeria where no significant association between the sex of the infant and the risk of MTCT of HIV [OR 1.36 (95% CI 95% CI 0.88 – 2.12)].

As we used secondary data from PMTCT clinics, it was difficult to control for inconsistencies and missing values. Maternal HIV-1 viral load and duration of disease, duration and means of rupture of membranes, instrumental delivery, postpartum maternal ART adherence, partner HIV status and household monthly income were not systematically recorded and could not be taken into account. The infant feeding option was incompletely defined; the DNA/PCR form (Appendix 13) recorded if children were ever or never breastfed only, the role mixed feeding played could not be analysed. This

study did not aim to differentiate when MTCT occurred i.e. pre-partum, intra-partum or post-partum period. The fact that all potential factors were not included and assessed may affect generalization of predictors in this study. Despite these limitations, to the best of our knowledge, this study presented primary results of PMTCT interventions in the Federal Capital Territory, Abuja.

5.2 Conclusion

In-depth interviews with HIV-positive mothers whose children tested positive to HIV were conducted using a semi-structured interview guide. The findings show that the execution of a PMTCT program in a Primary Health Care setting is practicable with a notable decrease in the prevalence of MTCT of HIV transmission. The findings tell of various hurdles to the application of PMTCT interventions such as exclusive breastfeeding that may affect the prevalence of MTCT of HIV among HIV-positive infants. Socio-environmental factors within which HIV-positive mothers try to use PMTCT interventions without success have been highlighted. Commonly reported factors that made exclusive breastfeeding impracticable were pressure from male partner, mother-in-law and other members of the extended family that was consequent upon non-disclosure of HIV serostatus. Health facilities not accessible at night due to non-availability of health staff was also reported as influencing the place of delivery, other factors that determined the choice of place of delivery were cultural practices, mother-in-law influence, and belief in the supernatural.

The prevalence of MTCT of HIV in the FCT-Abuja among those who participated in the PMTCT programme was 8.7%. MTCT of HIV was associated with a number of possibly modifiable risk factors, and thus findings of this study can be used to improve PMTCT service delivery in the FCT and similar settings. In 402 mother – infant pairs studied in the Federal Capital Territory, Abuja, the predictors of mother – to – child transmission of HIV included breastfeeding, home delivery and unmarried status. CD4+ count less than 350/mm^3 and non-use of ARV by mother or/and infant. The use of ARVs was shown to reduce vertical transmission of HIV in a program setting, nonetheless non-chemo-

prophylactic factors such as breastfeeding and home deliveries had a noteworthy effect on postnatal HIV transmission. Addressing the cultural barriers and social constraints to uptake of PMTCT interventions such as skilled delivery and exclusive breastfeeding should be a priority.

5.3 Recommendations

The recommendations made based on the findings of this study are as follows

1. Government should provide personnel to increase the uptake of PMTCT services especially skilled delivery by pregnant HIV-positive women

2. Government should conduct health-workers' sensitization to impress upon them the need to involve the male partners of HIV-positive women in counselling and testing, which would help address the issue of non-disclosure

3. The health authorities should increase the use of mobile testing services to provide more women the opportunity of learning their status and consequently placed on ARVs

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APPENDIX 1

Data collection Instrument (Proforma)

S/NO	QUESTION	Fill or check as appropriate
01	Facility Name	
02	Age of the respondent at last birthday (years)	
03	Marital status	Single Cohabiting Married Separated/Divorced Unknown
04	Religion	Islam Catholic Protestant Others (Specify) Unknown
05	Educational status	Literate Non-literate Unknown
06	Occupational status	Employed Unemployed Unknown
07	Number of children alive (if any)	
08	Sex of Infant	Male Female Unknown
09	Age of Infant at time of test (in weeks)	

Appendix 1

APPENDIX 1

S/NO	QUESTION	Fill or check as appropriate
01	Clinical stage of disease	Stage I Stage II Stage III Stage IV
02	Hb/PCV level at booking (if available)	
03	CD4+ count	
04	VDRL status	Negative Positive Unknown
05	Infant feeding choice	Ever breastfed Never breastfed
06	Did client use ART	Yes No Unknown
07	How many weeks did client use ART (in weeks)	
08	Regimen used?	
09	Did infant receive ART?	Yes No Unknown
10	ARV used?	
11	Where was delivery conducted?	
12	Mode of delivery	Vaginal delivery Caesarean section
13	Episiotomy/vaginal cuts?	Yes No Unknown

APPENDIX 2

My name is _____. I am working temporarily as a research assistant for a researcher, Dr. Uzoma Ogbonna. He is a Postgraduate student of the Department of Epidemiology and Medical Statistics of the University of Ibadan, Nigeria who is conducting a study among pregnant women.

The objectives of the study are to determine the prevalence of HIV infection, determine the association between socioeconomic factors and health facility factors and HIV infection among HIV-exposed infants of attendees of PMTCT clinics in FCT – Abuja and assess the knowledge, attitude and practices of HIV infected women attending PMTCT clinics in FCT – Abuja from January 2015 to April 2016

A number of people will be interviewed as a part of this study in selected health centers in FCT – Abuja, Nigeria. You as an attendee of the PMTCT clinic will be asked questions regarding the services offered to you and interventions used during this pregnancy.

Your signature on this form will confirm your consent for participation. You are free to withdraw from the interview at any time. Your answers to these questions cannot be traced to you because you will be assigned a unique number.

Insights from this study will be valuable in improving the interventions provided by the PMTCT program.

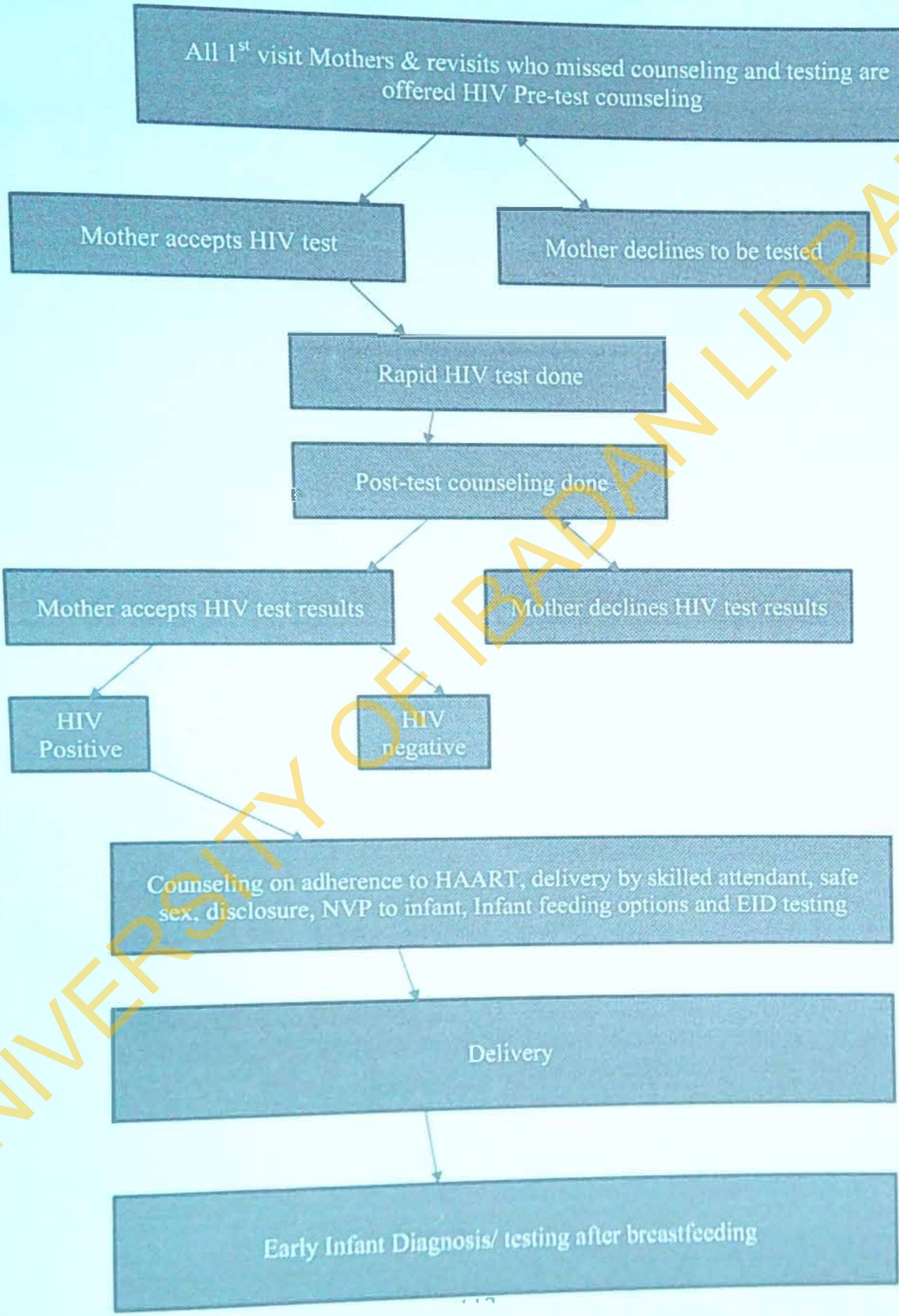
Apart from the time spent to answer questions, there is no risk involved in participating in this assessment.

Thanks for your time.

_____ _____

Signature Date

APPENDIX 3

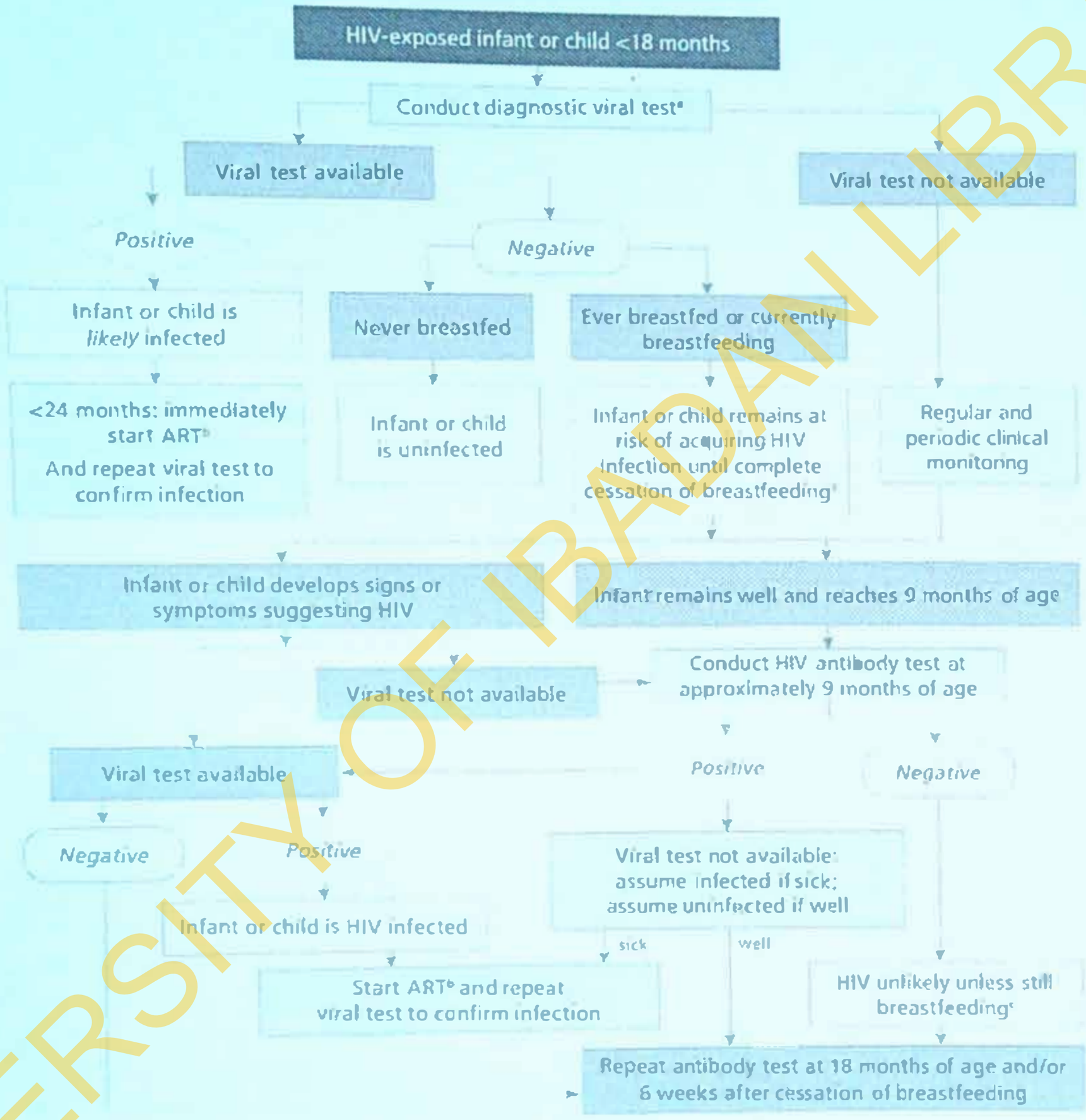


APPENDIX 4

Table 1: Three Options for PMTCT[1]

	Treatment (for CD4 count < 350 cells/mm3)	Prophylaxis (for CD4 count> 350 cells/mm3)	Infant receives
Option A	Triple ARVs starting as soon as diagnosed, *continued for life*	*Antepartum*: AZT starting as early as 14 weeks gestation *Intrapartum*: at onset of labour, single-dose NVP and first dose of AZT/3TC *Postpartum*: daily AZT/3TC through 7 days postpartum	Daily NVP from birth until 1 week after cessation of all breastfeeding, or, if not breastfeeding or if mother is on treatment, through age 4–6 weeks
Option B	Triple ARVs starting as soon as diagnosed, *continued for life*	Triple ARVs starting as early as 14 weeks gestation and *continued intrapartum and through childbirth if not breastfeeding or until 1 week after cessation of all breastfeeding*	Daily NVP or AZT from birth through age 4–6 weeks regardless of infant feeding method
Option B+	Triple ARVs starting as soon as diagnosed, *continued for life*	Triple ARVs starting as soon as diagnosed, *continued for life*	Daily NVP or AZT from birth through age 4–6 weeks regardless of infant feeding method

APPENDIX 5



[a] For newborns, test first at or around birth or at the first postnatal visit (usually 4–6 weeks). See also Table 5.1 on infant diagnosis.
[b] Start ART, if indicated, without delay. At the same time, retest to confirm infection.
[c] The risk of HIV transmission remains as long as breastfeeding continues.

APPENDIX 6

HTC 002

HIV COUNSELLING AND TESTING: CLIENT INTAKE FORM

State: ____________ **LGA:** ____________ **Facility name** ____________

Referred from : ____________ (Self, TB, STI, FP, OPD, others)

Setting : ____________ (CT, TB, STI, FP, OPD, Mobile C (Alternative FBCT setting))

Client's Name ____________ Age ______ Date of visit ______

Client's Code ____________ Sex ______ First time visit [No] [Yes]

State of Residence ____________ LGA of Residence ____________

Marital status ____________ No. of own children <5 years [ ] (if married) No. of wives/co-wives [ ]

Type of Counseling: [Individual] [Couple]

Pretest Counseling

MARK with "X" where it applies. [0] = No, [1] = Yes

Knowledge Assessment		**HIV Risk Assessment**	
Previously tested HIV negative	[0] [1]	Ever had sexual intercourse	[0] [1]
Client pregnant (if yes, refer to PMTCT)	[0] [1]	Blood transfusion in last 3 months	[0] [1]
Client informed about HIV transmission routes	[0] [1]	Unprotected sex with casual partner in last 3 months	[0] [1]
Client informed about risk factors for HIV transmission	[0] [1]	Unprotected sex with regular partner in the last 3 months	[0] [1]
Client informed on preventing HIV transmission methods	[0] [1]	STI in last 3 months	[0] [1]
Client informed about possible test results	[0] [1]	More than 1 sex partner during last 3 months	[0] [1]
Informed consent for HIV testing given	[0] [1]	([illegible]) **Risk score**	

Clinical TB screening		**Syndromic STI Screening**	
Coughing for > 2 weeks	[0] [1]	*Female* Complaints of vaginal discharge or burning when urinating?	[0] [1]
Weight loss of > 3 kg in last 4 weeks	[0] [1]	*Female* Complaints of lower abdominal pains with or without vaginal discharge?	[0] [1]
Lymphadenopathy (swelling of the lymph nodes)	[0] [1]	*Male* Complaints of urethral discharge or burning when urinating?	[0] [1]
Fever for > 2 weeks	[0] [1]	*Male* Complaints of scrotal swelling and pain	[0] [1]
Night sweats for > 2 weeks	[0] [1]	Complaints of genital sore(s) or swollen inguinal lymph nodes with or without pains?	[0] [1]
([illegible]) **TB screening score** [illegible]		([illegible]) **STI screening score** [illegible]	

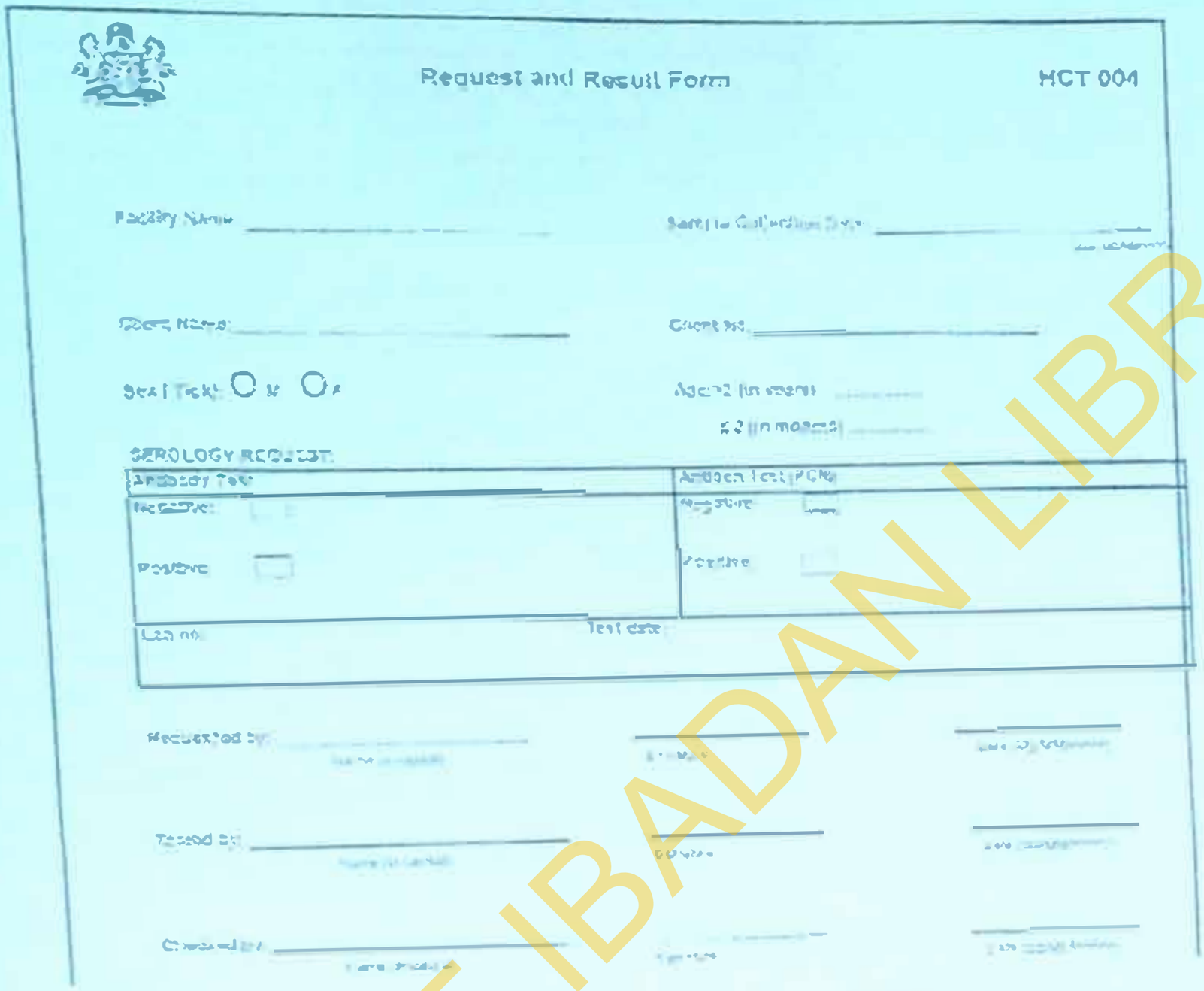
Post Test Counseling

HIV test result	negative [ ] positive [ ]	Counseling done	[0] [1]
		Risk reduction plan developed	[0] [1]
HIV Request and Result form signed by tester	[0] [1]	Post test disclosure plan developed	[0] [1]
HIV Request and Result form filled with CT Intake Form	[0] [1]	Will bring partner(s) for HIV testing	[0] [1]
Client received HIV test result	[0] [1]	Will bring own children <5 years for HIV testing	[0] [1]
If client tests HIV negative, and HIV Risk Assessment Score >0 or there is evidence for a STI syndrome, recommend re-testing after 3 months		Provided with information on FP and dual contraception	[0] [1]
		Client/Partner use FP methods (other than condom)	[0] [1]
		Client/Partner use condoms as (one) FP method	[0] [1]
		Correct condom use demonstrated	[0] [1]
Client referred to other services If [1] Specify ______	[0] [1]	Condoms provided to client	[0] [1]

Comments

Completed by ____________ Designation ____________ Sign ____________ Date ________

APPENDIX 7



Request and Result Form HCT 004

Facility Name _____ Date of Collection _____

Client Name _____ Client No _____

Serial Test: O or O Age of the client _____

Sex _____

SEROLOGY REQUEST

Serology Test	Antigen Test (PCR)
Reactive	Reactive
Positive	Positive
Lab no	Test date

Requested by: _____ _____ _____

Name (in block) Signature Date of Collection

Tested by: _____ _____ _____

Name (in block) Signature Date tested/received

Checked by: _____ _____ _____

Name (in block) Signature Date checked/verified

APPENDIX 8

Adult Initial Clinical Evaluation

1. Visit Date ____ / ____ / 20____ 2. Date HIV Confirmed ____ / ____ / 20____

3. Patient Surname ____________ 4. Other names ____________ (including Any/Alias)

5. Unique ID [State] [Facility No] [Serial enrollment No] Hospital(Unit) No ____________

7. Sex Male [ ] Female [ ] 8. LGA ____________ 9. Facility Name ____________

10. ANC No ____________ 11. Date of Birth (DD/MM/YYYY) ____ / ____ / 20____ Age ____ yrs

13. Marital status
- Single
- Married
- Widowed
- Separated
- Divorced

14. Educational level
- None
- Primary
- Senior Secondary
- Quranic
- Junior Secondary
- Post Secondary

15. Jobs/Occupation status
- Unemployed
- Employed
- Student
- Retired

16. Where does the patient live? ____________ (Describe) ____________

Address ____________

Ward/Village ____________

Town name ____________

Local Government Area (LGA) ____________

State ____________

Phone number ____________

17. Contact person/next of kin ____________

Address ____________

Ward/Village ____________

Town name ____________

State ____________

Relationship ____________

Phone number ____________

18. Presenting complaint ____________

Medical History

19. Symptom review: Duration

- Fever
- Cough
- Itching
- Genital discharge

20. Additional comments ____________

21. Past medical history ____________

22. Relevant Family history ____________ 23. Hospitalization ____________

24. Drug allergies ____________

25. Risk factors
- Unprotected sex
- Blood transfusion
- Occupation Hazard
- Long distance driver
- Commercial sex worker
- Harmful traditional practices
- IDU

26a. Last menstrual period ____________

26b. Currently pregnant ○ Y ○ N ○ Uncertain

26c. Gestational age ____________ wks

26d. Expected date of delivery ____ / ____ / ____

27. Latest CD4 (if available) [ ] cells/ml Date ____ / ____ / ____

28. Lowest CD4 (if available) [ ] counts/ml ○ lab records seen Date ____ / ____ / ____

29. Latest VL (if available) [ ] c/ml ○ lab records seen Date ____ / ____ / ____

APPENDIX 8

Patient Surname ______________________ Other names ______________________

Unique ID [| |] [| | | | |] [| | | |] Hospital/Unit No ______________________

30. Previous ARV exposure Yes [ ] No [ ]
(Care-giver should probe) If Yes,
30a. Name of Facility: ______________________
30b. Duration of Care: ___/___/___ ___/___/___
- ○ Transfer in with records
- ○ Earlier ARV but not a transfer in
- ○ PMTCT only
- ○ [illegible] received ARVs

31. Current medications
(Care-giver should probe and specify)
- ○ None
- ○ ART
- ○ CTX
- ○ Anti TB drugs
- ○ Other (specify)

32. Service entry into program:
- ○ STI ○ TB ● Sex workers outreach
- ○ OPD ○ Wards ○ Current clinic patient
- ○ HCT ○ Casualty ○ Self referral
- ○ CBO ○ ANC/PMTCT ○ [illegible] transfer in
- ○ Private ○ IDU

33. Adherence (Complete if patient has ever received ARV before coming to this facility)

a. Participating in an adherence program ○ Y ○ N
Missed ARV in the last 3 days ○ Y ○ N
[ ] Enter code for why patient missed medication

b. Treatment was interrupted ○ Y ○ N
Date ___/___/___ Number of days [ ]
[ ] Enter code for why patient interrupted medication

c. Treatment was stopped ○ Y ○ N
Date ___/___/___ Number of days [ ]
[ ] Enter code for why patient medication was stopped

Reason codes	
1 [illegible]	9 Toxicity
2 [illegible]	10 Drug interaction
3 [illegible]	11 [illegible]
4 [illegible]	12 Drugs not available
5 [illegible]	13 [illegible]
6 [illegible]	14 [illegible]
7 [illegible]	15 [illegible]
8 Patient moved	16 Other (specify)

34. Patient has disclosed status to:
- ○ No one ○ Friend
- ○ Family member ○ Spouse
- ○ Spiritual leader ○ Other ______________________

35. HIV status can be discussed with ______________________
(record related person, if any)

36. Is patient a member of a support group? ○ Y ○ N

37. Past or current ARV side effects ○ None
- ○ [illegible] nausea/vomit
- ● Headache
- ○ Diarrhea
- ○ Pain, abdomen or muscle
- ○ [illegible]
- ○ Confusion
- ○ Tingling of extremities
- ○ Rash
- ○ Jaundice
- ○ [illegible] syndrome
- ○ [illegible]
- ○ Anemia
- ○ Weakness fatigue
- ○ Pancreatitis
- ○ Fat accumulation or loss
- ○ Hyperglycemia
- ○ Kidney problems
- ○ Liver problems
- ○ Other (specify) ______________________

38. Physical exam (note: NSF = no significant findings)

Temp ___ °C | BP ___/___ mmHg | Pulse ___ | Wt ___ kgs | Ht ___

General appearance ○ NSF
- ○ Pallor
- ○ Febrile
- ○ Depressed
- ○ Jaundice
- ○ [illegible]
- ○ Other (specify) ______

Skin ○ NSF
- ○ [illegible] dermatitis
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ Other (specify) ______

Head/Eye/ENT ○ NSF
- ○ [illegible]
- ○ Thrush
- ○ Oral KS ______
- ○ Abnormal fundoscopy
- ○ Other (specify) ______

Breasts ○ NSF
- ○ Lumps masses
- ○ Discharge
- ○ Other (specify) ______

Cardiovascular ○ NSF
- ○ Abnormal heart rate
- ○ Auscultation finding
- ○ Other (specify) ______

Genitalia ○ NSF
- ○ Genital discharge
- ○ Genital ulcer/lesion
- ○ [illegible]
- ○ Other (specify) ______

Respiratory ○ NSF
rate ______ breaths/min
- ○ Labored breathing
- ○ Cyanosis
- ○ Wheezing
- ○ [illegible] percussion
- ○ Auscultation findings
- ○ Other (specify) ______

Gastrointestinal ○ NSF
- ○ [illegible]
- ○ Hepatomegaly
- ○ Splenomegaly
- ○ Tenderness
- ○ Other (specify) ______

Neurological ○ NSF
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ [illegible]
- ○ [illegible] of extremities
- ○ Other (specify) ______

Mental status ○ NSF
- ○ [illegible]
- ○ [illegible]
- ○ Mood [illegible]
- ○ [illegible]
- ○ Anxiety
- ○ Suicidal ideation
- ○ Other (specify) ______

Additional and detailed findings:

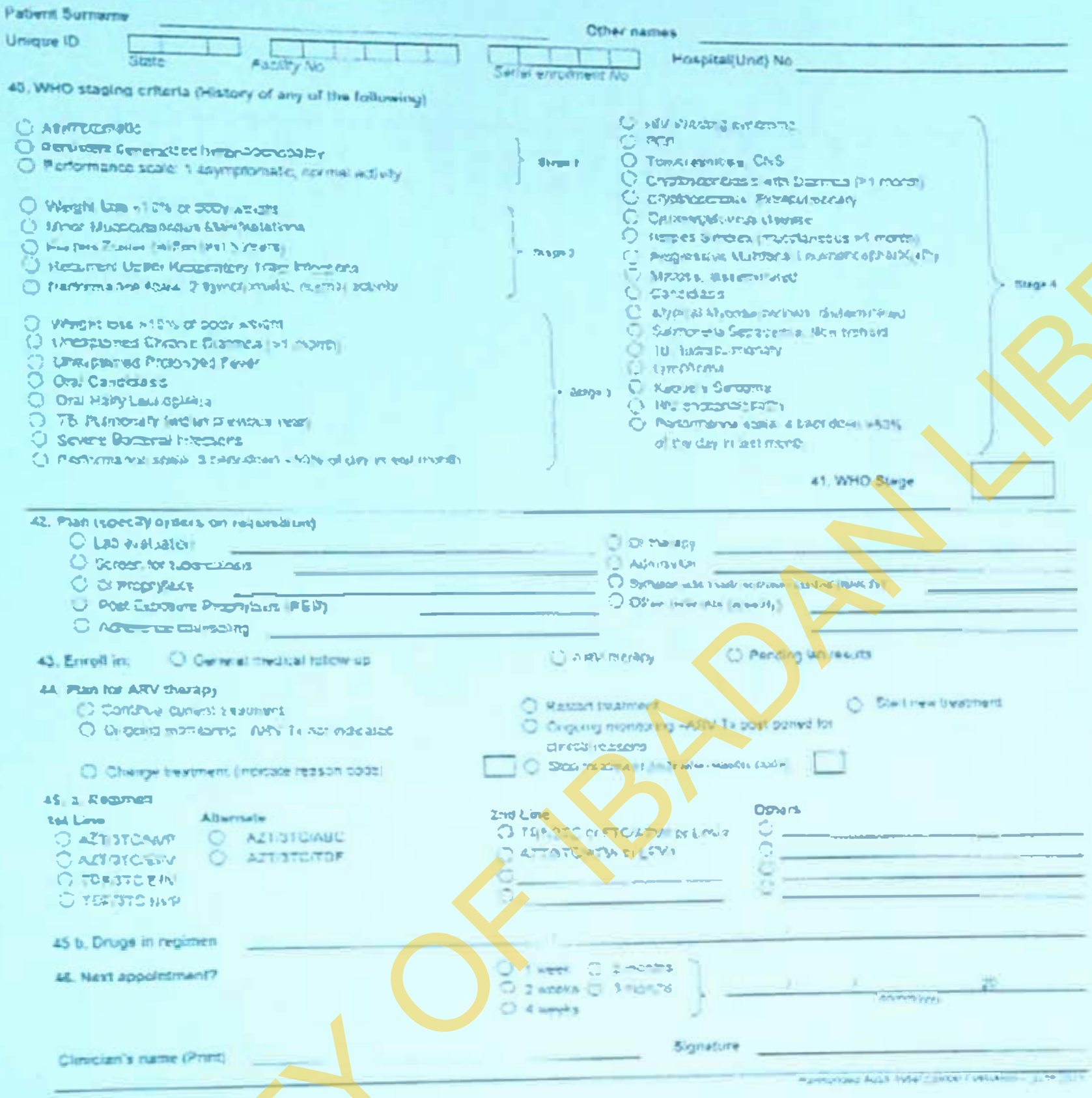
39. Assessment ○ Asymptomatic ○ Symptomatic ○ AIDS defining illness/opportunistic infection

____

____

____

APPENDIX 8



APPENDIX 9

Care/ART CARD Number ____ FACILITY NAME ____ 1. Hospital number ____

INITIAL VISIT

2. Unique ID ☐☐☐☐☐☐☐☐☐☐ 3. Date enrolled in HIV care ____

4. Surname ____ Other Names ____ 5. Address ____

5b. Telephone nos (whose) ____

6. Sex: M ☐ F ☐ 7. Age ____(Yrs/Months) 8. DOB ____ 9. Care Entry Point ☐ ____

10. Date of Confirmed HIV test ____ 11. Mode of HIV Test: (HIV-Ab) (PCR) 12. Where ____
(circle as appropriate)

13. Prior ART ____

ART COMMENCEMENT

14. Date Medically eligible ____ 15. Why Eligible: Clinically only [ ] CD4 [ ] CD4% [ ] TLC [ ] 16. Date Initial Adherence Counselling Completed ____

17. Date Transferred in ____ 18. Facility transferred From ____ 19. First ART Regimen ____

20. Date ART started ____ 21. Clinical Stage at start of ART ____

Status at Start of ART 22. Weight ____(kg) 23. Height (if child) ____ (cm) 24. Functional ☐ 25. CD4 at start of ART ____

SUBSTITUTIONS/SWITCHES

Substitute within 1st line

26. Date of New Regimen ____ 27. Why ☐☐ 28. New Regimen ____

29. Date of New Regimen ____ 30. Why ☐☐ 31. New Regimen ____

Switch to 2nd Line (or Substitute within 2nd line)

32. Date New Regimen ____ 33. Why ☐☐ 34. New Regimen ____

35. Date New Regimen ____ 36. Why ☐☐ 37. New Regimen ____

DISCONTINUATIONS & INTERRUPTIONS

38. ART Interruptions

Stopped (S) Lost (L) (circle as appropriate)		Date	Why	Date of restart if placed back on medication
S	L			
S	L			
S	L			
S	L			
S	L			
S	L			

39. Patient transferred out (ART) (PRE-ART) Date ____ 40. Facility referred To ____

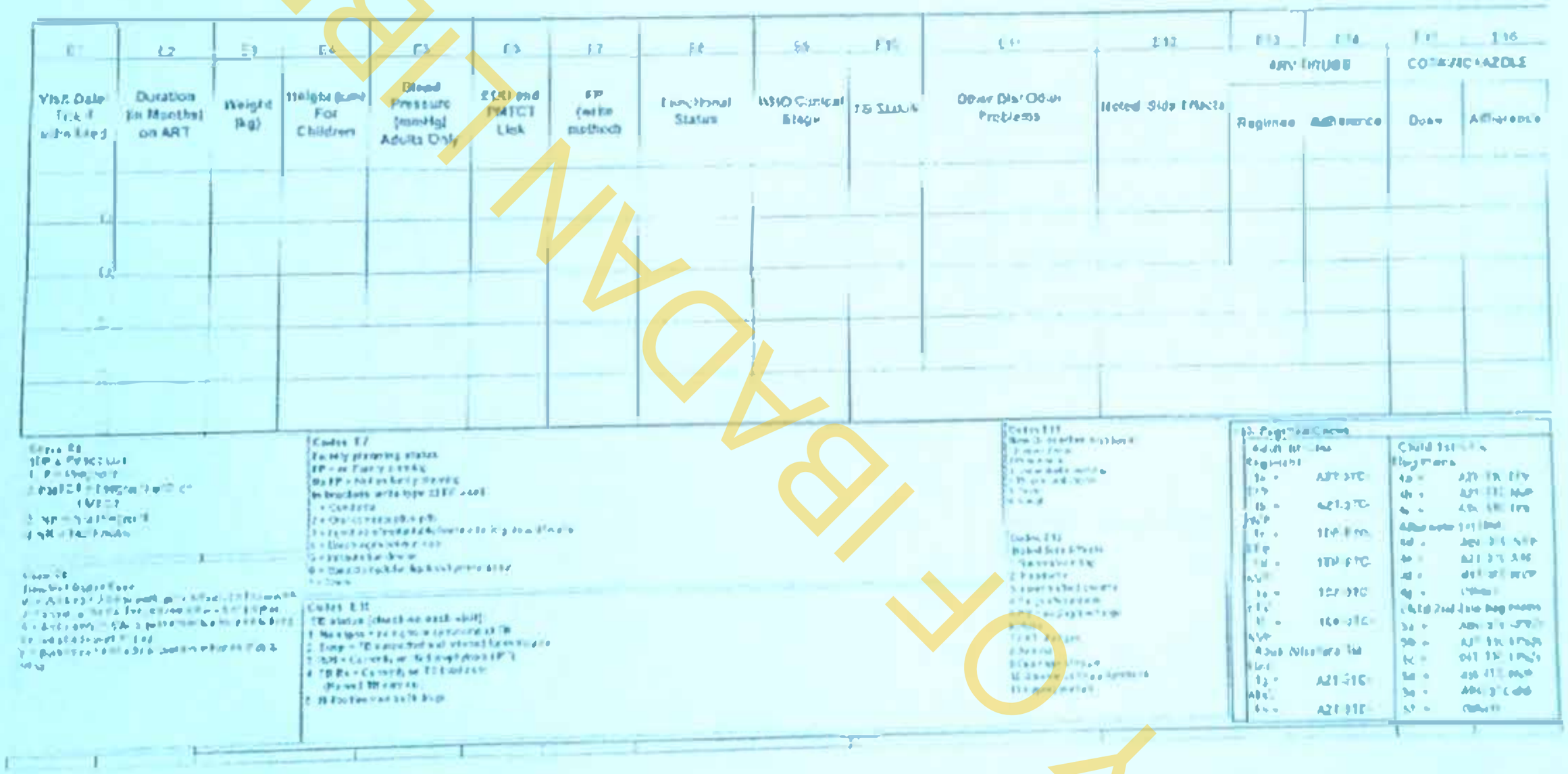
41. Patient has died (ART) (PRE-ART) date ____ 42. Source of death information ____

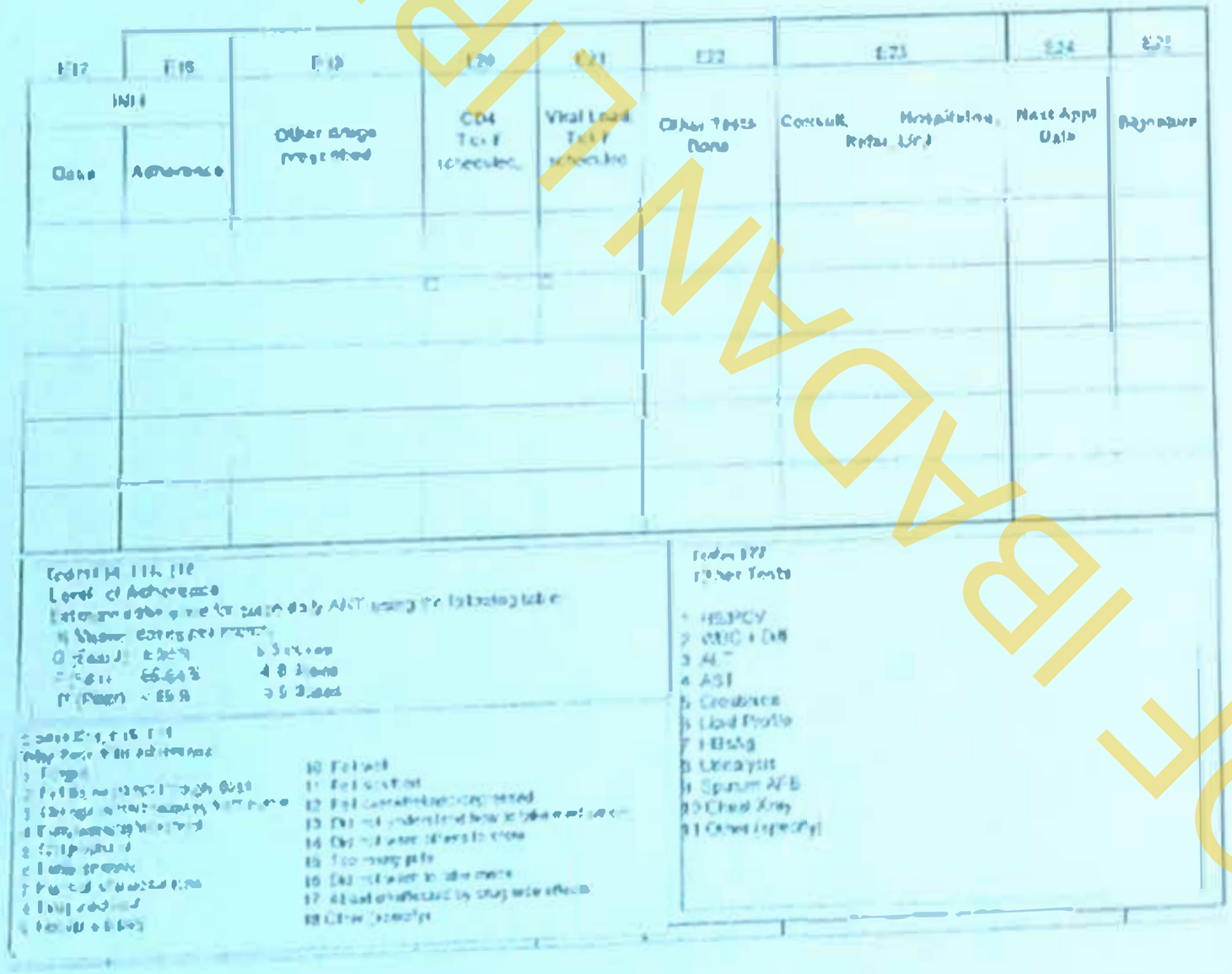
43. Cause of Death ____ HIV related Yes [ ] No [ ] Don't know [ ]

44. Drug Allergies

Harmonized July 2011

APPENDIX 9





APPENDIX 10

CLIENT REFERRAL FORM

HCT 005

- Referring Organizations: please fill out Part A and ask client to take it to the receiving organization.
- Please fill out one form per service needed
- Receiving organizations: please fill out Part B and either return it directly to the referring organization or ask the client to return it to the referring organization at next visit.

Part A: Referral Slip: To be filled out by the organization making the referral (referring organization)

Date	Client name Client Address Client phone number	Age Sex
Referred from (unit/department)		
Name of person referring client/designation		
Name, Address & Phone number of referring organization		
Referred to (unit/department)		
Name of contact person		
Name, Address & Phone number of the receiving organization		
Services needed/Notes		Signature

CLIENT REFERRAL FORM

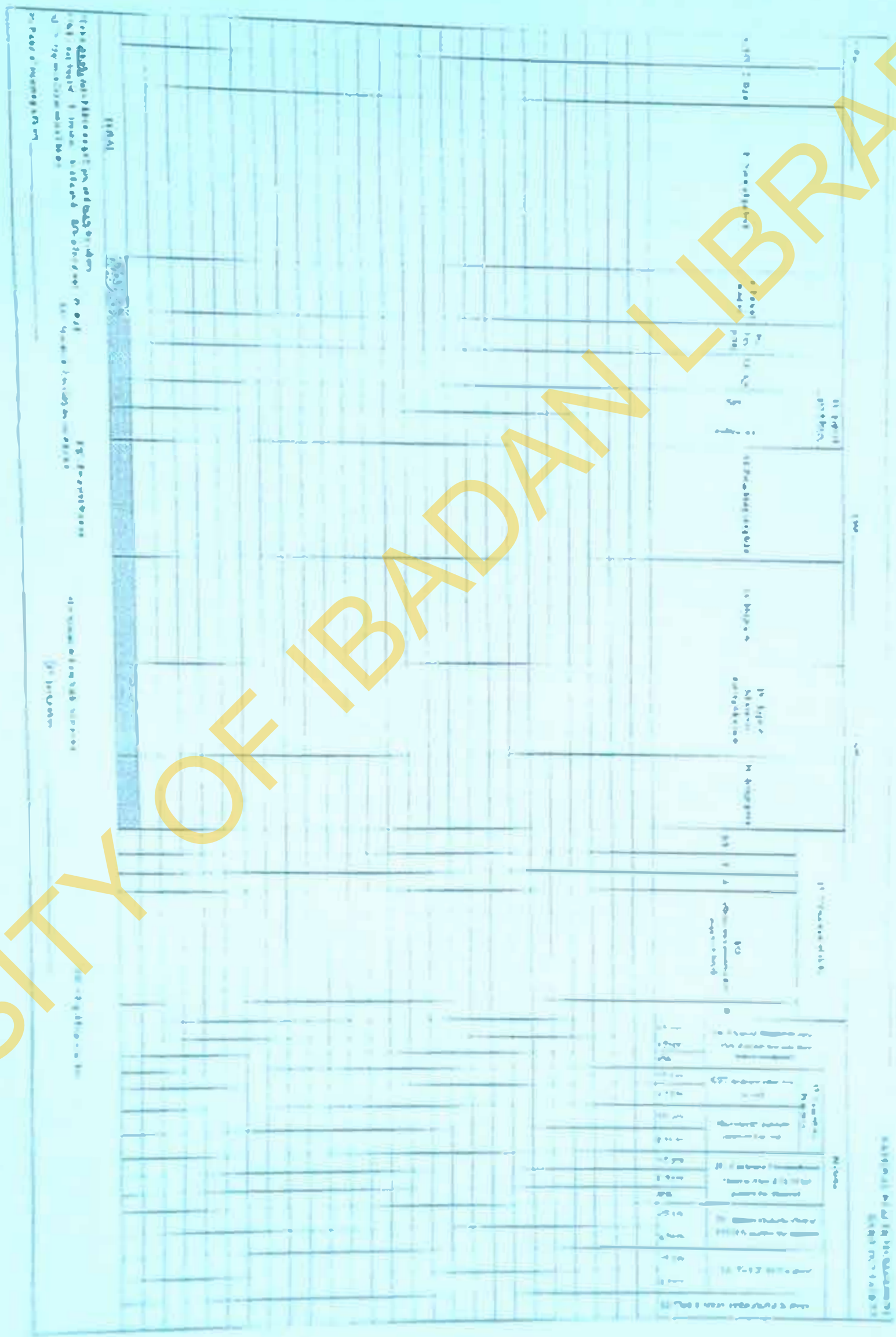
Part B: Services provided: To be filled out by the organization providing the service(s)

Name & address of organization providing the service(s):			
Date	Client name	Age Sex	
List services provided here	Service category/code as numbered [illegible]	Result / follow-up needed	Follow up date
Additional comments			
Signature of Service provider			

Categories of services 1. Adherence counseling and treatment support 2. Antiretroviral therapy 3. Child care 4. Clinical care	5. Education/ schooling 6. Family planning 7. Financial, material and microfinance support and services 8. Food support	9. HIV counseling and testing 10. Home-based care 11. Legal support 12. Nutrition counseling 13. [illegible]	14. PMTCT services 15. Pharmacy 16. [illegible] support 17. [illegible] services 18. Prevention services (including peer counseling and [illegible])	19. Psychosocial support 20. Social services 21. Spiritual support 22. STI services 23. TB services 24. [illegible]

APPENDIX 11

APPENDIX 11



APPENDIX 11

APPENDIX 12

Laboratory Order and Results Form

Patient's ART status: Non-ART ( ) ART ( ) Collection Date ____/____/____ (DD/MM/YYYY)

STATE ____________ LGA ____________

Facility Name [ ] Baseline ( ) Repeat ( )

Patient Name [ ] (Surname) [ ] (Other Names)

Sex: MALE ( ) FEMALE ( ) Age: [ ]

ID [ ] - [ ] [ ] Hospital (Clinic) No. ____________

Lab Registration No. ____________

[illegible]

ORDERS	RESULTS
( ) CD4	[ ] cells/µl
( ) CD4%	[ ] %
( ) WBC	[ ] x 10⁹/L
( ) Lymphocytes	[ ] mm³ [ ] %
( ) Monocytes	[ ] mm³ [ ] %
( ) Polymorphs	[ ] mm³ [ ] %
( ) Eosinophils	[ ] mm³ [ ] %
( ) Basophils	[ ] mm³ [ ] %
( ) Hb/PCV	[ ] % [ ] g/dl
( ) Platelets	[ ] x 10⁹/L

( ) HBsAg (Hepatitis B surface antigen) Negative ( ) Positive ( )

( ) VDRL Negative ( ) Positive ( )

[illegible]

( ) Creatinine [ ] µmol/l

( ) ALT/SGPT [ ] IU/l

( ) Urinalysis GLUCOSE [ ] PROTEIN [ ]

( ) Cytology: VIA/Pap Smear

ORDERS	RESULTS
( ) Viral Load	[ ] copies/ml
( ) Na+	[ ] mmol/L
( ) K+	[ ] mmol/L
( ) Cl-	[ ] mmol/L
( ) HCO3	[ ] mmol/L
( ) BUN	[ ] mmol/L
( ) Fasting Glucose	[ ] mmol/L
( ) Total Bilirubin	[ ] µmol/L
( ) Amylase	[ ] U/L
( ) Total Cholesterol	[ ] mmol/L
( ) LDL	[ ] mmol/L
( ) HDL	[ ] mmol/L
( ) AST/SGOT	[ ] U/L
( ) Triglyceride	[ ] mmol/L
( ) Alk. Phosphatase	[ ] U/L
( ) Pregnancy	negative ( ) positive ( )
( ) Malaria smear	negative ( ) positive ( )

Additional tests [illegible]

Specify exact clinical indication for requested test(s):

____

____

____

____

APPENDIX 13

APPENDIX 13

APPENDIX 14

Infant HIV PCR (DBS) Laboratory Request/ Report

Sample sent from: (insert name/location of facility) ______________________

Result to be sent to: (insert name/location of facility) ______________________

INSTRUCTIONS: [illegible] accompany each DBS [illegible]

Section 1: Patient Information

Hospital Number: ______________________

First Name ☐☐☐

Surname ☐☐☐☐

Date of Birth (DD/MM/YY) ☐☐☐

Age (Months) ____ **Gender:** Male ☐ Female ☐

If child is ≥ 9 months old, do rapid test and complete rapid test information below

Section 3: Lab Use Only

Sample Reference Number

Date Specimen received by Lab (DD/MM/YY) ☐☐☐

Was sample testable? Yes ☐ No ☐

If no, reason test was not performed

- Technical problems ☐
- Labeled improperly ☐
- Insufficient blood ☐
- Layered or clotted ☐
- Improper packaging ☐

Date assay performed: ___/___/___

Test Result: Positive ☐ Negative ☐ Indeterminate ☐

Date Result sent back: ___/___/___

Section 2: CLINICAL INFORMATION *(COMPLETE IN CLINIC BEFORE SENDING SPECIMEN TO LAB)*

Date Specimen Drawn DD/MM/YY
___/___/___

Reason for PCR (tick one)
- ☐ 1st test for healthy exposed baby
- ☐ 1st test for sick baby
- ☐ Repeat test after cessation of breastfeeding (test at least six weeks after last breast milk)
- ☐ Repeat because of problem with first test

For infants 9 months or older:
Rapid test done?
☐ No ☐ Yes

If yes, date done: ___/___/___

Result of rapid test:
☐ Positive ☐ Negative
☐ Indeterminate

ART administered to Mother during pregnancy:
(tick all received, nothing, or unknown)
- ☐ Nothing
- ☐ HAART started during pregnancy
- ☐ HAART started before pregnancy
- ☐ AZT + 3TC at 34-36 weeks
- ☐ AZT less than 4 weeks
- ☐ AZT more than 4 weeks
- ☐ NVP
- ☐ Unknown

Baby received: (tick all received, nothing, or unknown)
- ☐ Nothing
- ☐ AZT for 6 weeks
- ☐ NVP
- ☐ Unknown

Was baby ever breastfed?
☐ No ☐ Yes ☐ Unknown

Is baby breastfeeding now?
☐ No ☐ Yes ☐ Unknown

Age (in months) breastfeeding stopped

Cotrimoxazole given to baby?
- ☐ No
- ☐ Yes, taking CTX daily
- ☐ Starting CTX today

_____________________ ________
Clinician- Name/Sign *Date*

_____________________ ________
Lab Scientist- Name/Sign *Date*

FEDERAL CAPITAL TERRITORY

Health Research Ethics Committee

Research Unit, Room 10, Block A Annex, HHSS, FCTA Secretariat,
No. 1 Kapital Street Area 11, Garki, Abuja - Nigeria

Name of Principal Investigator:	Dr. Ogbonna Uzoma Uzochukwu
Address of Principal Investigator:	Nigeria Field Epidemiology & Laboratory, No. 50 Haile Sellasie Street, Asokoro District, Abuja
Date of receipt of valid application:	25/11/2015

Notice of Research Approval

Protocol Approval Number: FHREC/2016/01/28/25-04-16

Study Title: **Prevalence of HIV and Risk Factors Associated with Perinatal HIV Infection among Infants of Attendees of PMTCT Clinics in Kwali, FCT – Abuja.**

This is to certify that the FCT Health Research Ethics Committee (FCT HREC) has approved the research described in the above stated protocol

Effective Date: - 25/04/2016
Expiration Date: - 24/04/2017

Note that no activity related to this research may be conducted outside of these dates. Only the FCT HREC approved informed consent forms may be used when written informed consent is required. They must carry FCT HREC assigned protocol approval number and duration of approval of the study.

The National Code of Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, and with the tenets of the code. The FCT HREC reserves the right to conduct compliance visit to your research site without prior notification.

Modifications: Subsequent changes are not permitted in this research without prior approval by the FCT HREC.

Problems: All adverse events or unexpected side effects arising from this project must be reported promptly to FCT HREC.

Renewal: This approval is valid until the expiration date. If you are continuing your project beyond the expiration date, endeavor to submit your annual report to FCT HREC early, and request for renewal of your approval to avoid disruption of your project.

Closure of Study: At the end of the project, a copy of the final report of the research should be forwarded to FCT HREC for record purposes, and to enable us close the project.

Desmond Emeronye Okafor
For: Secretary, FCT HREC
April 25, 2016