DETERMINANTS OF MOTHER TO CHILD TRANSMISSION OF HIV AMONG EXPOSED INFANTS IN KERICHO COUNTY REFERRAL HOSPITAL, KENYA

BY

JANE MUMBI MULI

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MASENO UNIVERSITY

DECLARATION

I declare that this research thesis is my original work and has not been submitted for a degree award in any other university or learning.

Jane Mumbi Muli

PG/MPH/00001/013

Sign…… Date …….

This research thesis has been submitted for examination with our approval as the candidate's Supervisors.

Dr. Louisa N. Ndunyu (PhD)

Department of Public Health

Maseno University

Sign…… Date …….

Dr. Dickens Samuel Omondi Aduda (PhD)

School of Health Sciences / Directorate of Research Innovation and Partnerships

Jaramogi Oginga Odinga University of Science and Technology

Sign…… Date …….

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DEDICATION

To my parents, Rose and John, you two worked tirelessly and sacrificed your meagre resources to ensure that I attain education. May the almighty God bless you.

ABSTRACT

In Kenya, the rise in mother to child transmission (MTCT) of HIV from 8.3% in 2016 to 11.5% in 2018, compared to the global target of <5%, particularly, among medium and low HIV burden counties, including Kericho is a worrying public health concern. Kericho County recorded an increase in MTCT of HIV from 8.1% in 2014 to 14.5% in 2018, the reason for this increase is not fully understood.Determinants of MTCT of HIV are multi-factorial, with complex pathways which have not been fully explored.In this study determinants of MTCT of HIV among exposed infants at the Kericho County referral hospital were assessed. Specifically, to assess maternal sociodemographic and infant related determinants; maternal clinical determinants and predictors of MTCT among HIV exposed infants. Using a cross-sectional study design, 102out of 129 HIV positive postnatal mother-child pairs in the hospital were selected by simple random sampling, consented and surveyed using interviewer administered questionnaires and clinical information abstracted from patient records. Data was analyzed using Chi square tests followed by binary logistic regression to show associations of maternal sociodemographic determinants; infant related characteristics and maternal clinical determinants with infant's HIV status. The mean age of mothers was 28.5 years (SD=6.2). HIV prevalence among infants enrolled was 13.7% with median age at infants' HIV diagnosis being 8 weeks (IQR 4–12). Of all infants, 97% were initiated on prophylaxis immediately after birth and 92.2% exclusively breast fed. Findings revealed risk of MTCT significantly increase for infants whose mothers had low monthly income (p= 0.025), CD4 count above 500 cells/ml (p= <0.042), viral load >50 copies/ml (p= <0.001), infants that had delayed age (>6 weeks) at HIV diagnosis (p= <0.001), late initiation of infant prophylaxis (p= <0.001), early mixed feeding in the first 3 days after birth (p= <0.001) and mixed infant feeding within the first 6 months (p= 0.007). Early mixed feeding increased odds of HIV transmission by 7 -fold (OR= 7.12, p= 0.019) and delay in infants age at HIV diagnosis significantly increased MTCT risk (OR= 0.04, p= 0.005).Presence of stigma (OR= 0.073, p= 0.003) increased the likelihood of MTCT while high perceived self-efficacy (OR= 8.15, p= 0.008) was protective. These findings indicate need to improve mother's income levels and implement PMTCT interventions addressing delays in infant testing and initiation of prophylaxis, avoidance of mixed infant feeding, strengthening maternal viral load and CD4 monitoring, stigma reduction and building self-efficacy.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANC	Antenatal care
ART	Antiretroviral therapy
ARV	Antiretroviral
AZT	Zidovudine
EBF	Exclusive Breast feeding
eMTCT	elimination of mother to child transmission
ERF	Exclusive Replacement feeding
HCWs	Health care workers
HEI	HIV Exposed Infant
HIV	Human Immunodeficiency Virus
HVL	High viral load
KARPR	Kenya AIDs Response Progress Report
KCRH	Kericho County Referral Hospital
LDL	Low detectable levels
LLV	Low level viremia
LTFU	Loss to Follow Up
MBPs	Mother-baby pairs
MCH	Maternal and child health
MTCT	Mother to Child Transmission
NASCOP	National Aids and STDs Control Program
NVP	Nevirapine
PLWH	People Living With HIV
PMTCT	Prevention of mother-to-child transmission of HIV
SDG	Sustainable Development Goals
UHC	Universal Health Care
UNAIDS	JOINT United Nations Program on HIV/AIDS
VL	Viral load
WHO	World Health Organization
PCR	Polymerase Chain Reaction
DNA	Deoxyribonucleic acid

OPERATIONAL DEFINITION OF TERMS

An infant -A child less than18 months of age

HIV exposed infant-A child aged below 18 months old born to HIV positive mother whose HIV status has not yet been determined using PCR DNA test.

PCR Test- It is a laboratory test to detect genetic material, such as HIV virus.

Antiretroviral Therapy-Treatment for HIV infection using three or more ARV drugs

Determinant-Isa factor that influences the transmission of HIV from mother to her infant

First contact-It refers to the initial facility visit of a HIV exposed infant for a blood draw to determine HIV status.

HIV-This refers to the human Immunodeficiency virus

HIV infected infant-It refers a child whoislessthan18monthsofage, whose HIV diagnoses has been determined with DNA/Polymerase Chain Reaction (PCR) method to be HIV positive.

HIV infected mother-It refers to a mother who has been diagnosed HIV positive

ARV prophylaxis-Short term use of ARV drugs in infant to reduce MTCT

Intervening variable-It's a measurable characteristic that shows the relationship between the independent and dependent variable.

Low HIV burden Counties-These are 12 counties that contribute to 25% HIV burden

Mature Minor-Refers to study participants aged above fifteen years who are married, mothers with children or family head

Medium HIV burden Counties-These are 9 counties that account for 19% HIV burden

Mother to child transmission-Passing of the HIV virus from the mother to the infant during pregnancy, delivery or breastfeeding. Sometimes referred to as vertical transmission.

MTCT prevalence-It refers to the percentage of children living with HIV as a result of vertical transmission

Prenatal-Refers to period before giving birth

Postnatal period-Refers to time beginning immediately after delivery or childbirth up to 12 months.

Prevalence-This refers to the number of persons with the health outcome, in this case HIV, in a given population

Safe infant feeding-Refers to early initiation of breastfeeding within 1hr after birth and exclusive breast feeding within the first 6 months of life

Replacement feeding-Refers to commercial infant formula milk.

Mixed feeding- – Givingan infant younger than six months of age other foods and/or liquids together with breast milk.

Exclusive breastfeeding - Giving an infant only breast milk, excluding any other foods or liquids with exception of prescribed medicine

Viral Load- Measure of amount of HIV virus in the body, expressed in copies/ml

Undetectable viral load blood copies of viral load below 50 copies/ml (WHO, 2021)

High viral load - blood copies of HIV virus above 50 copies/m

High CD4 Count -CD4 count of > 500 cells/ul

Mothers on PMTCT program	Mothers who have been diagnosed HIV positive and initiated on ART for prevention of MTCT of HIV either during pregnancy, or delivery or during breastfeeding period.
Prevention of mother to child transmission	Strategies to prevent transmission of HIV from an HIV-positive mother to her child during pregnancy, delivery or breast feeding.
Early mixed feeding	Any oral feeds given apart from breast milk and prescribed medications within the first 3 days after birth
Clinical determinants	Factors related to physical assessment of HIV disease progression and laboratory investigations. These included clinical stage of HIV, timing of HIV diagnosis, breast condition, CD4 count and viral load measurements.

Maternal sociodemographic factors	This comprises of: age, education status, occupation, income, parity/family size, marital status and place of residence
Infant related determinants	These are infant factors associated with MTCT of HIV. They include, age at HIV diagnosis, initiation and timing of ARV treatment and infant feeding practices
Timing of infant prophylaxis	Refers to the age at which ARV prophylaxis is started
Late initiation of infant prophylaxis	Refers to commencement of ARV prophylaxis to the infant past 6 weeks of birth.
Early infant Diagnosis	HIV test conducted within 6 weeks of age to infants born of HIV infected mothers
Delayed infant age at diagnosis	An HIV test conducted to an infant past 6 weeks of age
Standard package of care	Minimum services provided to PLHIV. Includes; screening and treatment of opportunist infections, reproductive services, mental health, nutrition, counseling and preventive services (NASCOP, 2018).

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The Human Immunodeficiency Virus (HIV) pandemic is a major global health concern that has created an enormous challenge to human survival. In 2018, the Joint United Nations Programme on HIV and AIDS (UNAIDS) report estimated 38 million people were living with HIV globally, with Sub-Saharan Africa accounting for more than half of the burden (UNAIDS, 2019a). Women are unduly affected by HIV, accounting for 59% of new infections, with four in five new infections occurring among adolescent girls aged 15–19 years (UNAIDS, 2022). This disparate disease burden has been attributed to multilevel factors including a combination of environmental as well as host biological, socio-economic, cultural and behavioral factors. This has programmatic implications on disease control across other demographic groups (Scully, 2018).

Mother-to-child transmission (MTCT) of HIV is an important driver of new cases, accounting for over 10% of all new HIV infections globally (UNAIDS, 2019a). Understanding the key drivers of MTCT and how they interact across contexts to increase risks for HIV transmission is crucial for more effective programming.

Sub-Saharan Africa (SSA) accounts for over 80% of the global HIV burden with MTCT contributing to 90% of HIV infections in young children.Mother to child transmission of HIV rates in SSA dropped from 18.1% in 2010 to 9.9% in 2017 but, the changes vary differentially by population sub-groups. About 159,000 new infant HIV infections are reported annually, with half of the infections occurring during breastfeeding period is of concern (UNAIDS, 2022). Moreover, the UNAIDS (2022) report also showed that 2.6 million newborn deaths were due to HIV, in addition to about 12 million infants being orphaned yet, these deaths are largely preventable.

Substantial differences in HIV prevalence across geographical and demographic contexts have been reported across studies yet, no consensus on explanatory factors (Dorrington, 2017). A recent meta-analysis of HIV prevalence in Africa (Birdthistle et al., 2019) showed there is still lack of reliable estimates of HIV incidence to inform prevention intervention programs, limited understanding of HIV epidemic dynamics and temporal trends in different populations and subgroups.

Kenya has an HIV prevalence of 4.9%, being twice as high among women at 6.6% compared to that of men at 3.1% (KENPHIA, 2020). Adolescents aged 15 – 24 years accounted for 51% of new infections among adults by 2015 with females accounting for 33% of total new HIV infections (NACC, 2016). Mother to child transmission of HIV remains high in Kenya at 11.5%, against the target of 5%, with 4,700 HIV related deaths reported annually among under 15 years of age (NACC, 2018).The coverage of PMTCT programs among mothers initiating prenatal care is more than 90%, however, MTCT rates increases sharply in the post-natal period, partly due to follow up gaps (Mwau et al., 2017).

Kericho County is classified as a medium HIV burden County with HIV prevalence of 2.9%, higher among females at 4.1%, with high MTCT rates of 14.5%(NACC, 2018).The surrounding counties of Bomet, Baringo, Uasin Gishu, Nandi, Kisumu and Nakuru have much lower MTCT rate of 7.7%, 12.3%, 12.4%, 10.9%, 8.7% and 10.1% respectively (NACC, 2018). Kericho County recorded an increase in MTCT from 8.1% in 2014 to 14.5% in 2018 and is ranked number twenty nine Nationally in terms of MTCT of HIV (KASP, 2018). The reasons for the high MTCT rates in Kericho County are yet to be explored.

Without any maternal interventions, the risk of MTCT of HIV ranges from 30% to 45%, with 15-30% occurring during pregnancy and delivery and the highest risk of 20-45% during postnatal period (WHO, 2017). HIV positive women are provided with a standard package of care comprising of, initiation of antiretroviral therapy (ART), CD4 count and viral load monitoring, adherence counselling among others (NASCOP, 2018). Any gaps predispose them to HIV transmission risk.

Early Infant Diagnosis (EID) is a virologic test used to determine the extent to which PMTCT strategies have averted MTCT of HIV. It is recommended to all HIV-exposed infants within 6 weeks of age and serves as an entry point for antiretroviral (ARV) prophylaxis and treatment (NASCOP, 2018). Only about 42% of HIV exposed infants are tested within 6 weeks (AShiono et al., 2017).

Without any intervention, about 35% of HIV infected children die by their first birthday and about 52% by 2 years, with the peak at two to three months of age (Adebimpe, 2013; WHO, 2021). Older infants at the time of HIV diagnosis and mixed infant feeding practices have been

linked to increased MTCT risk (AShiono et al., 2017). This is a concern particularly given that only 60% of children aged below 6 months are exclusively breastfed (KDHS, 2022).

New pediatric HIV incidence is highest among infants of adolescents and young women mothers (Toska et al., 2020). Majority of the postnatal women in Kericho county are young (15-30 years) and probably experiencing multiple intersecting identities, that may further modify their protective or risky behaviors (PEPFAR COP, 2020). Studies have not conclusively explored sociodemographic characteristics and the role they play in MTCT of HIV (Beyene et al., 2018; Mugwaneza et al., 2018).

Mother to child to transmission of HIV is a multifactorial event, with the interplay of the virus, maternal and infant as well as other environmental factors. The distribution patterns and influence of these factors however, are known to differ across geographical regions over time yet, relative attributable contributions to MTCT are not clearly understood (Ellington et al., 2018). Data on viral suppression among mothers enrolled in PMTCT program is missing in majority of the studies (AShiono et al., 2017). Kericho County has low viral suppression among adults of 44.7%, against the target of 95%, however that of mothers enrolled in PMTCT program is unknown (KENPHIA, 2020). Nevertheless, Kericho County has high antenatal care and child welfare clinic coverage of 95% (KDHS, 2022). Understanding the interactions of these factors is critical to enable design of interventions that act complementarily across contexts.

High self-efficacy has been noted to be beneficial for individual level compliance while presence of HIV-related stigma negatively affects uptake of interventions. Understanding the intervening role of these two factors on known determinants in the context of ongoing robust interventions can enhance priority setting (Helova et al., 2021). Limited studies have explored the interaction of MTCT risk factors in the context of self-efficacy and stigma as intervening variables.

Despite several studies on MTCT of HIV (AShiono et al., 2017; Mwau et al., 2017) the emerging pattern of increase in MTCT in previously predominantly medium- and low-burden Counties, including Kericho has not been studied (Waruru et al., 2021). The study was conducted in Kericho County referral hospital (KCRH), a level 5 facility that began providing comprehensive PMTCT services in 2002. Based on hospital records, it serves over 60% of mothers in need of PMTCT services from within and across the County (KDHS, 2022). The

study provided information on determinants of MTCT of HIV among exposed infants in KCRH, this is important in formulation of interventions to reduce MTCT rates to a level that it will no longer be of public health.

1.2 Problem Statement

Kericho County is a medium HIV burden County with HIV prevalence of 2.9%, with females disproportionately affected at 4.1% (NACC, 2018). Kericho County recorded an increase in MTCT of HIV from 8.1% in 2014 to 14.5% in 2018, instead of declining to the targeted 5% for the same period(NACC, 2018). The County is ranked number twenty nine in MTCT of HIV out of forty-seven counties nationally (KASP, 2018). The surrounding counties have a relatively lower MTCT of HIV rate ranging from 7.7% to 12.3% (NACC, 2018).

Compared to the five-high burden Counties (Siaya, Kisumu, Migori, Homabay and Busia) in Kenya, which contributes about half of the HIV burden in Kenya, MTCT rates are rising among medium- and low -burden Counties. This emerging pattern is of high concern yet the determinants of this increase is still not fully understood. Maternal and child HIV infections have been linked to maternal and infant morbidity and mortality (Ndege et al., 2016).

In Kericho County, about 65% of the people living with HIV are women, with a median age of 20 years at first birth, a pool with increased vulnerability including infant feeding challenges (KDHS, 2022). The role of sociodemographic factors in MTCT of HIV remains unclear. Even though 95% of pregnant women seek antenatal care services in Kericho County, MTCT rates remains high at 14.5%, despite robust program interventions (NACC, 2018). The factors contributing to the high MTCT rates are yet to be established.

Determinants of MTCT of HIV are multifactorial, with complex pathways which have not been fully explored, where both the virus, maternal and infant as well as environmental factors interact. Kericho County has a low viral suppression of 44.7% with gaps noted in infant HIV testing (KENPHIA, 2020). The interplay of these risk factors with other intervening variables to determine HIV outcome among exposed infants across regions and population sub-groups in Kericho County has not been studied. The study sought to understand the determinants of MTCT of HIV among HIV exposed infants to enable effective policy formulation and program planning to reduce new infant HIV infections.

1.3 Study Objectives

1.3.1 Broad Objective

To assess determinants of mother to child transmission (MTCT) of HIV among exposed infants on care at the Kericho county referral hospital, Kenya.

1.3.2 Specific Objectives

The specific objectives are to:

i. Establish maternal sociodemographic determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.
ii. Examine infant related determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.
iii. Assess maternal clinical determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.
iv. Determine predictors of mother-to-child transmission of HIV among exposed infants at the Kericho County Referral Hospital, Kenya.

1.3.3 Research Questions

i. What are the maternal sociodemographic determinants associated with mother to child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya?

ii. What are the infant related determinants associated with mother to child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya?

iii. What are the maternal clinical determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya?

iv. What are the predictors of mother-to-child transmission of HIV among exposed infants at the Kericho County Referral Hospital, Kenya?

1.4 Significance of the Study

This study sought to understand the determinants of MTCT of HIV among exposed infants in Kericho County Referral hospital. The study results provide crucial information on specific

determinants of mother to child transmission of HIV among exposed infants, if when acted upon could reduce infant HIV infections. This is important in designing public health interventions tailored to address MTCT of HIV. Elimination of MTCT is critical to achieving Sustainable Development Goal (SDG) number three which aims at ending the AIDS epidemics by 2030.

The progress in Kericho County towards eliminating MTCT of HIV is lagging behind. Kericho County has a maternal HIV prevalence of 4.1% and MTCT rate of 14.5%, high above the national average of 11.5% and the targeted 5% (NACC, 2018). More than half of the new infant HIV infections occur during postnatal period, hence understanding both the maternal and infant determinants contributing to the high MTCT rate is crucial in lowering transmission risk (AShiono et al., 2017).

This study contributes to the scientific body of knowledge on maternal sociodemographic, infant related and maternal clinical determinants of MTCT of HIV. The study also provided results on specific predictors of MTCT of HIV by exploring the interaction of identified determinants of mother to child transmission (MTCT) of HIV with self-efficacy and stigma an analytic aspect largely missing from previous studies.

The information is likely going to be useful to the national and County ministries of Health and stakeholders implementing PMTCT programs and inform policy formulation as well as potential targeted interventions to reduce MTCT of HIV. This is likely to have an impact on maternal and child survival and achievement of an AIDS free generation.

1.5 Assumptions of the study

COVID-19 pandemic was not going to influence the findings of this study andwomen routinely seeking postnatal services in Kericho county referral hospital MCH clinic will not be affected.

1.6. Study Limitations

i. Recall bias on early infant feeding practices collected by self-report from the mothers. This was mitigated by appropriate questioning techniques with multilayered questions / collecting additional information on current infant feeding practices. Literature has shown that infant feeding options recall since birth is close to those repeated within 24hrs recall and are more accurate way of measuring infant feeding practices (Fenta et al., 2017).

ii. Missing data on maternal CD4 data from extracted medical records. 85% of extracted charts did not have CD4 count results indicated in the files. However, analysis was restricted to those with result. CD4 monitoring is recommended among those newly diagnosed and those failing treatment (NASCOP, 2018).

iii. Not all the potential mother to child transmission factors were included in the study, for example obstetric factors and some pregnancy-related factors like antenatal care follow up. This is because previous studies and gaps noted have demonstrated that the highest MTCT risk occurs during postnatal period (AShiono et al., 2017). However, secondary data on maternal clinical and biological factors routinely collected during antenatal clinic visits, for example, timing of HIV diagnosis, maternal viral load and CD4 count were included in the study.

iv. Whereas the study is not generalizable to the general population, given it focused on a self-selected health facility attending population, it closely reflects the patterns to be expected in Kericho County's PMTCT HIV programming. It is estimated that at least 95% of the registered pregnant mothers seeking antenatal and child welfare clinic services attend this hospital (KDHS, 2022). However, assuming homogeneity, an assumption of equal or similar variances between the population attending health facility versus the general population regardless of source of care the observed findings are likely to mimic similar distribution patterns in the population.

CHAPTERTWO
LITERATUREREVIEW

2.1 Introduction

This chapter reviews literature on mother to child transmission of HIV in the context of high coverage of PMTCT programs among mothers initiating prenatal care of more than 90% and rising MTCT in a low HIV burden County in Kenya. The topical areas reviewed include the status of HIV MTCT in Kenya as well as the potential role of maternal sociodemographic factors, infant related determinants, maternal clinical determinants associated with mother to child transmission of HIV as well as predictors of mother to child transmission of HIV.

2.2 Overview of HIV/AIDS

The HIV pandemic is a major global health concern that has created an enormous challenge to human survival. In 2018, an estimated 37.9 million people were living with HIV globally, with 21.7 million on antiretroviral treatment (ART) (UNAIDS, 2022). Eastern and southern Africa is disproportionally affected accounting for more than half of the HIV burden in women and four in five new infections occurring among adolescents' girls aged 15–19 years (UNAIDS, 2022).

More than 90% of HIV infections among children are found in Sub-Saharan Africa, with 12 million orphaned as a result of HIV (Hussen et al., 2022; UNAIDS, 2022). A recent meta-analysis of HIV prevalence in Africa (Birdthistle et al., 2019) showed there is still lack of reliable estimates of HIV incidence to inform prevention intervention programs, limited understanding of HIV epidemic dynamics and temporal trends in different populations and subgroups.

Kenya is ranked fifth globally in regard to number of HIV infections with 1.3 million adult's HIV infected (NACC, 2018).The national HIV prevalence is 4.9% with that of women twice at 6.6% compared to that of men at 3.1% (KENPHIA, 2020). There are approximately 13,000 children newly HIV infected annually, with 4,700 HIV related deaths reported (NACC, 2018). Adolescents aged 15 – 24 years accounted for 51% of new infections among adults by 2015 with females accounting for 33% of total new HIV infections (Chan et al., 2019).

Kericho County is classified as a medium HIV burden County with HIV prevalence of 2.9%, higher among females at 4.1% (NACC, 2018). Kericho County is surrounded by low, medium and high burden counties of Baringo, Nandi, Bomet, Nakuru, Nyamira, Uasin Gishu and

Kisumu with HIV prevalence of 1.8%, 2.6%, 2.8%, 3.0%, 3.9%, 5.5% and 17.5% respectively (NACC, 2018). Kericho County has a high MTCT rate of 14.5% and is ranked number twenty nine nationally (KASP, 2018). The reasons for the high MTCT rates in Kericho County are yet to be explored.

2.3 Overview of Mother to Child Transmission of HIV

Vertical transmission of HIV is the leading cause of HIV among children aged below 15 years especially in the Sub-Saharan African countries, where more than 80% of children living with HIV are found (Kassa, 2018). In these settings, MTCT rates are unacceptably high above the global target of less than 50 new pediatric infections per 100 000 live births and a transmission rate of either less than 5% in breastfeeding populations or less than 2% in non-breastfeeding mothers (WHO, 2017). Approximately half of the children who acquired HIV in 2018 were in 6 countries, all in Sub-Saharan Africa, Kenya included (Mutabazi et al., 2017; UNAIDS, 2019b). In eastern and southern Africa, where approximately 67% of births, MTCT rates are still high at 9.4% (Belachew et al., 2020).

Prevention of HIV incidences among women, and those already HIV infected enrolment into PMTCT programs are critical for eliminating HIV epidemic in children. Interventions particularly targeting adolescent girls and young women aged 15–24 years who are greatly affected by HIV, would lead to a higher impact towards eliminating MTCT(Chan et al., 2019).
Kenya has made strides towards elimination of Mother-to-Child Transmission (eMTCT) of HIV with transmission rates reduced three-fold from as high as 26% in 2009 to 8.3% in 2015 and a reduction of HIV incidences among children from 22,564 to 6,613 (490 per 100,000 live births) (Kenya eMTCT, 2016). Despite this initial progress in reduction of MTCT, recent Ministry of Health reports indicate that national MTCT rates rose from 8.3% in 2016 to 11.5% in 2018. This was more marked particularly among medium- and low- HIV burden Counties, with disparities across the care continuum and socio-demographic transitions (Kenya HIV estimates, 2018).

Coverage with PMTCT program among mothers initiating antenatal care is high at about 91% yet, MTCT of HIV increases sharply in post-natal period (KDHS, 2014). Kericho County is one of the 21 counties that recorded an increase in number of new infections with MTCT rate of 9% in 2015 and 14.5% in 2018, majority being young mothers <25 years old (Kenya eMTCT, 2016; Kenya HIV estimates, 2018). A study done in Kericho County on predictors of loss to follow up

(LTFU) among HIV exposed infants (HEIs) showed that delays in commencement of interventions contributes to significant child illnesses and untimely deaths (Too & Gura, 2018). Other similar studies have reported potential problems related to high viral loads postnatally (Myer et al., 2017); dropping off care and treatment, and; lack of adherence to recommended feeding practices(AShiono et al., 2017). The determinants of these trends and their characteristics are still largely understudied.

All HIV positive mothers receive standard package of care comprising of, ART therapy irrespective of CD4 cell count, WHO clinical stage, age, pregnancy status, or comorbidities; screening and prevention of opportunistic infections and non-communicable diseases, reproductive health services, mental health services, nutrition services and health education and counselling (NASCOP, 2018). However, variation can occur due to bridge in the standard of care provided hence the break through new infections. More comprehensive understanding of these factors would help improve capacity to develop appropriate interventions to address identified needs.

2.4 Maternal sociodemographic determinants associated with MTCT of HIV

Maternal sociodemographic characteristics of key importance to HIV MTCT include age, education status, marital status, occupation, income status, parity and place of residence. Maternal sociodemographic status are key determinants of health and health outcomes (KENPHIA, 2020), yet their relative contribution, clustering and level of interaction as drivers of MTCT are still poorly understood in the study context.

Adolescent girls and young women are worst hit by the HIV pandemic in In sub-Saharan Africa, in spite of contributing to only 10% of the population (Chan et al., 2019). In Kenya, findings from a national population based survey conducted across all forty seven counties showed HIV prevalence to be consistently higher among females compared to males across all the age groups (KENPHIA, 2020).

In a cross-sectional facility based nationally representative study conducted in South Africa found that adolescent mothers lacked knowledge of their HIV-positive status and the risk of drop off from PMTCT continuum of care was higher among those less educated and primiparous (S. Woldesenbet et al., 2015). In contrast, unmatched case control study in Ethiopia

found no association between age, weight and height and HIV in children (Beyene et al., 2018). In Kericho County, about 60% of the women seeking child health services are less than 30 years (Kigen et al., 2018). However, no studies have been conducted to establish the link with MTCT and child HIV status.

Education is one of the determinants of decision-making power within families and is likely to influence health seeking behaviour. In Kenya, an association between those with higher level of education and income with knowledge on HIV was noted in a matched case–control study in 20 clinics in western Kenya (Okoko, Owuor, Kulzer, et al., 2017). In contrast , however, ART adherence among postnatal women has not shown to be influenced by education status in a similar hospital based study in Kenya (CUImbaya & Odhiambo-Otieno, 2015). Understanding relative role of education level with regard to MTCT makes it is easier to design effective information and promotion interventions targeting these populations.

Occupation and income affect one's socioeconomic status and can possibly influence health choices. However, studies consistently show mixed result across different contexts and by methodologies used. In a cross-sectional facility based study in Rwanda on impact of maternal ART on MTCT found that higher sociodemographic status were borderline risk factors for MTCT (Mugwaneza et al., 2018). In contrast, a hospital based cross-sectional study conducted in Kenya revealed no statistical significant association in PMTCT uptake and the amount of income earned by the respondent's family (Ndonga & Matu, 2019). This is in contrast with a cross-sectional facility based study done in Kericho County on assessment of exclusive breastfeeding, the study found that those employed had higher chances of practicing mixed feeding putting their infants at risk compared to the unemployed (Ndwiga, 2016). The findings suggest the need for additional studies to assess the link between sociodemographic status and MTCT to aid in development of tailored strategies for these women.

Marital status and failure to disclose ones HIV status have been demonstrated to affect adherence , in a retrospective study conducted in South Africa (Adeniyi et al., 2018).In contrast, findings from a cross-sectional facility based study in Kenya found no association between the husband's knowledge of the wife's HIV status and the women's acceptance to use ARV's (CUImbaya & Odhiambo-Otieno, 2015).

Place of residence and parity can potentially affect knowledge on HIV and both mothers and infant's health outcome. In a retrospective study conducted in India, higher parity was linked with less chances of contracting HIV among women (Darak et al., 2015). This is in contrast to a prospective cohort study in Rwanda that showed an association between HIV status of infants and parity (Bucagu et al., 2013). This is similar to a cross-sectional facility-based study conducted in Nairobi that revealed that there was no association between gravidity and uptake of PMTCT(Ndonga & Matu, 2019).

There is no conclusive evidence on association of place of residence and parity on MTCT of HIV in Kenya. In a nationally representative survey conducted in Kenya, HIV prevalence was noted to be similar in both rural and urban settings (Sirengo et al., 2014). In contrast, a recent survey has shown higher HIV prevalence in rural settings (KENPHIA, 2020). Similarly, rural residence was shown to significantly affect HIV outcome in a retrospective cohort study in Ethiopia (Wudineh & Damtew, 2016a).

Given the evolution of HIV pandemic, there is need to assess maternal sociodemographic determinants associated with MTCT. Majority of the postnatal women in Kericho county are young, case control study conducted in Kericho found 60% mothers of the HIV exposed infants were aged 15-30 years (Kigen et al., 2018). The study did not however explore link with MTCT. There are mixed findings from studies on attributable contributions of maternal sociodemographic determinants in MTCT of HIV across different geographical and epidemiological contexts, hence further studies are warranted. Some studies depict that they are borderline risk factors while others did not find any link (Beyene et al., 2018; Mugwaneza et al., 2018). This study was multi-dimensional, showing interaction between sociodemographic characteristics with multiple determinants of MTCT and further explored interactions with intervening variables.

2.5 Infant related determinants associated with MTCT of HIV

Mother to Child transmission of HIV is dependent on several factors among them infant related determinants. The study focused on early infant diagnosis, early initiation of antiretroviral prophylaxis for the HIV exposed infants (HEI) and infant feeding practices. Globally it has been a major challenge to optimally reduce the number of infants living with HIV in spite of increase in ART coverage among pregnant from 51% in 2010 to 80% in 2017(Mutabazi et al., 2017).

Kenya had 7,600 children aged between 0-14 years who had been newly infected with HIV through vertical transmission in 2018 (NACC, 2018) . Children aged 18 months of age and below who are born to HIV-positive mothers require virological testing to determine their HIV status and linkage to treatment and preventive interventions(NASCOP, 2018). Only about 40% of HIV exposed infants are tested within the stipulated period of within 6 weeks of birth (AShiono et al., 2017). Studies show that early HIV diagnosis within eight weeks of birth and immediate initiation on ART reduces HIV related morbidity and mortality (Hussen et al., 2022). There has been inadequate focus on support to mother-child pairs during the breastfeeding period, with studies done in South Africa showing loss to follow up increasing to 70% and 81% at four and six months after birth consecutively (Adeniyi et al., 2018). Similarly, a facility based case-control study conducted in Kericho county found high number of HIV exposed infants dropping off from care (Too & Gura, 2018). These studies did not however explore the association of early infant testing and other interventions on their role in determining infant's HIV outcome.

In order to reduce MTCT, it is crucial to ensure HIV positive mothers are on ART treatment as well as provide Infant prophylaxis to their exposed infants. A prospective cohort study conducted in Vietnam that revealed that missed opportunities for both maternal and infant ART could be linked to HIV transmission (Nguyen et al., 2020). These studies did not however explore on the timing of initiation, duration and the different regimens used for purposes of PMTCT of HIV and association with other factors.

Infant feeding and choice of feeds are critical for an infant's survival and quality of life, with exclusive breastfeeding being recommended within the first six months (KDHS, 2022). However, among HIV positive women, this is still considered a complex issue with divergent opinions on whether a HIV positive mother should breastfeed or not. There is lack of consensus from studies regarding the populations' knowledge, practices and perspectives on exclusive breastfeeding among HIV mothers (Lang'at et al., 2018).Infant feeding practices were classified into seven categories namely; not breastfeeding, exclusive breast feeding, breastfeeding and consuming plain water, breastfeeding and consuming non milk liquids, breastfeeding and consuming other milk and breastfeeding and consuming complementary feeding (KNBS, 2016).

Despite the numerous health benefits of breastfeeding to mother-child pair, in Kenya, mixed feeding is introduced at early age despite the national average of exclusive breastfeeding at 6 months after birth of 60% (KDHS, 2022). Population-based survey data reveals that EBF rates vary with context, the mean duration of exclusive breastfeeding in Rift Valley region is 3.1 months compared to the national average of 4.3 months(KDHS, 2014). Similarly, a facility based cross-sectional study conducted in Kericho County on exclusive breastfeeding found the duration of EBF for 6 Months was at 62.5% (Ndwiga, 2016). The study did not however assess the feeding options among HIV positive postnatal women as well the timing of introduction of mixed feeding and link with MTCT of HIV.

Infant feeding practices cannot be generalized across all settings and are likely to be influenced by socio-demographic characteristics unique to that region. A study on infant feeding practices in Kiambu, Kenya revealed that socio-demographic factors play a crucial role in making infant feeding choices among mothers living with HIV (Andare et al., 2019). The study did not however explore the link with MTCT as well as other factors likely to influence infant's HIV outcome. A prospective cohort study conducted in India showed that maternal age and breastfeeding past 6 months is linked with higher rates of MTCT of HIV (Potty et al., 2019). There is need to assess the link in a different sociodemographic context using a different study design in Kericho County.

In Kenya, Ministry of health infant feeding recommendations do not factor in alternatives to exclusive breast feeding especially among HIV positive women with high viral load. A study conducted in Rwanda found that exclusive breastfeeding does not totally eradicate the risk of HIV transmission (Bucagu et al., 2013). Similarly, majority of the HIV transmission has been demonstrated to occur during breastfeeding period (AShiono et al., 2017).

Infant feeding practices, especially when exclusive breastfeeding is a requirement continue to pose health and social challenges among breastfeeding populations. A recent meta-analysis by Bispo et al., (2017) that involved 11 experimental and observational studies on postnatal HIV transmission on breast-fed infants did not consider role of other modes and timing of initiating infant feeding on transmission risk.

This study sought to address literature gaps on infant related determinants associated with MTCT of HIV, which have not been fully explored. The study focused on infant feeding practices immediately after birth, timing of infant interventions and association with MTCT of HIV and explored interaction with self-efficacy and stigma to determine their association with infant HIV status.

2.6 Maternal clinical determinants associated with MTCT of HIV

Mother to child transmission of HIV is a multifactorial event, with both the virus, maternal and infant as well as other environmental factors playing crucial roles (Ellington et al., 2018).Maternal clinical determinants that have been shown to affect MTCT of HIV include; low hemoglobin (HB) levels during pregnancy; low CD4 count and high viral load (Bucagu et al., 2013; Nandlal et al., 2014). Anaemia, characterized by low HB levels (<11g/dl) is often a complication of both HIV and ART. It is however, more prevalent in advanced disease, characterized by low CD4 counts <350 and high viral load of 1000 (Nandlal et al., 2014; Odhiambo et al., 2016). Monitoring HB, maternal viral load (VL) and CD4 counts is important to track disease progression and hence risks associated with MTCT(Liu et al., 2017).

Viral suppression improves the well-being of both mother and her baby and minimizes the possibility of vertical transmission of HIV (Onoya et al., 2020).It is crucial to monitorviral load and CD4 count values in persons living with HIV as they are vital indicators of immunologic wellbeing and virologic control(Onoya et al., 2020). Further, high viral load is a proxy measure of advanced HIV disease and presence of co-morbidities such mastitis increases the transmission risk. In a retrospective cohort study in Uganda, high baseline CD4 count and exclusive breastfeeding reduced HIV transmission (Izudi et al., 2018).

Initiation of ART before pregnancy has shown to improve immunologic and virologic control with higher viral suppression noted by the time of delivery (Onoya et al., 2020). In Kenya, viral load for pregnant and breastfeeding women is done at first ANC visit for those already on ART at enrollment to ANC clinic, or 3 months after ART initiation for those newly diagnosed and starting ART during pregnancy, and then every 6 months until the end of the breastfeeding period (Guidelines, 2018).

Viral load suppression is dependent on maternal retention and ART adherence and is key in reducing MTCT(Bvochora et al., 2019). Majority of the previous studies relied on self-reported adherence to measure treatment outcomes (Bortich, 2016; Tsegaye et al., 2016) . Approximately 95 per cent retention is required at each step of the PMTCT continuum of care to achieve the elimination of MTCT of HIV, however, gaps have been noted with only 76% prenatal and 54% post -birth adherence levels (Ndege et al., 2016).

To achieve viral load suppression means a mother needs to be on the ART during pregnancy and after delivery and during breastfeeding period. However, high ART coverage alone is not a guarantee to achieving viral suppression as noted in a study conducted in Kenya showing failure to achieve virologic suppression in spite of months of ART (Chan et al., 2019). The findings are similar to those of cohort study conducted in Africa region, including Kenya, that revealed episodes of vireamia among HIV infected patients on ART (Kiweewa et al., 2019) . These studies did not however correlate the findings with infant's HIV status.

In Kenya, based on the most recently published population-based survey, the prevalence of viral load suppression (VLS) among HIV positive adults on ART is 71.6%, with VLS decreasing differentially with age (with younger people being disproportionately disadvantaged), against the target of 95% (KENPHIA, 2020). However, the survey did not include information on viral load distribution and suppression among pregnant and breastfeeding women in Kenya due to data limitation.

Viral Load Monitoring during pregnancy and postpartum is recognized as a key strategy that will protect the gains earned by PMTCT programs (Vrazo et al., 2020). However, it is noted that complementary focus on overall maternal health , including iron deficiency and breast condition is often neglected (Ellington et al., 2018).

For the vision of eliminating the impact of the AIDS epidemic to be achieved there is need to scale up of evidence-based interventions such as, through improved surveillance of recent HIV infections, treatment initiation and viral suppression. Studies still show inconsistences of effect of viral load and CD4 count on MTCT, with a study in Kenya and Ethiopia not including viral load data due to unavailability and incompleteness (AShiono et al., 2017; Beyene et al., 2018).

The study sought to fill gaps from previous studies in regard to maternal clinical determinants that were not included in the analysis due to missing or incomplete data. The interaction of the risk factors with stigma and perceived self-efficacy was further explored to determine independent predictors of MTCT of HIV, an analysis often missing in previous studies.

2.7 Intervening variables affecting mother to child transmission of HIV

Stigma related to acquisition of HIV/AIDS may hinder the uptake of PMTCT interventions hence further derail the efforts towards the achievement of AIDS free generation. Stigma and discrimination has shown to affect enrolment of pregnant women in PMTCT programs (Turan et al., 2013). This hence denies the mother a crucial opportunity to be started on the lifesaving ART and prevent perinatal HIV transmission.

HIV stigma scale was measured in this study using a shorter version of 12 items of the HIV stigma index which has 34 items , this has been tested and shown to have comparable results with the full scale one (Reinius et al., 2017) . The scale had 3 domains namely, self or internalized stigma, perceived stigma and experienced stigma. A randomized control trial on effects of stigma in South Africa noted that increase in stigma was statistically associated with lack of employment and among mothers diagnosed HIV positive before their current pregnancy(Peltzer et al., 2018). Further the self -stigma and perceived stigma were also noted to affect disclosure of ones HIV status (Madiba et al., 2021). Studies suggest that stigma has an impact on mother-to-child transmission, hence need to invest on stigma eradication for favourable maternal and infant outcomes (Madiba et al., 2021).

A prospective mixed-methods study conducted in western Kenya reported peer support during pregnancy through 6 weeks postpartum was associated with improved uptake of PMTCT services (Helova et al., 2021) . This was perceived as beneficial by the mothers themselves and further improved uptake of ART (Helova et al., 2021). The findings are similar to those from a descriptive comparative study conducted in Nairobi County that showed lack of partner support, stigma and discrimination as the main barriers to PMTCT uptak**e** (Em, 2019)**.** These studies did not however study the effects on infant's HIV status. However, in contrast a facility based cross-section study found that investment in health systems can effectively prevent infant HIV infection despite substantial HIV-1 stigma (Kinuthia et al., 2011).

Perceived self-efficacy refers to one's confidence and trust that they are capable of performing new or previously unexplored tasks deemed difficult and achieve the expected results (Schwarzer & Warner, 2013). Self-efficacy was assessed using a 5-point Likert scale ranging from I (strongly agree) to 5 (strongly disagreed). This was classified in 3 levels at analysis as , high self-efficacy ; moderate self-efficacy and low self -efficacy (Mwangi et al., 2021). Perceived self-efficacy is likely to influence the acceptance of PMTCT-HIV-test use as well as HIV-treatment adherence (Aregbesola & Adeoye, 2018; Workagegn et al., 2015). Older women who are in formal relationships have been noted to have lower perceived self-efficacy (Donahoe, 2012). A cross-sectional study conducted in Sudan indicated that the high self-efficacy and associated with increased odds of maternal HIV testing (Elsiddig Elsheikh et al., 2022).

Whereas several studies linking stigma and perceived self-efficacy with the uptake of PMTCT interventions exist, the association with MTCT of HIV was hardly explored. Assessing the interaction of these intervening factors and their influence on infant's HIV outcome was hence warranted to inform HIV programs on their association with MTCT of HIV.

2.8 Predictors of mother to child transmission of HIV

Determinants of MTCT of HIV are multidimensional and vary across contexts, yet their clustering and interplay as drivers of MTCT are still unclear. In this setting, 37% of HIV positive women giving birth at the facility are not on ART (NACC, 2018). Even with optimal ART during prenatal period and delivery the chances of transmission to the infant is not zero, indicating potential for a range of other risk factors for MTCT influencing its risk. These factors mutually interact and influence each other but in complex and heterogenous ways. It is recommended that modelling interactions between risk factors for transmission and outcomes is ideal to accurately estimate their variable interdependence as well as interactions(Liu et al., 2017).

Literature review from low-income countries found that stigma is an important modifier of HIV-related outcomes (Turan & Nyblade, 2013). Multiple systematic reviews have shown that psychological interventions do not always result in improved ART uptake among HIV-positive women and infant HIV testing (Ambia & Mandala, 2016). In addition, majority of mothers in

this setting are less than 25 years, an age-group already experiencing multiple intersecting identities, which may further modify their protective or risky behaviors as well as health seeking. Conversely, behaviours may be further modified by health education and promotion activities, designed to improve knowledge, efficacy and intentions for behaviour change (Okoko, Owuor, & Kulzer, 2017). However, these interventions also act differentially across population groups and geographical contexts and may exhibit temporal patterns (Lang'at et al., 2018) hence there was need to clarify contextual variations in the relative impact of risk factors.

Addressing gaps from previous studies on the complex, heterogenous and multidimensional MTCT risk factors and modelling interactions between risk factors is ideal for determining the independent predictors of MTCT of HIV. Multiple systematic studies have not shown impact of psychosocial interventions on MTCT with varying results. Understanding predictors of MTCT of HIV in Kericho County referral hospital would enable design of targeted interventions to reduce MTCT of HIV.

2.9 Summary of Knowledge gaps

Mother to child transmission of HIV remains a public health threat with 90% of HIV infections among children due to MTCT despite multiple studies (AShiono et al., 2017; UNAIDS, 2018a).

i. There are mixed findings from studies on attributable contributions of maternal sociodemographic determinants and MTCT of HIV across different geographical and epidemiological contexts. Some studies depict that they are borderline risk factors while others did not find any link (Beyene et al., 2018; Mugwaneza et al., 2018). Hence further studies are warranted.
ii. There are divergent opinions on the role of infant related determinants and the role they play in MTCT. The issue of infant feeding practices among HIV positive women remains complex with half of infant HIV infections occurring during breastfeeding period(Potty et al., 2019). There is lack of consensus from studies regarding the populations' knowledge, practices and perspectives on exclusive breastfeeding among HIV positive mothers (Lang'at et al., 2018). Gaps have also been noted in studies in exploring the role of early infant testing and infant ARV prophylaxis in determining the HIV outcome (Fasakin et al., 2018; Mutabazi et al., 2017).

iii. Existing studies show inconsistences of effect of viral load and CD4 count on MTCT, with a study by AShiono et al., (2017) in Kenya not including viral load data due to unavailability. A similar study in Ethiopia had significant incomplete records of CD4 and viral load data hence their role in MTCT of HIV not explored (Beyene et al., 2018). Maternal health and wellbeing are important in determining MTCT of HIV outcome and are often neglected in previous studies (Ellington et al., 2018; Liu et al., 2017).The study sought to fill gaps from previous studies in regard to maternal clinical determinants of MTCT of HIV.

iv. Mother to child transmission has complex pathways which are not clearly understood, with both the virus, maternal and infant as well as other environmental factors playing crucial roles (Ellington et al., 2018). Modelling interactions between risk factors for transmission has been shown to be ideal in accurately estimating their interdependence, yet this is not widely explored in many studies to provide independent predictors of MTCT of HIV (Liu et al., 2017).

    a. While stigma and self-efficacy can influence the uptake of HIV preventive measures, there are limited studies available to explore the interactions with other risk factors and impact on infant's HIV outcome. Understanding of such relationships and identification of potential factors that are more influential on MTCT risk would enable design of targeted interventions in Kericho County, a region with high MTCT rate.

2.10 Conceptual Framework

Mother to child transmission of HIV occurs primarily during prenatal period, childbirth or postpartum. In order to minimize the transmission at each of these stages, health care interventions targeting both the mother and child are provided at each step. The study specifically assessed maternal sociodemographic determinants, infant related and maternal clinical determinants as independent variables. The intervening variables for this study were stigma and self-efficacy. The interaction of the determinants of MTCT of HIV with stigma and perceived self-efficacy was further explored to determine independent predictors of MTCT of HIV. The determinants have been derived from literature review and have shown to affect the

infant's HIV status which is the outcome variable of the study and categorized is either HIV positive or HIV negative.

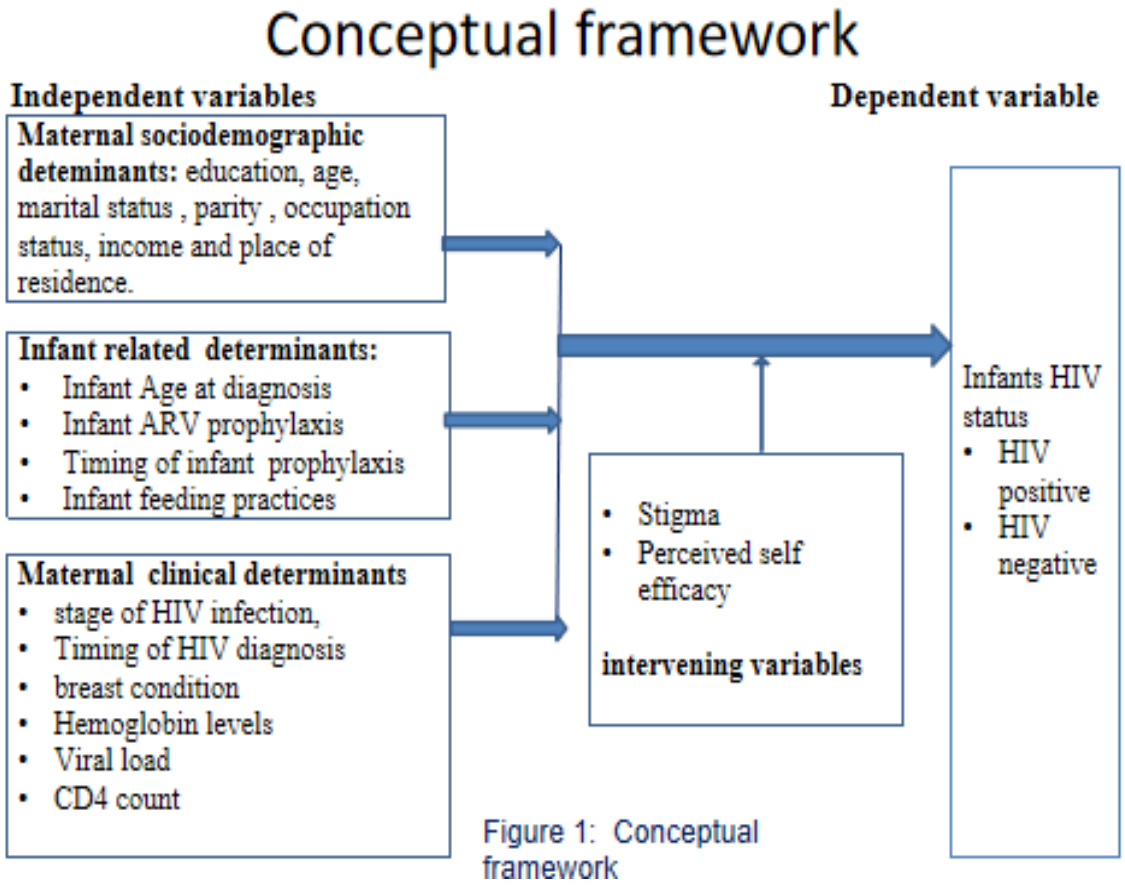

Figure 2.1: Conceptual framework on determinants of MTCT from literature review (Beyene et al., 2018; Liu et al., 2017)

CHAPTER THREE
METHODOLOGY

3.1Introduction

Methodology aspects described in this chapter include the study area, study design that was applied, target population, sample size determination and sampling procedure, data collection instruments, validity and reliability of the instruments, data collection procedure and data management plan, data analysis techniques and ethical considerations.

3.2 Study Area

The study was conducted in Kericho County referral hospital (KCRH), level 5 facility in Kericho County. There are 366 health facilities spread across Kericho County comprising of 14 hospitals, 180 health centers, 159 dispensaries and 13 clinics. 271 are government owned, 41 private and 40 by non-governmental organizations. One hundred and sixty-four health facilities provide HIV care and treatment services to mothers in need of PMTCT services as well other HIV positive individuals. Kericho County referral hospital is the only referral facility within the County and was purposively selected as it provides comprehensive HIV care and treatment services integrated within maternal and child welfare clinic.

Kericho County is multi-ethnic with Kipsigis sub-tribe of the Kalenjin tribal group been the majority. Other inhabitants include Luo's, Luhya's, Kisii's, Kikuyus, Somalis and Indians. It has an estimated population of 877,975 with a male to female ratio of 49:51 (department of health services Kericho County, 2018). The fertility rate is moderate at 3.1% with a poverty index of 30.6%. Kericho County HIV prevalence is at 2.9% , higher among females at 4.1% and MTCT rate of 14.5% (Kenya HIV estimates, 2018). ART coverage among pregnant women is at 63% against the national target of 95% (Kenya HIV estimates, 2018). The bordering counties (Appendix x); of Kisumu, Nakuru, Homabay, Nandi, Uasin Gishu, Baringo and Bomet have higher PMTCT coverage ranging from 71% to 91%.

Kericho County Referral hospital (KCRH) is the largest public hospital in Kericho County with a 250-bed capacity. It is a level 5 facilities, with a comprehensive HIV clinic integrated in maternal and child welfare clinic, serving clients within the County and surrounding 7 counties. The hospital began providing PMTCT services since 2002 hence cumulative experience in HIV programming. Child welfare clinic for postnatal mothers records high attendance with 95.7%

uptake of immunization services reported by 14 weeks after birth and 95% seeking at least one antenatal care clinic visit hence plausible for a facility based study (KDHS, 2022). Based on 2020 hospital records, clients on ART in KCRH were about 4,232. Of these 65% (3,077) were females and about 170 pregnant at the time of commencement of treatment. The hospital was purposively selected because it attends to most (60%) of the women in need of PMTCT services in the County and is the only referral facility serving patients from across the county (Kenya HIV estimates, 2018).

The facility hosts a HIV comprehensive care clinic (CCC), maternal, child health and family planning clinic (MCH/FP). An average of 50 antenatal clients seek services on a daily basis. HIV services are provided within the MCH clinic and the facility has engaged persons living with HIV as mentor -mothers who provide psychosocial support to clients enrolled in the PMTCT clinic.

3.3 Study design

The research design adopted for the study was analytical cross sectional. This was appropriate for the study since data on determinants of MTCT of HIV was collected and analysed to establish associations and interactions with the health outcome (infants HIV status). The data was collected at one specific time point, between January and February 2022.

In analytical cross-sectional studies, data on the prevalence of both exposure or risk factor and health outcome, in this case HIV positive or negative, are obtained for the purpose of establishing interactions (Wang & Cheng, 2020).

3.4 Target Population

This comprised of HIV infected postnatal mothers paired with their HIV exposed infants. As at December 2020, based on Kenya health information system (KHIS), the total number of HIV infected postnatal clients on ART in KCRH was 129. This formed the sampling frame and the sample size was drawn from this population.

3.5 Inclusion and Exclusion criteria

3.5.1 Inclusion Criteria

The study participants who agreed to participate and gave informed consent met the following criteria:

i. HIV infected postnatal women enrolled in KCRH MCH HIV care and treatment clinic.
ii. Those who were on ART for purposes of PMTCT for a minimum of 6 months.
iii. Those who had a HIV exposed infant aged ≤ 18months old, with at least one DNA-PCR test done and results given to the mother and available in the medical records.

3.5.2 Exclusion Criteria

i. Mothers who required urgent medical interventions.
ii. Mothers with acutely ill children.
iii. Infants brought in by non-biological caregivers.

3.6 Sample size determination

KCRH had 129 HIV positive mothers on ART for PMTCT as at December 2020, which is a minimum of 6 months prior to the study. This formed the sampling frame and the sample size was drawn from this population. The sample size was determined using the (Krejcie & Morgan, 1970) table (Appendix ix) for small sample populations. The table is for a one sample size study to estimate the MTCT rates among postnatal HIV positive mothers.

To get the sample size:

The table (Appendix ix) shows the size of the population and sample size at confidence level of 95% and margin of error of 5%, a sample of 97 was determined to be a representative sample of the targeted 129 population of HIV positive postnatal mothers.

The Krejcie and Morgan formula of sample size determination is depicted as below;

$$n = \frac{x^2 \mathrm{NP}(1-\mathrm{P})}{d^2(N-1) + x^2 \mathrm{P}(1-\mathrm{P})}$$

Where;

n= sample size

x^2= table value of chi-square @ d.f =1 for desired confidence level 0.05

N=Population Size

P=Population proportion (assumed to be .50)

d= degree of accuracy (expressed as a proportion 0.05)

This implies that;

$$n = \frac{3.841\text{x}\ 129(0.50)(1\text{-}0.50)}{0.05^2(.50) + 3.841(.50)(1 - 0.50)}$$

n=97

Since this is a clinical study, to finalize the estimate, the sample size was further adjusted for non – response rate. Previous studies (Kigen et al., 2018) conducted within the same setting found non- response rate of 6%.

This gave a final sample size of 102.

The sample size was applied to both the questionnaire respondents and abstraction of respective participant records to collect the corresponding information on biological parameters.

3.7 Sampling Procedure

To select the 102 HIV infected postnatal mothers, a line list was used for pairing HIV infected postnatal mothers with their corresponding HIV exposed infants. The clinic appointment register was then used to check the number expected on a particular day. The study respondents were then selected by simple random sampling based on the numbers expected on that particular day. Eligibility for study participation was determined and consenting done before enrolment. Since the postnatal clinic runs daily, the study was conducted during odd days of the week (Monday, Wednesday and Friday), this coincided with the clinic appointment days for HIV infected postnatal mothers.

This process continued on the respective clinic days until the sample size of 102 was reached. On average 8 participants were enrolled per study visit day. The participants were taken through a summary of the study protocol and given information on their freedom to participate, this was absolutely out of free will. Whenever a mother declined to take part, the next one was approached until the desired number was achieved.

3. 8 Study Procedures

3.8.1 Recruitment/enrolment of Participants

Attending clinicians identified postnatal mothers paired with their exposed infants who met the inclusion criteria guided by the line list and random selection criteria. The mothers were prompted about the study by the facility clinician and those who were willing to participate were directed to a research assistant using a referral note for consenting. Those who consented were enrolled into the study on the same day of clinic visit. This is because of high attrition of clients noted in clinical follow up visits (Kigen et al., 2018). For enrolled participants, the clinical data on maternal and infant characteristics on study variables were derived from their medical records using a standardized data abstraction form attached (Appendix III). All the MCH staff were briefed about the study and purpose during one of the weekly continuous medical education (CME) meetings.

3.8.2 Recruitment and Training of Research Assistants

Priortocommencement of the study, two research assistants were recruited to support data collection. These consisted of clinic staff providing services in MCH-FP clinic in Kericho County referral hospital (KCRH).

One-day training was conducted for research assistant and clinic support staff. The training involved explaining the objectives of the study, the importance of the investigations and application of the results to the community and country at large. Data collection involved a comprehensive review of HIV infected postnatal client's records together with those of their infants using abstraction form (Appendix III) and administration of questionnaire to study respondents. A review of consent forms was conducted and online course on bioethics in medical research, scientific misconduct, regulation of research participants and maintaining confidentiality, and confidentiality form signed.

The research assistants took part in the pilot study data collection. This made them well fussed with the tool and enhanced smooth flow of data collection with corrections and wording of the questions done based on feedback received.

3.8.3 Data collection tools

Data abstraction form: a data abstraction form (Appendix III) was used to systematically collect secondary data on clinical information from the study respondents' medical files

related to objective number two and three of the study. Secondary data collected included: DNA/PCR HIV results of the infant, infant ARV prophylaxis, WHO clinical staging, CD4 levels, pregnancy Hemoglobin levels, mothers viral load levels and type of antiretroviral regimens, all captured in Appendix III.

Questionnaire: This was structured and administered by the research assistants in person to the postnatal mothers randomly selected based on the study inclusion criteria. It was sub- divided into 3 parts i.e. part 'A' giving maternal sociodemographic information of the respondents related to objective 1 of the study and 'B' assessing infant feeding practices guided by variables in objective number 2 of the study on infant related determinants and "C" collected information on intervening factors, stigma and self-efficacy. The questionnaire was in grade 5 English for easy understanding by the respondents (Appendix IV).

3.8.4 Pre-testing of data collection tools

This was done in a neighbouring public Sub-County hospital - Kapkatet Sub-County hospital which had similar social demographic characteristics. A pilot study sample should be 10%-30% of the sample expected for the main study (Bryman, 2008). Therefore, a pilot sample of 30 (29%) was utilized. The reason for using a sample size of 30 was to ensure proportionate representation of variable characteristics during the pilot.

The results were used to inform review the data collection tools to ensure logic flow of the questions, addition and subtraction of the questions. The questionnaire was developed with the support of literature review and reviewed by my research supervisors. The efficiency of one language or two (English and Kiswahili or vernacular) was checked, this informed the adoption of one set of questionnaires.

3.8.5 Validity and Reliability

The study supervisors and peer comments on the tools were sought before data collection was done. The validity was ensured by pilot testing both questionnaire and abstraction form before conducting the main study and ensuring correct representative sample size selection. To ensure content and construct validity (accuracy, relevance and language appropriateness) two research assistants (2 clinical officers) with experience in managing HIV infected PMTCT clients,

reviewed the completed questionnaire. In addition, my university supervisors reviewed the questionnaire and provided feedback.

Daily checking, correction of completed questionnaires and supervision of research assistants during data collection was done to ensure accuracy, completeness and consistency of the data.
Chronbach's alpha test was used to assess reliability of the data collection tools.Cronbach Alpha for the number of items in the tool was found to be $\alpha = 0.82$ which is considered acceptable.Data was analysed using SPSS v.22.

3.8.6 Data collection procedure

Secondary data was abstracted from medical records of HIV infected postnatal women matched with that of their infants. Primary data was collected by administration of a questionnaire.
Here is a summary of the procedure that was followed:

i. **Verification of participants eligibility** - Research assistants completed participant information forms and abstracted data to determine if the participant met the inclusion criteria, before consenting.

ii. **Consenting**: Before data collection, informed consent form was precisely read out to the study participants in the preferred language (i.e. Kiswahili, or English). If the participant was unable to read, a witness was allowed to support the participant. Enough time was allowed for the participant to discuss the study objectives and procedures, ask questions, and get responses. When a literate participant felt comfortable and understood the study procedures, they were invited to consent to take part in the study. If the participant couldn't read or write, an independent witness who was not part of the study team was used. The witness and study member were required to sign, while the participant appended a thumbprint/ signature (see Appendix I).

iii. **Data abstraction**: The data abstraction form(Appendix III) was coded to de-identify the participants and contained only the study identification (SID) number and not personal identifiable information of the study participants to maintain confidentiality. The code captured the HIV clinic HAART number, date (two digits), and the last digits where assigned sequentially as the study participants enrolled in the study (01–102); example HAART number/DD/ enrolment number). The code included a unique

number, in this case the HAART number, to enable linking patient results to the file, this facilitated linkage to other recommended HIV intervention services. The names remained anonymous, the SID number was used to link maternal and infants' records and was only known to the researcher. Medical records were not removed from the clinic sites but only relocated to a separate room at the site for abstraction in order not to interrupt patient or routine workflow. Clinical data such as viral load of the mother, CD4 count, HB levels, maternal ART regimen, adherence levels, infant feeding method, infant ARV prophylaxis, age of the child and infant's HIV status were extracted from infant's medical record and mother's history recording charts/ patient files.

iv. **Administration of participant questionnaire** - Questionnaire was administered in-person with the research assistant recording responses to questions including information on maternal sociodemographic, infant feeding practices and maternal risk factors associated with MTCT. A standardized questionnaire attached was used (Appendix IV). Maternal and infant forms were linked to each other and to the medical files using a unique identifier. This enabled referral in cases a notifiable condition not previously diagnosed or reported was detected. Table 3.1 and 3.2 below shows the study variables and the measurements.

Table 3.1: Maternal study variables

No.	Maternal Variables	Definition	Measurement
1.	Maternal Age	Women age completed in Years	Chronological Age in years as documented in Patient files
2.	Marital status	Being in marriage or not	Self-report
3.	Parity	Number of children the woman has had	Count as per Patient files for documented parity / Self report
4.	Occupation	Type of employment - Formal employment, casual, house wife, farming	Self-report
5.	Level of education	Highest education attained	Self-report
6.	Place of residence	Area of residence- rural, peri-urban urban	Self-report
7.	Income levels	Average monthly income or expenditures	Self-report on a national wealth index scale
8.	WHO clinical staging	Clinical classification of HIV based on World Health Organization guidelines: WHO clinical stage 1 WHO clinical stage 11 WHO clinical stage 111	Patient file on WHO staging scale
9.	Breast condition	Cracked nipples, sore nipples, inflammation of the breast/mastitis	Mothers file/self-report
10.	Most recent CD4 Count	CD4 count in cell/ µl (>500, 201-500, ≤ 200)	WHO CD4 count criteria
11.	Haemoglobin levels	Hb levels in grams/ dl Normal blood levels >11g/dl Mild anemia 10 -10.9 g/dl Moderate 9.9 – 7.0 g/dl Severe <7 g/dl	Mothers file on pregnancy HB levels.
12.	The most recent HIV viral load levels	Copies of HIV virus in blood, measured in copies per ml. < 50 copies >50 to ≤ 1,000 copies > 1,000 copies	Counts as per laboratory tests (results within the last 6 months

Table 3.2: Infant study variables

No.	Infant variables	Definition	Measurement
1.	Age of infant at enrolment to HIV clinic	Infants age completed in months	Chronological age in weeks / months – Documented age in infants medical file
2.	HIV status of the infant	HIV positive or HIV negative based on initial test at 6 weeks or as soon as possible	DNA/PCR HIV results of the infant documented in the infants file- thereafter.
3.	Infants Age when HIV DNA PCR diagnosis was done.	Age completed in weeks at the time HIV DNA PCR diagnosis was done.	Documented age at time of HIV diagnosis in infants
4.	Infant ARV prophylaxis	Infants Anti-retroviral prophylaxis: Nevirapine (NVP), Zidovudine (AZT), NVP+ AZT, any other.	Infants file on documented ARV prophylaxis
5.	Timing of infant ARV prophylaxis	When infant was initiated with ARV prophylaxis: Immediately birth (within 24 hrs.), below 2 weeks, two to 6 weeks, 6 weeks and beyond	Self- report
6.	Method of infant feeding	Mode of infant feeding practiced	Self-report

The study activities were tracked by study checklist (Appendix V). For example, the first study participant was assigned a unique number; Subject Identification (SID) No. 1/DD/MM/2022 – to show: serial number; date; month and year. The participants then proceeded to their home after completing all the study procedures

3.9 Data management plan

3.9.1 Data editing

The research supervisor counter-checked each questionnaire daily for completeness and consistency while in the field in order to allow for clarification from the respondents. After which the questionnaire was marked complete and ready for entry.

3.9.2 Data coding and entry

The questionnaire was pre-coded before implementation, this ensured coded responses are available for entry into a standard data entry software package developed to assure consistency of coding and data base format, this was secured with a password. The software included inbuilt data quality control checks such as valid values, range checks and inconsistency checking. This helped ensure that no forms where omitted by verifying that forms for each assigned sequential ID numbers had been entered. This expedited analysis as well as maintained confidentiality.

3.9.3 Data cleaning

Upon entry, data was then subjected to a test run to try and identify any erroneous errors that may have been committed during data entry. Such errors were then eliminated to ensure the data is complete, consistent and accurate. Daily reviews were done to ensure questionnaires were completed appropriately.

3.10 Data analysis and Methods

Variable characteristics were summarized using descriptive statistics (mean, frequency and percentages). Inferential statistics was conducted using Chi-square analysis, variables of non-statistical significance at p value >0.05 in Chi-square analysis were excluded from binary logistical regression.

Intervening variables were included in the final model of binary logistic regression in order to test for interaction effects between the independent variables and outcome variables.

The specific objectives were analysed as described below:

i. **To establish maternal sociodemographic determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.**

Maternal sociodemographic characteristics included age, marital status, occupation, income, education, parity and residence. Descriptive analysis; percentages, mean and frequencies, were conducted and results summarized in tables. Pearson Chi square tests were used to test associations between categorical variables such as marital status, occupation, education, income and area of residence with the outcome variable (infants HIV status).Pearson chi-square was suitable since it is a non-parametric (distribution free) tool and is robust with respect to the distribution of data (Mchugh, 2013). All variables significantly associated with infant HIV status were entered into a binary logistic regression model and adjusted odds ratios (OR) and their 95% confidence interval calculated. Statistical significance was set at $p<0.05$.

ii. **To examine infant related determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.**

Data on infant's age at diagnosis, infant prophylaxis and infant feeding practices was analysed using descriptive statistics; mean to describe continuous variables such as infants age, frequency and percentages to describe categorical variables such as infant's prophylaxis regimen and feeding options and results presented using frequency charts and tables. Pearson chi-square statistics were used to examine associations between the dependent variable (infant HIV status) and each of the independent variables such as infants age at diagnosis, infant prophylaxis regimen and the method of infant feeding. All variables significantly associated with infant HIV status were entered into a binary logistic regression model and adjusted odds ratios (OR) and their 95% confidence interval calculated. Statistical significance was set at $p<0.05$.

iii. **Assess maternal clinical determinants associated with mother-to-child transmission of HIV among exposed infants seeking care at the Kericho County Referral Hospital, Kenya.**

The study utilized descriptive statistics (frequency and percentages) to summarize data and the results presented in tables. Pearson chi-square statistics was used to examine associations between the dependent variable (infant HIV status) and each of the independent variables which included stage of HIV, timing of HIV diagnosis, breasts condition, maternal viral load, C4 count

and Hemoglobin levels with the outcome variable (infants HIV status). Variables found significant (p value <0.05) were included in the final binary logistic regression model and their adjusted odds ratios calculated (Bursac et al., 2008). Enter method was employed because it considered moderation effect, it also allowed inclusion of desired variables which would otherwise be dropped by either backward/forward Logistic Regression. Variables significant at $p < 0.05$ in the final model were considered as independent determinant factors for infant HIV status.

iv. To determine predictors of mother-to-child transmission of HIV among exposed infants at the Kericho County Referral Hospital, Kenya.

To identify the most significant predictors, variables which were found to be statistically significant during the Chi-square analysis were entered into logistic regression model. The binary logistic regression test was done to determine the most significant predictors of MTCT of HIV. The model was tested for interaction effects to determine on whether intervening factors influenced the relationship between the independent variables and the outcome variable. Hosmer and Lemeshow test, the goodness to fit model, was applied to check how well the model fit (Fagerland & Hosmer, 2012). Variables with a p value <0.05 were considered significant. R-squared was used to represent the proportion of the variance of the variables/ predictors in the model. It was found to be about 65% which is above the threshold.

3.11 Ethical Considerations

Prior to data collection, approval was sought from Maseno University school of post graduate studies (SGS), appendix 'xi'. Further, ethical approval was obtained from Maseno University Ethical Review Committee (MUERC), appendix 'xii'. Research permit was also obtained from National Council for Science, Technology and Innovation (NACOSTI), appendix 'xiii'. Permission and a letter of authorization to conduct this study was sought from Kericho County Commissioner (appendix xiv), Kericho County Director of Education (appendix xv), Kericho Director of Health (appendix xvi) and Kericho County referral hospital Medical superintendent and management (appendix xvii). The researcher was trained on collaborative Institutional Training Initiative (CITI) ethics program hence accredited to undertake any human research (see appendix xviii).

3.11.1 Respect for study participants

All eligible study participants aged 18 years and above as well as two participants aged 17 years old, considered as mature minors gave consent after elaborate explanation and understanding of the aim of the study (SRH, 2015).Interviews were conducted in clinic rooms in order to guarantee both audio and visual privacy and confidentiality. Participation in the study was absolutely out of free will and devoid of any form of coercion with freedom to withdraw at any point of the study. Respondents were offered written consent form followed by extensive explanation by the research assistants. The informed consent form was read out verbatim to the participant in the preferred language (i.e. Kiswahili, or English). For the study participants who were illiterate, an impartial witness who was not part of the study team was used.

Enough time was allowed to discuss the study objectives, procedures, ask questions and get responses. Both the study participant and the impartial witness (in cases of special circumstances) were taken through consent form. The witness and study respondent appended a thumbprint/ signature (see appendix I). The witness remained throughout the procedure and signed the consent form to confirm that the study participant was completely informed. Two copies of informed consent were signed by the participant and the staff administering the consent. The research assistant retained one copy and the other copy was given to the participant. Only respondents who consented were enrolled into the study. Withdrawal from the study did not affect the participants future access to health care in the facility in any way. The researcher also ensured respect of study participants by asking only questions that were not detrimental to respondents' personality and dignity.

3.11.2 Confidentiality

Participants' confidentiality was protected through various means, including the use of an access-controlled, password protected computer and using study identification number. No Personally identifiable information was used in both the questionnaire and chart abstraction check list. Only codes were used in order to maintain participants' confidentiality. The code captured the HIV clinic HAART number, date (two digits), and the last digits were allocated serially as the study participants joined the study (01–102). The code included a unique number, in this case the HAART number, to enable linkage with other recommended HIV intervention services. The names remained anonymous, the SID number was used to link maternal and child

records and was only known to the researcher. Clinical information remained confidential and only released with written permission by the subject in cases of linkage to recommended HIV interventions. The study investigator stored all personally identifiable information and data bearing personal identifiers such as medical records at the hospital data room in an access-controlled, locked storage space. Research assistants were drawn from the clinic staff, this helped in reinforcing confidentiality and signed confidentiality agreement form (Appendix vi). As part of the study procedures the assistants were taken on specific ethical issues related to this study in order to understand and uphold their obligations to maintain confidentiality.

To reduce the risk of reverse identification of de-identified study participants from collected sociodemographic data, the researcher restricted data collection to only research assistants who were providing services in the clinic and who had pre-existing access to these records. Data entry, access and storage were restricted by a password. The researcher maintained a code book that linked the study number to the participant identifiers securely under double lock and key to allow follow up on necessary interventions.

3.11.3 Beneficence

This study potentially benefited the respondents by providing crucial information on key determinants of MTCT of HIV with the potential to reduce the number of children contracting HIV as well as increase child survival rates. Gaps identified in terms of service delivery informed the management and helped in the design and implementation of effective strategies aimed at reducing vertical transmission.

3.11.4 Nonmaleficence

This principle refers to an obligation of the researcher not to inflict any form of harm to the respondents (Singh, 2017). This study did not cause any harm to the respondents beyond what is considered minimum in routine care. The interviews lasted less than 1 hour, to lessen the time burden. Since there was potential for psychological harm during the interview, this was explained to the participant prior to interview. However, no case was noted that required referral to the clinic psycho-social counsellor. However, it is considered that the potential risk of social harm was not be any different from those routinely seeking HIV care and treatment services. KCRH has a mentor mother and a social worker who routinely provides psychosocial support to all persons living with HIV, including the study participants.

3.11.5 Justice

A detailed inclusion and exclusion criteria were considered in selection of study participants to ensure equal opportunities to the participants. The study population included HIV infected postnatal women of all ages and their infants. Inclusion of this population was necessary given the main objective of the study was to assess determinants of mother to child transmission of HIV among exposed infants. Randomization of study participants ensured that selection bias was addressed and provided an equal chance for those eligible to participate in the study.

3.11.6 Compensation

There was no financial reimbursement for the study participants. However, due to additional clinic waiting time for study participants, food snacks comprising of a packet of milk were provided. To reduce clinic waiting time any pending clinic procedures were fast tracked.

3.12 Data Retention and Disposition

The study data was analyzed and used to generate reports for academic purposes, as well as sharing with the Kericho County Referral hospital management and other stakeholders. The researcher upheld the principle of confidentiality by ensuring no personally identifiable information was shared in any of the reports. The information was securely filed and stored in a lockable cupboard for a minimum of five years for verification during analysis and future use (Wolverton, 2009).

3.13 Application of study results

The study provided new knowledge on determinants of MTCT likely going to be useful to the national and county ministries of Health and stakeholders implementing PMTCT programs and inform policy formulation to improve health outcomes among HIV infected mothers and their infants.

CHAPTER FOUR

RESULTS

4.1 Introduction

This section provides the study findings and their interpretation. The findings are in line with the research objectives as provided in chapter one, which were to establish maternal sociodemographic determinants, examine infant related determinants, assess maternal clinical determinants and predictors of MTCT among exposed infants seeking care at the Kericho County referral hospital.

4.2 Baseline Study Characteristics

4.2.1 Maternal sociodemographic determinants associated with MTCT of HIV

A total of 102 HIV positive postnatal mothers participated in the study. The mothers' mean age was 28.5years ± 6.2 (standard deviation: 6.2), 53% (54) were aged below 30yrs; 68.6% (n= 70) of the mothers had two or more children; majority, 75.5% (n= 77) were residing in rural settings while 59.8% (n= 61) had a monthly income of less than Ksh.5000. All (n= 102) mothers had undergone formal schooling with 39.2% (n= 40) having completed secondary education (table 4.1).

Table 4.1: Frequency distribution of maternal sociodemographic determinants

Independent Variable	Number	Percentage
	(N=102)	**%**
Age Group (years)		
≤24	24	23.5%
25-29	30	29.4%
30-34	25	24.5%
≥35	23	22.5%
Parity		
1 child	32	31.4%
2 or more	70	68.6%
Marital status		
Married	70	68.6%
Single	29	28.4%
Widowed	3	2.9%
Monthly income		
<Ksh.5,000	61	59.8%
Ksh. ≥5000	41	40.2%
Education Level		
None	0	0.0%
Primary	34	33.3%
Secondary	40	39.2%
Tertiary	28	27.5%
Occupation		
Employed	15	14.7%
Business/daily wages	38	37.3%
Unemployed	26	25.5%
Farming	23	22.5%
Area of residence		
Rural	77	75.5%
Urban	25	24.5%

Table legend: N= sample size

4.2.2 Baseline infant related determinants associated with MTCT of HIV

The HIV prevalence of infants enrolled in the study was 13.7% (n= 14). Over half, 60.8% (n= 62) of the infants were males. The median age at HIV diagnosis was 8.0 weeks (Interquartile range: 4-12) and majority, 75.5% (n= 77)were aged >6-8 weeks. Majority, 98.6% (n= 100) of the infants were on infant ARV prophylaxis, combination of Zidovudine (AZT) and Nevirapine (NVP) with 97% (n= 99) of them initiated immediately after birth. A vast majority, 92.2% (n=

94) reported practising exclusive breastfeeding. However, 11.8% (n= 12) reported early mixed feeding, meaning they gave other oral feeds apart from breast milk within 3 days after birth. Those who reported practicing mixed feeding within the first 6 months after birth were much lower, 4.9% (n= 5) compared to those who practiced early mixed feeding (table 4.2).

Table 4.2: Frequency distribution of infant related determinants

Independent Variable	**Number**	**Percentage**
	***(N=102*)**	**%**
HIV status Positive	14	13.7%
Negative	88	86.3%
Gender		
Male	62	60.8%
Female	40	39.2%
Age at time of diagnosis		
≤6 weeks	22	21.6%
>6- 8 weeks	77	75.5%
>8 weeks	3	2.9%
Infant ARV prophylaxis		
Zidovudine (AZT)	1	1%
Nevirapine (NVP) + AZT	100	98.6%
Others	1	1%
Timing of infant prophylaxis		
Immediately birth (within 72 hrs)	99	97.1%
2- 6 weeks	3	2.9%
Other	1	1%
Early mixed feeding - *Anything given (oral feeds) to Child in first 3days	2	2%
Can't remember		
Yes	12	11.8%
No	88	86.3%
Infant feeding practices		
Exclusive breastfeeding	94	92.2%
Exclusive replacement feeding	3	2.9%
**Mixed feeding	5	4.9%

Table legend:

1. anything given to child in the first 3 days after birth excluding breast milk and prescribed medicine. This included water, herbal concoctions and cow's milk.*

*** mixed feeding within the first 6 months after birth*

2. Abbreviations: AZT – Zidovudine, NVP- Nevirapine

4.2.3 Baseline maternal clinical determinants associated with MTCT of HIV

Majority of the mothers, 79.4% (n= 81) were diagnosed with HIV before their last pregnancy, 86% (n= 88) were in WHO clinical stage 1; 98% (n= 100) had normal breast condition and 82.4% (n= 84) with normal HB levels >11 g/dl. The median hemoglobin was 12.0 g/dl (interquartile range 8.0– 14 g/dl). Majority, 85% (n= 87) did not have CD4 count done. The mean CD4 count was 462 cells/ul ±3.4 (standard deviation= 3.4). Approximately three quarters, 71.6% (n= 73) of participants had undetectable viral load (< 50 copies/ml). Those who had detectable viral load (>50 copies/ml) had a median value of 75 copies per ml (interquartile range: 51-102,000 copies/ml). This is shown in table 4.3.

Table 4.3: Frequency distribution of maternal clinical determinants of MTCT of HIV

Independent Variable	**Number**	**Percentage**
	***(N=102*)**	**%**
Time of HIV diagnosis		
Before last pregnancy	81	79.4%
During the last pregnancy	18	79.6%
During delivery	0	0.0%
Postnatal	3	2.9%
Breast condition		
Normal	100	98%
Cracked nipples/Mastitis	2	2.0%
Pregnancy HB levels		
Normal blood levels >11g/dl	84	82.4%
Mild anemia 10 -10.9 g/dl	16	15.7%
Moderate 9.9 – 7.0 g/dl	2	1.9%
WHO staging		
I	88	86.3%
II	7	6.9%
III	7	6.9%
CD4 Count		
>500 cells/ul	6	5.9%
201-500 cells/ul	8	7.8%
≤ 200 cells/ul	1	1%
Not done	87	85.3%
Viral load results (copies/ml)		
<50	73	71.6%
>50 to <1000	8	7.8%
≥1000	6	5.9%
Not done	15	14.7%

Table legend: Abbreviations: HB, Hemoglobin; WHO, Word Health Organization

4.2.4 Intervening variables

A) Stigma

Stigma was assessed using a shorter version of HIV stigma scale of 12 items with 3 domains; internalized stigma, perceived stigma and experienced stigma (Reinius et al., 2017). This was measured using a 5-point Likert scale ranging from I (strongly agree) to 5 (strongly disagreed). For internalized stigma, when the study participants were presented with the statement, "I feel ashamed because of my HIV status", more than half, 57.8% (n= 59) strongly disagreed. About one quarter of the participants strongly agreed with, "feeling guilty" and "blaming themselves" due their HIV status. Majority, 76.5% (n= 78) and 83.3% (n= 85)) strongly disagreed with the statements, "I feel I should be punished and "I feel suicidal" in regard to their HIV status respectively.

On perceived stigma, about half, 49% (n= 50) strongly disagreed with the statement "People think that having HIV is shameful and they should not be associated with me", however, 18.6% (n= 19) strongly agreed with the statement "I fear of how others would respond by me or my child testing HIV positive". On experienced stigma, majority, 80% (n= 82) strongly disagreed with "been denied health services", however, about half, 49% (n= 50) strongly agreed with "being gossiped due to their HIV status". This is shown in table 4.4 below.

Table 4.4: Frequency distribution of participants responses on stigma.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Internalized Stigma					
*I Feel ashamed because of my HIV status	59(57.8)	9 (8.8)	4(3.9)	6(5.9)	24 (23.5)
*I feel guilt of my HIV status	50(49.0)	9(8.8)	9(8.8)	7(6.9)	27(26.5)
*I blame myself because of my HIV status	48(47.1)	8(7.8)	10(9.8)	10(9.8)	26 (25.5)
*I blame others because of my HIV status	48(47.1)	3(2.9)	7(6.9)	13(12.7)	31(30.4)
* have low self-esteem because of my HIV status	47(46.1)	6(5.9)	25(24.5)	10 (9.8)	14(13.7)
*I feel I should be punished	78(76.5)	7(6.9)	5(4.9)	5(4.9)	7(6.9)
*I feel suicidal due to my HIV status	85(83.3)	5(3.9)	1(1.0)	4(3.9)	7(6.9)
Perceived Stigma					
**People think that having HIV is shameful and they should not be associated with me	50(49.0)	8(7.8)	20(19.6)	13(12.7)	11(10.8)
**Fears about how other people would respond by either me or my child testing HIV-positive	32(31.4)	11(10.8)	29(28.4)	11(10.8)	19(18.6)
Experienced Stigma					
***Being gossiped about because of your HIV status?	25(24.5)	7(6.9)	4(3.9)	16(15.7)	50(49.0)
***Been denied any health services because of your HIV status?	82(80.4)	8(7.8%)	2(2.0)	8(7.8)	2(2.0)
***Been excluded from social activities because my status	47(46.1)	6(5.9)	25(24.5)	10 (9.8)	14(13.7)

*Legend: *Internalized stigma, **perceived stigma, ***experienced stigma,*

B) Self-efficacy

Self-efficacy was assessed using a 5-point Likert scale ranging from I (strongly agree) to 5 (strongly disagreed). This was further classified in 3 levels ; high self-efficacy (agree and strongly agree), moderate self-efficacy (neutral) and low self -efficacy (strongly disagree and disagree) (Mwangi et al., 2021). Majority across the statements showed high self-efficacy ranging from 88% to 93% (n= 102). This is shown in table 4.5. below**.**

Table 4.5: Frequency distribution of participants responses on self -efficacy.

Statement	**Low self-efficacy**		**Moderate**	**High self-efficacy**	
	Strongly disagree	***Disagree***	***Neutral***	***Agree***	***Strongly agree***
	n (%)	***n (%)***	***n (%)***	***n (%)***	***n (%)***
I am responsible for maintaining my health by taking ARV medications	1(1%)	0(0%)	1(1%)	8(8%)	92(90)
I am able to practice exclusive breastfeeding (EBF) for the first six months after birth.	1(1%)	2(2%)	1(1%)	8(8%)	90(88%)
My baby's health depends on how well I look after her/him and giving prescribed medications	0(0%)	0(0%)	2(2%)	7(7%)	93(91%)
My baby and I are able to keep all the clinic appointments without fail	1(1%)	1(1%)	1(1%)	9(9%)	90(88%)

Legend: N=sample size, 102.

4.3 Determinants of Mother-Child Transmission of Hiv

4.3.1 Maternal Sociodemographic characteristics associated with MTCT of HIV

On univariable analysis, no significant association was noted between HIV transmission and maternal age (chi-square: 3.672, *p*= 0.721), parity (chi-square: 0.370, *p*= 0.831), marital status *(*chi-square: 1.527, *p*= 0.822), level of education (chi-square: 1.340, *p*= 0.720), occupation *(*chi-square: 7.456, *p*= 0.114) and area of residence (chi-square: 0.526, *p*= 0.729). Monthly income levels of less than Ksh. 5000 was significantly associated (chi-square: 11.144:*p*= 0.025) with MTCT of HIV with a higher proportion of positive infants, 16.4% (n= 10).Although a high

proportion of positive infants, 18.5% (n= 10) was noted among mothers aged below 30 years, it was not significantly associated with HIV transmission (chi-square: 3.672, *p*= 0.721). Similarly, a high proportion of positive infants was noted among women with ≥ 2 children, 14.3% (n= 10) and those residing in rural areas, 14.3% (n= 11) though not significantly associated with MTCT of HIV with *p* values of 0.831 and 0.769respectively (Table 4.6 below).

In summary, only low-income levels among the mothers increased the risk of MTCT of HIV. Maternal age, parity, marital status, level of education, occupation and area of residence did not have any significant association with MTCT of HIV.

Table 4.6: Bivariate Chi square analysis of maternal sociodemographic determinants associated with MTCT.

Maternal variables		**Infants HIV Status**		***x^2 value***	***p* value**
Variable Name	***Total***	***Positive***	***Negative***		
	N=102	***n (%)***	***n (%)***		
Age Group(years)					
≤24	24	4(16.7%)	20(83.3%)	3.672	.721
25-29	30	6(20%)	24(80%)		
30-34	25	2(8%)	23(92%)		
≥35	23	2(8.7%)	21(91.3%)		
Parity					
1 child	32	4(12.5%)	28(87.5%)	0.370	0.831
≥2 children	70	10(14.3%)	60(85.7%)		
Marital status					
Married	70	9(12.9%)	61(87.1%)	1.527	0.822
Single	18	3(16.7%)	15(83.3%)		
Divorced	11	1(9.1%)	10(90.1%)		
Widow	3	1(33.3%)	2(66.7%)		
Occupation					
Employed	15	5(33.3%)	10(66.7%)	7.456	0.114
Business/daily wages	38	4(10.5%)	34(89.5%)		
Unemployed	26	2(7.7%)	24(92.3%)		
Farming	23	3(13.0%)	20(87.0%)		
Monthly income (Ksh.) <5000	61	10(16.4%)	51(83.6%)	11.144	*0.025
≥5000	41	4(9.8%)	37(90.2%)		
Education Level					
None	0	0(0%)	0(0%)	1.340	0.720
Primary	34	6(17.6%)	28(82.4%)		
Secondary	40	4(10%)	36(90%)		
Tertiary	28	4(14.3%)	24(85.7%)		
Place of residence				0.526	0.769
Urban	25	3(12%)	22(88%)		
Rural	77	11(14.3%)	66(85.7%)		

Table legend: (1) N, sample size 102. The percentages based on row totals for each category
*2) *statistically significant <0.05*
3)Abbreviations, x^2 Chi-square value, p value- level of significance

4.3.2 Infant related determinants associated with MTCT of HIV

On chi-square analysis, delayed infants age at the time of HIV diagnosis (chi-square: 19.526, *p*= <0.001), late initiation of infant prophylaxis (chi-square: 19.429, *p* =<0.001), Anything given to the child within the first 3 days after birth (chi-square: 32.266, *p*= <0.001) and mixed infant feeding practices within the first 6 months after birth (chi-square:9.844, *p*= 0. 007) were significantly associated with HIV transmission. A high proportion of HIV positive infants was noted among those diagnosed past 6 weeks of age, 12% (n= 12); initiated on prophylaxis after 6 weeks of age 100% (n= 3); practiced early mixed feeding within the first 3 days after birth, 66.7% (n= 8) and mixed infant feeding practices within the first 6 months of life, 60% (n= 3). Infants gender (x^2 = 0.090, *p*= 0.794) and type of infant ARV prophylaxis (x^2 = .325, p= 0. 850) were not significantly associated with infant's HIV status. Majority, 83(88.3%) of the HIV negative infants were among mothers who practiced exclusive breast feeding (table 4.7 below).

In summary infant related determinants significantly associated with MTCT of HIV were delayed infants age at the time of HIV diagnosis, late initiation of infant prophylaxis, anything given to the infant within the first 3 days of birth and mixed infant feeding practiceswithin the first 6 months after birth.

Table 4.7: Bivariate Chi square analysis of Infant related determinants associated with MTCT of HIV

Infant related factors	**Infants HIV status**			x^2 ***value***	***p* value**
Variables	***Total***	***Positive***	***Negative***		
	N=102	***n (%)***	***n (%)***		
Age at time of diagnosis					
≤6 weeks	22	2(9.1%)	20(90.9%)	19.526	*0.001
>6- 8 weeks	77	9(11.7%)	68(88.3%)		
>8 weeks	3	3(100%)	0(0%)		
Gender					
Male	62	8(12.9)	54(87.1%)	0.090	0.794
Female	40	6(15%)	34(85%)		
Infant ARV prophylaxis					
Zidovudine (AZT)	1	0(0%)	1(100%)	.325	.850
Nevirapine (NVP) + AZT	100	14(14%)	86(86%)		
Others	1	0(0%)	1(100%)		
Timing of infant prophylaxis					
Immediately birth	99	11(11.1%)	88(88.9%)	19.429	*0.001
2 - 6 weeks	-	-	-		
> 6 weeks	3	3(100%)	0(0%)		
****Anything given to Child in first 3days**					
Can't remember	2	0(0%)	2(100%)		
Yes	12	8(66.7%)	4(33.3%)	32.266	*0.001
No	88	6(6.8%)	82(93.2%)		
Infant feeding practices					
EBF	94	11(11.7%)	83(88.3%)	9.844	*.007
ERF	3	0(0%)	3(100%)		
Mixed feeding	5	3(60%)	2(40%)		

Table legend*: The percentages are based on row totals for each category,*

*** Early mixed feeding, anything given to child in the first 3 days after birth excluding breast milk and prescribed medicines*

*** mixed feeding within the first 6 months after birth*

**statistically significant <0.05.*

Abbreviations:(x^2) = Chi-Square value, EBF - exclusive breastfeeding, ERF- exclusive replacement feeding

4.3.3 Maternal clinical determinants associated with MTCT of HIV

On chi-square analysis there was no significant association found in regard to time when mother was HIV diagnosed (chi-square: 2.070, *p*= 0.352), clinical stage of HIV (chi-square*:* 1.197, *p*= 0.550), breast condition (chi-square: 2.267, *p*= 0.132) and maternal HB (chi-square: 0.361, *p*= 0.835) with infant's HIV status. Majority, 85% (n= 87) of the mothers did not have CD4 count results. However, those with CD4 count of >500 cells/ml (chi-square: 8.185, *p*= 0.042) and viral load of more than 50 copies/ml (chi-square: 58.002, *p*= <0.001) were significantly associated with MTCT of HIV (table 4.8).

In summary, only high maternal viral load of above 50 copies/ml and CD4 count greater than 500 cells/mlhad a statistically significant association with MTCT of HIV. None of the other clinical factors had significant association with MTCT of HIV.

Table 4.8: Bivariate Chi square analysis of maternal clinical determinants associated with MTCT of HIV.

Independent Variable	Infants HIV Status			x^2 value	*p* value
	Total	*Positive*	*Negative*		
	N= 102	*n (%)*	*n (%)*		
Time of HIV diagnosis					
Before last pregnancy	81	12(14.8%)	69(85.2%)		
During the last pregnancy	18	1(5.6%)	17(94.4%)	2.070	.352
Postnatal period	3	1(33.3%)	2(66.7%)		
WHO clinical Stage					
I	88	13(14.8%)	75(85.2%)		
II	7	1(14.3%)	6(88.7%)	1.197	.550
III	7	0(0%)	7(100%)		
Breast condition					
Normal	100	13(13%)	87(87%)	2.267	.132
Cracked nipples/mastitis	2	1(50%)	1(50%)		
CD4 count (cells/ul)					
>500	6	3(50%)	3(50%)		
201-500	8	0(0%)	8(100%)	8.185	*.042
≤ 200	1	0(0%)	1(100%)		
Not done	87	11(12.6%)	76(87.4%)		
Viral load result					
<50 copies per ml	73	3(4.1%)	70(95.9%)		
>50 to <1000	8	6(75%)	2(25%)	58.002	*0.001
≥ 1000	6	5(83.3%)	1(16.7%)		
Not done	15	0(0%)	15(100%)		
Pregnancy HB levels					
Normal levels >11g/dl	84	(14.3%)	72(85.7%)		
Mild anemia 10-10.9 g/dl	16	2(12.5%)	14(87.5%)	.361	.835
Moderate 9.9– 7.0 g/dl	2	0(0%)	2(100%)		

*Table legend: (1) The percentages are based on row totals for each category, (2) *statistically significant p= <0.05, (x^2) = Chi-Square value.*

4.3.4 Predictors of mother-to-child transmission of HIV

To identify the most significant predictors of MTCT of HIV, variables which were found to be statistically significant during Chi-square analysis (p= <0.05) were entered into the binary logistic regression model. These were, mothers' level of income, infants age at the time of HIV diagnosis, timing of infant prophylaxis, anything given to the child with the first 3 days after birth (early mixed feeding), mixed feeding within the first 6 months of age, maternal CD4 count and viral load. Stigma and self-efficacy were also entered in the model to test for interactions with the independent variables. Hosmer and Lemeshow test, the goodness to fit model, was applied to check how well the model fit. Variables with a p=<0.05 were considered predictors of MTCT of HIV.

On binary logistic regression, early mixed feeding measured by oral feeds given to the child in the first three days after birth increased odds of HIV transmission by 7 -fold (OR= 7.122; 95%CI 1.375 – 36.902; p= 0.019). Age at time of infant diagnosis was significant, any week change /delay in time of HIV diagnosis significantly increased the chances of HIV transmission (OR= 0.026; 95% CI 0.002-0.334, p= 0.005). However, mothers' level of income (OR= 0.892; 95% CI 0.354-2.251, p= 0.809); maternal CD4 count (OR= 1.133; 95% CI 0.469-2.736, p= 0.781) ; viral load (OR= 0620.485; 95% CI 0.000-, p= 0.998); timing of infant prophylaxis (OR= 0.000; 95% CI 0.000, p = 0.999) and infant feeding method (OR= 0.000; 95% CI 0.000, p = 0.999) were not found to be statistically significant on binary logistic regression (table 4.9).

Table 4.9: Multivariate analysis to determine predictors of mother-to-child transmission of HIV

Variables	*Beta value*	*S.E.*	*Wald*	*Df*	*p value*	*Odds Ratio*	*95% C.I. for OR*	
							Lower	*Upper*
1. Income levels	-.114	.472	.058	1	.809	.892	.354	2.251
2. CD4 count in cells/ul	.125	.450	.077	1	.781	1.133	.469	2.736
3. Viral load levels	6.431	3142.452	<.001	1	.998	620.485	.000	-
4.Timing of infant prophylaxis	-57.779	34793.014	<.001	1	.999	.000	.000	-
5. **Mixed feeding	-11.233	13081.916	.000	1	.999	.000	.000	-
6. ***Early mixed feeding	1.963	.839	5.471	1	.019*	7.122	1.375	36.902
7.Age in weeks at the time of diagnosis	-3.651	1.303	7.850	1	.005*	.026	.002	.334
8.Perceived Self Efficacy	2.098	.785	7.138	1	.008*	8.151	1.749	37.992
9.Stigma	-2.616	.890	8.634	1	.003*	.073	.013	.419
Constant	3.017	4.117	.537	1	.464	20.438	-	

*Table Legend :1. Model Goodness of fit using Hosmer Lemeshow test at x^2=12.722, df = 8, p=0.122).2.Abbreviations: S.E-standard error, df - degree of freedom, CI -confidence interval, OR -odds ratio3.*** anything given to child in the first 3 days after birth excluding breast milk and prescribed medicine.*

*4** mixed feeding within the first 6 months after birth*

5. statistically significant <0.05.*

Stigma and perceived self-efficacy were the intervening variables. There was no statistical difference in the various types of stigma hence were collapsed into one variable, stigma.Presence of stigma increased the like hood of HIV positive infant (OR= 0.073; 95% CI 0.013-0.419, p = 0.003) while perceived self-efficacy was protective. The odds of having HIV negative infant was

eight-fold higher among mothers with high perceived self-efficacy (OR= 8 .151; 95% CI 1.749 - 37.992 *p*= 0.008).

In the presence of stigma alone, the predictors were very significant, meaning the odds of transmission of HIV to the infant increased significantly. The Hosmer-Lemeshow also showed that the model was the best of fit. Anything given to the child in the first three days after birth increased odds of HIV transmission (early mixed feeding) by 9-fold (OR= 9.099; 95%CI 2.104 – 39.355; *p*= 0.003), compared to 7-fold when stigma was paired with self-efficacy. Any week delay in time of infant HIV diagnosis significantly increased the chances of HIV transmission (OR= 0.67; 95% CI 0.009 - 0.500, *p* = 0.008). This is shown in table 4.10 below.

Table 4.10: Multivariate analysis to determine independent predictors of MTCT of HIV with stigma as the intervening variable

Variables	*Beta value*	*S.E.*	*Wald*	*Df*	*P value*	*Odds ratio*	*95% C.I. for OR*	
							Lower	*Upper*
Early mixed feeding	2.208	.747	8.734	1	.003*	9.099	2.104	39.355
Age in weeks at the time of diagnosis	-2.699	1.024	6.948	1	.008*	.067	.009	.500
Stigma	-2.264	.752	9.058	1	.003*	.104	.024	.454
Constant	9.585	3.387	8.011	1	.005*	14544.248		

Table Legend:1. Abbreviations: S.E-standard error, df - degree of freedom, CI -confidence interval, OR -odds ratio

*2. *statistically significant <0.05.*

3. Model Goodness of fit using Hosmer Lemeshow test at X^2=7.231, df = 8, p= 0.512

In the presence of perceived self- efficacy alone, the predictors were significant but the model was not best of it. Anything given to the child in the first three days increased the chances of HIV transmission by 4-fold, (OR= 4.993, OR [95% CI] = [1.256- 19.854] *p*= 0.22) while delayed age at the time of diagnosis(OR= 0.58, OR [95% CI] = [0.006- 0.530] *p*= 0.012) increased transmission risk. However, the Hosmer-Lemeshow test revealed that the model was not the best of fit with even constant/intercept not significant (*p*= 0.223) as shown in table 4.11 below.

Table 4.11: Multivariate analysis to determine independent predictors of MTCT of HIV with perceived self-efficacy as the intervening variable

Variables	*Beta value*	*S.E.*	*Wald*	*Df*	*P value*	*Odds Ratio*	*95% C.I. for OR*	
							Lower	***Upper***
Early mixed feeding	1.608	.704	5.212	1	.022*	4.993	1.256	19.854
Age in weeks at the time of diagnosis	-2.840	1.124	6.377	1	.012*	.058	.006	.530
Perceived Self Efficacy	1.776	.637	7.782	1	.005*	5.905	1.696	20.566
Constant	-3.791	3.113	1.483	1	.223	.023		

Table Legend: 1. Abbreviations: S.E-standard error, df - degree of freedom, CI -confidence interval, OR -odds ratio

*2. *statistically significant <0.05.*

3. Model Goodness of fit using Hosmer Lemeshow test at X^2=12.745, df = 3, p=0.005

In summary; the model containing both stigma and perceived self - efficacy was considered the best model because the Nagelkerke R- square was higher, explaining about 65% of the variations observed in the study ($p< 0.05$).

Independent predictors of MTCT of HIV in presence of both stigma and perceived self -efficacy were, early mixed feeding and delayed infants age at the time of HIV diagnosis. Early mixed feeding increased HIV transmission by 7-fold compared to infants who were exclusively breast fed. Further, any delay in time of infant HIV diagnosis increased significantly the risk for MTCT of HIV. Whereas presence of stigma negatively affected MTCT outcomes, high perceived self-efficacy was noted to be protective and improved infant outcomes

CHAPTER FIVE
DISCUSSION

5.1 Introduction

This chapter discusses the findings of the study in line with the research objectives in chapter one. Exploration of related studies on mother to child transmission of HIV was done to point out any similarities and areas of divergence.

5.2 Discussion

5.2.1 Maternal Sociodemographic determinants associated with MTCT of HIV

The average age of mothers observed was 28.5 years with a narrow spread, indicating a relatively young population. This phenomenon mirrors the women seeking antenatal care and child welfare clinics in Kericho County, with the peak age being 28 years. Mother to child transmission of HIV is a multifactorial event with complex pathways where both the virus, maternal and infant, environmental as well as systems factors concurrently synergize each other to influence in diverse ways the HIV epidemic dynamics across regions and sub-populations in Kenya (Ellington et al., 2018).

In the current study, the proportion of positive infants noted among mothers aged below 30 years was relatively higher yet, age was not found to be significantly associated with MTCT of HIV. This points to possible extraneous factors independent of maternal age putting the mothers at risk of transmitting HIV to their infants. A recent study in Kenya by (Waruru et al., 2021) indicated presence of increasing male infectivity levels but their interactions and relative contributions to increasing risks for MTCT was unclear. Similar studies in Ethiopia (Negussie Deyessa, 2015) and Kenya (Okoko, Owuor, & Kulzer, 2017) also noted no association between maternal age, occupation, parity and marital status with MTCT of HIV.

Whereas in the current study, earning a low monthly income of less than Ksh.5000 significantly increased the likelihood of higher maternal MTCT of HIV in bivariate analysis, consistent with the (KENPHIA, 2020)study, it was not independently associated with MTCT in a multivariate analysis. In a previous study conducted in western Kenya (Ndege et al., 2016)those with higher level of education and income had relatively better knowledge on HIV indicating potential interaction among these variables. In contrast, a hospital based cross-sectional study conducted in Kenya among predominantly rural folk with high MTCT risk revealed no statistically

significant association in PMTCT uptake and the participant's level of family income (Ndonga & Matu, 2019).

Systematic reviews of studies from low- and medium-level income countries in sub-Saharan Africa found there was no association of socioeconomic status and perinatal transmission of HIV where there is relative equitable access to health care services provided to HIV positive mothers (Peltzer & Pengpid, 2013; Siegfried et al., 2011; S. A. Woldesenbet et al., 2017). This could be because of provision of standard package of maternal and child health services including HIV services that are widely accessible. This can be a pointer to other factors beyond maternal socioeconomic and demographic factors that are responsible for the high infant HIV infections. However, the relative factor contribution, clustering and level of interaction of income with other drivers of MTCT was not further explored in this study.

In summary, in the current study low monthly income was significantly associated with infant's HIV status. The finding of no significant association between mother's age, occupation, parity, marital status, education level and area of residence with MTCT of HIV in the current study is similar to most studies in Kenya.

5.2.2 Infant related determinants associated with MTCT of HIV

The observed prevalence of HIV among the infants was 13.7%. This is higher than the national average of 11.5%, but comparable to 14.5% that was reported in Kericho County in 2017 (Kenya HIV estimates, 2018). This reveals an existing variability in MTCT potentially related to contextual factor interactions. Also, it may indicate gaps in mother and infant care follow up as well as higher community transmission of HIV. This is of high concern given the County is classified as a low HIV burden region, where HIV transmission ranges at 2.9%, higher among females at 4.1% (Kenya HIV estimates, 2018).

Majority of the participants presented late to the clinic, resulting to delayed testing of HIV exposed infants and consequently, the late initiation of infant prophylaxis. Delayed age (beyond 6 weeks) at time of HIV diagnosis was significantly associated with increased risk for MTCT of HIV in the current study. Infants diagnosed beyond 6 weeks of age were more likely to be HIV positive compared to those diagnosed within 6 weeks. The median age at first postnatal visit was 8 weeks compared to the nationally recommended 6 weeks (NASCOP, 2018; World Health

Organization, 2018). The late presentation to the postnatal clinic and delayed testing and HIV diagnosis increases the risk of preventable mother to child HIV transmission. A similar study conducted in Kenya and Ethiopia indicated that delayed age of infant HIV testing, older infants and late enrolment increases the chances of infants contracting HIV (AShiono et al., 2017; Wudineh & Damtew, 2016a). In Kenya, performance of postnatal care visit is still suboptimal, with attendance by 6 weeks as recommended being about 69% in rural settings, indicating need for strengthening postnatal care programs (KDHS, 2022).

Studies by (Wudineh & Damtew, 2016a) in Ethiopia noted the significance of starting infant prophylaxis immediately after birth as an important intervention to reduce the chances of having an HIV infected infant. Whereas early initiation in treatment is critical, without adherence to treatment and observance of safe infant feeding practices the risk of contracting HIV still remains.

In the current study, anything given to the infant in the first 3 days after birth (early mixed feeding) and mixed infant feeding practices within the first 6 months of age were significantly associated with MTCT of HIV. Some of the feeds given alongside breast milk included, water mixed with medicinal herbs and cow's milk. Early mixed feeding has been shown to corrode the mucosal epithelia which increases susceptibility to infective agents. The infant's gastrointestinal system is immature and irritation makes them prone to damage hence, acting as entry point for the HIV virus present in the mother's milk (Quitadamo et al., 2021).

Exclusive breast feeding during this period is recommended because breast milk has been shown to contain anti-inflammatory factors that diminish replication of the HIV virus (Quitadamo et al., 2021). Also, breast milk has immunological components that increase the number of white blood cells in circulation, which help to reduce the chances of the infant contracting HIV infection (Quitadamo et al., 2021). In a previous study by (Mwau et al., 2017) observed that mixed infant feeding when compared with early exclusive breast feeding, was associated with a 7 -fold higher risk of MTCT of HIV.

Whereas Kenya adopted the WHO guidelines recommending exclusive breastfeeding for the first 6 months of life for all mothers regardless of HIV status (WHO, 2016) this has not yet been universally accepted. Studies done in Kenya noted cultural practices that advocate for

introduction of herbal medications when a child is born deter the practice of exclusive breastfeeding. Often the community does not perceive this as a form of mixed feeding (Lang'at et al., 2018).Any form of mixed feeding within the first 6 months of birth might increase the transmission risk due to the underdeveloped gastrointestinal tract that allows the HIV virus to pass through to the infants blood stream (Wudineh & Damtew, 2016a).

In summary, delayed age at the time of HIV diagnosis beyond 6 weeks, late initiation of infant prophylaxis, and any form of mixed infant feeding practices, that is, anything given to the infant in the first 3 days of birth and mixed infant feeding practises within the first 6 months after birth increased significantly the risk of MTCT of HIV.

5.2.3 Maternal clinical determinants associated with MTCT of HIV

In the current study, there was significant association between high maternal viral load of above 50 copies/ml and CD4 count of above 500 cells/ml with MTCT of HIV.However, over 85% of the study participants did not have a CD4 count done. According to the current, Kenya HIV care and treatment guidelines, CD4 count is not a mandatory test before initiation of treatment. However, it is only recommended for the newly HIV diagnosed and those suspected to be failing treatment (NASCOP, 2018). A previous study in Rwanda by Mugwaneza et al. (2018) observed that CD4 count was not a predictor of MTCT although the study used a cut off of 350 cells/ul unlike in the current study that used a cut off 500 cells/ul. Low CD4 count of less than 200 copies per ml is an indicator HIV disease progression and has been associated with increased HIV transmission risk (Liu et al., 2017).

Comparatively, a high viral load of more than 50 copies/ml was significantly associated with MTCT of HIV. High viral load poses a significant risk in transmitting HIV to the unborn child especially among breastfeeding infants. Breastmilk is one of the pathways to transmission of HIV as the virus can infiltrate through the intestinal mucosa into the interstitial cells. Undetectable or low viral load reduces chances of HIV transmission and further affirms the treatment messaging given to HIV patients that undetectable equals to untransmissible (Onoya et al., 2020; Wudineh & Damtew, 2016b).

A recent nationally representative study showed that Kericho County has a much lower viral suppression among adults of 44.7% against national average of 71.6% and the targeted 95%

required to eliminate MTCT of HIV (Bortich, 2016; KENPHIA, 2020). This might help to explain the observed high infant HIV prevalence noted in the current study. Mothers who are newly diagnosed with HIV during their last pregnancy or postnatally have been shown to be more likely to pass the virus to their infants due to high viral load (Hussen et al., 2022).

Existing studies still show inconsistences of effect of viral load and CD4 count on MTCT, with a study by AShiono et al., (2017) in Kenya not including viral load data due to unavailability. A similar study in Ethiopia by (Beyene et al., 2018) showed presence of significant incompleteness of CD4 and viral load records. This supports the need for more consistent assessment of multiple aspects of both mother and infant (Odhiambo et al., 2016; Potty et al., 2019; Wudineh & Damtew, 2016a).

In summary, high maternal viral load of above 50 copies/ ml and CD4 count above 500 cells/ml were the only clinical determinants of MTCT of HIV. However, currently there is still inconsistency in their application for routine monitoring, yet this is essential to reducing transmission risk. Whereas elimination of MTCT is critical to achieving Sustainable Development Goal (SDG) number three, which aims at ending the AIDS epidemics by 2030, the current study findings show the challenges towards achieving the global targets. The barriers however, are surmountable through program improvement interventions. Enhancing strategies to strengthen postnatal PMTCT is desirable to avert preventable HIV infections (UNAIDS, 2018b).

5.2.4 Predictors of mother to child transmission of HIV

The independent predictors of MTCT were early mixed feeding and delayed age at time of HIV diagnosis, these were observed to have varying effects in presence stigma and self-efficacy. Early mixed feeding referred to giving an infant any oral feeds other than breast milk and prescribed medications within the first 3 days after birth. Early mixed feeding increased HIV transmission by 7-fold compared to infants who were exclusively breast fed.

Delayed age at the time of HIV diagnosis referred to HIV test conducted past 6 weeks of age. Further, any delay in time of infant HIV diagnosis increased significantly the risk for MTCT of HIV. The delayed infant HIV diagnosis as well as late presentation to the postnatal clinic can be attributed to various factors; systems- and socio-cultural-related factors, among them stigma on the part of the mother, lack of testing commodities in the facilities or lack of capacity of the health care provider to collect blood samples for infant diagnosis.

Stigma and perceived self-efficacy, the intervening variables in the study, were noted to significantly affect MTCT of HIV. Whereas presence of stigma negatively affected MTCT outcomes, perceived self-efficacy was noted to be protective and improved infant outcomes. Perceived self-efficacy downgraded the adverse effects of stigma on MTCT. Stigma may be experienced as internalized stigma, perceived stigma or experienced stigma (Reinius et al., 2017). Stigma among mothers, regardless of the various types, can be a barrier to adherence and early initiation of treatment as noted in this study (Gesesew et al., 2017). Studies conducted in Nigeria (Aregbesola & Adeoye, 2018) and South Sudan (Elsiddig Elsheikh et al., 2022) found women with high self-efficacy were likely to get tested for HIV and adhere to treatment. Whereas, studies from low-income countries found that stigma is an important modifier of HIV-related outcomes leading to delay in seeking timely medical interventions (Gesesew et al., 2017), multiple systematic reviews of literature in sub-Saharan Africa have shown that psychological interventions do not always result in improved ART uptake and infant HIV testing among HIV-positive women (Ambia & Mandala, 2016). On the other hand, investing in health systems strengthening can enhance commodity security and health care workers capacity.

Majority of mothers in the current study were aged below 30 years, an age-group already experiencing multiple intersecting identities (Gander, 2016). Intersecting identities may further modify their protective or risky behaviors as well as health seeking. Conversely, behaviours may be further modified by health education and promotion activities, designed to improve knowledge, self- and collective-efficacy as well as intentions for behaviour change (Okoko, Owuor, & Kulzer, 2017). However, these interventions also act differentially across population groups and geographical contexts and may exhibit temporal patterns that are worth considering early in the design of the study (Lang'at et al., 2018).

As observed in the current study, stigma reduction strategies while critical, addressing perceived self-efficacy concurrently can augment stigma reduction strategies substantially.This has considerable implications on the design of health promotion and education interventions to improve PMTCT service uptake and psychosocial support.

In summary, the modifying role of stigma and self-efficacy on the determinants of MTCT in this population sample indicates the complex context for implementing PMTCT activities in this region. Their inclusion in the analysis helped to clarify contextual factors which independently

predicted mother to child transmission as noted in the current study, which were: early mixed feeding and delayed age at time of HIV diagnosis. Stigma was noted to increase significantly the risk of MTCT while perceived self-efficacy downgraded the adverse effects of stigma on MTCT, meaning high perceived self-efficacy is crucial in lowering MTCT especially where stigma is involved.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

i. Low monthly income levels was the only maternal sociodemographic determinant associated with mother-to-child transmission of HIV. There was no significant association between mother's age, occupation, parity, marital status, education level and area of residence with MTCT of HIV in the current study.

ii. Infant related determinants associated with mother-to-child transmission of HIV were, delayed age at the time HIV diagnosis beyond 6 weeks, late initiation of infant prophylaxis and any form of mixed infant feeding practices.

iii. Maternal clinical determinants associated with MTCT of HIV were high viral load of more than 50 copies per ml and CD4 count above 500 cells/ml. Viral suppression is key in reducing MTCT risk as observed in the current study.

iv. The independent predictors of mother to child transmission were early mixed feeding practices and delayed infants age at time of HIV diagnosis in presence of stigma and perceived self-efficacy as the intervening variables. Presence of stigma negatively impacted on MTCT by increasing transmission risk while self-efficacy was protective.Self-efficacy downgraded the adverse effects of stigma on MTCT, meaning high perceived self-efficacy is crucial in lowering MTCT especially where stigma is involved.

6.2 Recommendations from this study

i. HIV programs as well as County governments should focus on improving the income levels of HIV positive mothers in order to lower the risk of MTCT of HIV.

ii. HIV programs need to design interventions aimed at strengthening early testing of HIV exposed infants within 6 weeks of age, early initiation of ARV prophylaxis, promoting exclusive breast feeding starting from the immediate post birth period until 6 months of age.

iii. Health care workers providing services in HIV clinics should strive to achieve viral suppression among PMTCT mothers and enhance CD4 monitoring aimed at reducing MTCT of HIV

iv. HIV policy makers, program managers and implementers in Kericho County should focus on strategies aimed at eradicating mixed infant feeding practices, facilitating early testing of HIV exposed infants as well as improving self-efficacy and stigma reduction among HIV positive mothers as key interventions to reduce MTCT of HIV.

6.3 Recommendations for future studies

The study recommends the following areas that can be explored for further research by scholars:

i. A qualitative study on infant feeding practices among HIV positive women

ii. A comprehensive qualitative study on the modifying effects of stigma and self-efficacy on MTCT of HIV

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APPENDICES

Appendix i: Informed consent form

DETERMINANTS OF MOTHER TO CHILD TRANSMISSION OF HIV AMONG EXPOSED INFANTS IN KERICHO COUNTY REFERRAL HOSPITAL, KENYA

MASENO UNIVERSITY

AND

KERICHO COUNTY REFERRAL HOSPITAL

NAME OF INVESTIGATOR	INSTITUTION	ROLE
JANE MUMBI MULI	MASENO UNIVERSITY	PRINCIPAL INVESTIGATOR(CANDIDATE)
DR. LOUISA NDUNYU	MASENO UNIVERSITY	SUPERVISOR/CO-INVESTIGATOR
DR. DICKENS ADUDA	JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY	SUPERVISOR/CO-INVESTIGATOR

Introduction

My name is Jane Mumbi pursuing master in public health at Maseno University. Am currently undertaking a research as part of my studies at the university and am asking you to take part in an interview on determinants of mother to child transmission of HIV among HIV exposed infants in Kericho county referral hospital.

I am asking for your permission to go ahead and read to you the reason for carrying out this study. If you agree to be part of the study, I will need you to sign the agreement form and remain

with one copy. Feel free to seek for any clarification at any point as I take you through this process.

Purpose

The purpose of this project is to provide information on the factors that lead to mother to child transmission of HIV among HIV exposed infants in Kericho County referral hospital, in Kenya. It will assess maternal socio-demographic factors, infant factors, maternal clinical, viral load and immune factors. The findings from this study will be expected to generate new information on causal factors of Mother to Child Transmission of HIV. The findings will be helpful in policy formulation and programming to eliminate paediatrics HIV.

Procedure

If you decide to participate in this interview then you will give your views on factors that are likely to affect the passage of HIV from a mother to her child. Your participation will take approximately 45 minutes and notes will be taken during the process to enable us analyse the information received from respondents.

Benefits

The information you will provide on factors that affect mother to child transmission will be helpful to the hospital management, county as well as national government in terms of putting the necessary structures in programs to minimize the transmission of HIV from mother to her child. However, you may not receive direct benefit for taking part in the study.

Risks and discomforts

Neither your participation in this interview nor responses will in any way hinder the services that you are to receive here at the facility today or in future. You are also at liberty to decline to respond to any questions asked if you feel uncomfortable.

Costs and compensation

You will not be paid nor receive any incentive to participate in this interview.

Confidentiality

We would like to make it clear that the responses you provide here will be treated with absolute confidentiality. Your identity and that of your child, medical records and participation in this research will be strictly confidential. Results from these interviews will be aggregated and not looked at individually. Your name will not be written on program activity papers or used in any report. This signed consent form with your signature will be kept separate from other papers and reports in a safe, locked place and will not be accessible to anyone else apart from the research team.

Voluntariness

If you have read/been explained on the content of this research, please take note that your participation is categorically out of free will. You can at any time withdraw from the interview and/or the consent without any consequences. In addition, you have the right to decline to respond to any question you are not comfortable with during the interview.

Contact

In case you have any questions pertaining to this research or interview, please feel free to contact me at any time.

Name Jane Muli: Student Maseno University

Telephone number: 0716430201 or by

Email: jan.mumbi@gmail.com

Please leave a question or comment for me…….

You can also contact the chair of Maseno University ethical review committee at:

Tel: +254057351221

Email: muerc-secretariate@maseno.ac.ke

Do you give your consent to be part of this research?YesNo ☐ ☐

Respondent's Declaration

This study was explained to me and I was given an opportunity to ask questions, everything I needed to know concerning the study was made very clear and am satisfied with it. I therefore, willingly give my consent to be part of this research.

Parent/Caregiver's Signature: _____

Date (DD/MMM/YY): _____

Name of Investigator:

_____

Thumbprint if Parent/guardian is unable to read and write

Investigator's Signature: _____ Date (DD/MMM/YY): _____*If applicable*

Name of impartial witness: _____

Impartial witness Signature: _____Date (DD/MMM/YY): _____

Be reminded that two copies of the form are to be signed. When completed, one copy is for the patient; the other copy (original) to be kept in medical notes.

Study personnel statement

I have precisely and correctly read aloud all the information relating to this study to the prospective study respondent and without any doubt made sure that the respondent understood the study procedures and content. I wish to further confirm that the respondent was given a chance to clarify any information and ask any questions which were all elaborately answered and to the satisfaction of the respondent. I would want to offer an assurance that the respondent was not forced into giving the consent, and the consent has been given absolutely free and voluntarily

…… ……. .

Signature of research assistant Date

Appendix ii: Kiswahili Consent Form

KIAMBATISHO: FOMU YA IDHINI

VIAMUZI VYA MAMA KWA MTOTO, UAMBUKIZI WA VIRUSI VYA UKIMWI (VVU) KATI YA WATOTO WACHANGA WALIOTENGAMANA NA VIRUSI KATIKA HOSPITALI YA RUFAA YA KAUNTI YA KERICHO, KENYA

CHUO KIKUU CHA MASENO

NA

HOSPITALI YA RUFAA YA KAUNTI YA KERICHO

JINA LA MTAFITI	TAASISI	WAJIBU
JANE MUMBI MULI	Chuo kikuu cha Maseno	Mtafiti mkuu (mgombea)
Daktari. LOUISA NDUNYU	Chuo kikuu cha Maseno	Msimamizi / mchunguzi mzaidizi
Daktari. DICKENS ADUDA	Chuo kikuu cha sayansi na teknolojia cha Jaramogi Oginga Odinga	Msimamizi / mchunguzi mzaidizi

Utangulizi

Jina langu ni Jane Mumbi kutafuta shahada ya uzamili katika afya ya umma katika Chuo Kikuu cha Maseno. Hivi sasa ninafanya utafiti kama sehemu ya masomo yangu katika chuo kikuu na ninakuuliza ushiriki katika mahojiano juu ya viamua vya maambukizi ya VVU kutoka kwa mama kwenda kwa mtoto kati ya watoto wachanga walio na VVU katika hospitali ya rufaa ya kaunti ya Kericho.

Ninaomba ruhusa yako kuendelea na kukusomea sababu ya kufanya utafiti huu. Ikiwa unakubali kuwa sehemu ya utafiti, nitakuhitaji utia saini fomu ya makubaliano na ubaki na nakala moja. Jisikie huru kutafuta ufafanuzi wowote wakati wowote ninapokupitisha kupitia mchakato huu.

Lengo

Madhumuni ya mradi huu ni kutoa habari juu ya sababu zinazosababisha maambukizi ya VVU kutoka kwa mama kwenda kwa mtoto kati ya watoto wachanga walio katika VVU katika hospitali ya rufaa ya Kaunti ya Kericho, nchini Kenya. Itatathmini mambo ya mama na idadi ya

watu, sababu za watoto wachanga, kliniki ya mama, mzigo wa virusi na sababu za kinga. Matokeo kutoka kwa utafiti huu yatatarajiwa kutoa habari mpya juu ya viamua vya Uambukizi wa VVU kutoka kwa Mama kwenda kwa Mtoto. Matokeo yatasaidia katika uundaji wa sera na programu ya kuondoa VVU ya watoto.

Utaratibu

Ukiamua kushiriki kwenye mahojiano haya basi utatoa maoni yako juu ya sababu ambazo zinaweza kuathiri kupitisha VVU kutoka kwa mama kwenda kwa mtoto wake. Ushiriki wako utachukua takriban dakika 45 na noti zitachukuliwa wakati wa mchakato kutuwezesha kuchambua habari zilizopokelewa kutoka kwa wahojiwa.

Faida

Habari utakayotoa juu ya sababu zinazoathiri maambukizi ya mama kwenda kwa mtoto yatasaidia kwa usimamizi wa hospitali, kaunti na serikali ya kitaifa kwa kuweka miundo muhimu katika programu za kupunguza uambukizi wa VVU kutoka kwa mama kwenda kwa mtoto wake. Walakini, unaweza usipate faida ya moja kwa moja kwa kushiriki katika utafiti

Athari na usumbufu

Kushiriki kwako katika mahojiano haya au majibu hayatazuia kwa vyovyote huduma utakazopokea hapa kwenye kituo leo au siku zijazo. Uko huru pia kukataa kujibu maswali yoyote yanayoulizwa ikiwa unahisi wasiwasi.

Gharama na fidia

Hautalipwa wala kupokea motisha yoyote ya kushiriki katika mahojiano haya.

Usiri

Tungependa kuweka wazi kuwa majibu unayotoa hapa yatashughulikiwa kwa usiri kabisa. Utambulisho wako na wa mtoto wako, rekodi za matibabu na ushiriki katika utafiti huu zitakuwa za siri kabisa. Matokeo kutoka kwa mahojiano haya yatakusanywa na hayataangaliwa kibinafsi. Jina lako halitaandikwa kwenye karatasi za shughuli za programu au kutumika katika ripoti yoyote. Fomu hii ya idhini iliyosainiwa na saini yako itawekwa kando na nyaraka zingine na ripoti mahali salama, imefungwa na haitapatikana kwa mtu mwingine yeyote isipokuwa timu ya utafiti.

Kujitolea

Ikiwa umesoma / umeelezewa juu ya yaliyomo kwenye utafiti huu, tafadhali kumbuka kuwa ushiriki wako kimsingi hauna hiari. Unaweza wakati wowote kujiondoa kwenye mahojiano na / au idhini bila matokeo yoyote. Kwa kuongezea, una haki ya kukataa kujibu swali lolote ambalo haufurahii nalo wakati wa mahojiano.

Mawasiliano

Ikiwa una maswali yoyote yanayohusu utafiti huu au mahojiano, tafadhali jisikie huru kuwasiliana nami wakati wowote.

Jina Jane Muli: Chuo Kikuu cha wanafunzi cha Maseno

Namba ya simu: 0716430201 au kwa

Barua pepe: jan.mumbi@gmail.com

Tafadhali acha swali au maoni kwangu …….

Unaweza pia kuwasiliana na mwenyekiti wa kamati ya ukaguzi wa maadili ya Chuo Kikuu cha Maseno kwa:

Simu: +254057351221

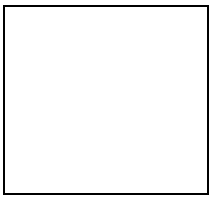
Barua pepe: muerc-secretariate@maseno.ac.ke

Je! Unatoa idhini yako kuwa sehemu ya utafiti huu? Ndio ☐ LA ☐

Azimio la Mhojiwa

Utafiti huu ulielezwa kwangu na nilipewa nafasi ya kuuliza maswali, kila kitu nilichohitaji kujua kuhusu utafiti huo kilifanywa wazi kabisa na nimeridhika nacho. Kwa hivyo mimi kwa hiari ninatoa idhini yangu kuwa sehemu ya utafiti huu

	Alama ya kidole ya gumba ikiwa Mzazi / mlezi hawezi kusoma

Sahihi ya Mzazi / Mlezi: _____  na kuandika

Tarehe (DD / MMM / YY): _____

Jina la Mchunguzi:

_____

Sahihi ya mchunguzi: _____ Tarehe(SS/MMM/MM):_____

Kumbuka kwamba nakala mbili za fomu zitatiwa sahihi. Ikikamilika, nakala 1 ni ya mgonjwa; 1 (asilia) kuhifadhiwa kwenye ripoti za matibabu.

Taarifa ya kibinafsi ya kunakili Utafiti

Nimesoma kwa usahihi na kwa ukamilivu habari zote zinazohusiana na utafiti huu wa kutarajiwa wa mhojiwa wa huu utafiti na bila shaka yoyote nilihakikisha kwamba mhojiwa anaelewa taratibu na yaliyomo kwenye utafiti. Ninapenda kuthibitisha zaidi kuwa mhojiwa alipewa nafasi ya kufafanua habari yoyote na kuuliza maswali yoyote ambayo yote yalijibiwa kwa ufafanuzi na kuridhika na mhojiwa. Ningetaka kutoa hakikisho kwamba mhojiwa hakulazimishwa kutoa idhini, na idhini hiyo imepewa bure kabisa na kwa hiari

…… .....

Sahihi ya Msaidizi wa utafiti Tarehe

Appendix iii: Data abstraction form

Date: ___/___/2022 Facility name: __

Mothers Unique Code: | | | | | | — | | | — | | | |

Dear……

My name is Jane Mumbi, I am a health professional and currently pursuing my Master's in Public Health at Maseno University. I am undertaking this study as part of a research project culminating to the award of a master's degree in public health.

The purpose of this study is to determine the reasons for passing HIV infection from mother to her infant. Information on the reasons obtained will be useful in coming up with measures to minimize the number of children contracting HIV infection. It will also help both you and baby live a long healthier life.

My research assistant and I will be abstracting some medical information related to the study from your records as well as those of your child, we kindly request for your time and support.

Study Title: Determinants of Mother to Child Transmission of HIV among exposed infants in Kericho County Referral Hospital.

Investigators: Jane Muli, Principal investigator; Dr. Louisa Ndunyu, Co-investigato; Dr. Dickens Aduda, Co-investigator.

Section A: Maternal Sociodemographic data

1. Age. [ ]
2. Parity (Number of previous pregnancies).

Primiparous (one child)	[1]
Multiparous (2 or 3 children)	[2]
Multiparous (4 or more children)	[3]

3. Marital status.

Married monogamous	[1]
Married polygamous	[2]
Single (never married)	[3]
Widow	[4]
Separated or divorced	[5]

4. Occupation.

Formal employment	[1]
Business person	[2]
Unemployed / house wife	[3]
Farming	[4]
Daily wages/casual labourer	[5]

5. Education Level.

None	[1]
Incomplete primary	[2]
Completed primary	[3]
Secondary	[4]
Tertiary/college	[5]
Other	[6]

Section B: Clinical information

6. When was the mother diagnosed HIV positive?

Before last pregnancy	[1]
When she was pregnant with this child	[2]
During delivery of this child	[3]
During breastfeeding period	[4]

7. WHO clinical stage?

WHO stage I	[1]
WHO stage II	[2]
WHO stage III	[3]
WHO stage IV	[4]

8. Breast condition.

	Yes [1]	No [0]
Cracked nipples		
Inflammation of the breast/ Mastitis		

9. When was ART started?

Before last pregnancy	[1]
When I was pregnant with this child	[2]
During delivery of this child	[3]
During breast feeding period	[4]

10. Type of ART regimen?

TDF+3TC+EFV	[1]
TDF+3TC+DTG	[2]
AZT+3TC+NVP	[3]
Other (specify)	[4]

11. Duration on ART?

Less than 6 months	[1]
Between 6 months and 1 year	[2]
More than 1 year	[3]
Other (specify)	[4]

12. Adherence levels?

Good (≥95)	[1]
Inadequate (85-94%)	[2]
Poor≤84%	[3]

13. Latest CD 4 count in cell/ul (within the last 6 months)

>500	[1]
201-500	[2]
≤ 200	[3]
Not done	[4]

14. Latest Viral load results (within the last 6 months).

< 50 copies per ml (Less than detectable levels (LDL)	[1]
50 to <1000	[2]
≥ 1000	[3]
Not done	[4]

15. Pregnancy hemoglobin levels

Normal blood levels >11g/dl	[1]
Mild anemia 10 -10.9 g/dl	[2]
Moderate 9.9 – 7.0 g/dl	[3]
Severe <7 g/dl	[4]

Section C: Child's information

16. Childs age at enrollment to care

≤ 6 weeks	[1]
>6 weeks – 8 weeks	[2]
>8 weeks	[3]

17. Gender.

Male	[1]
Female	[2]

18. HIV Status (DNA/PCR results - at 6 weeks or initial test post birth/delivery)?

HIV positive	[1]
HIV negative	[2]

19. Age at the time of HIV diagnosis (in weeks)

≤ 6 weeks	[1]
>6 weeks – 8 weeks	[2]
>8 weeks	[3]

20. Infant ARV prophylaxis initiated at enrollment?

Nevirapine (NVP) syrup	[1]
Zidovudine (AZT)syrup	[2]
NVP+AZT	[3]
Other (specify)	[4]
None	[5]

21. When was infant prophylaxis initiated?

Immediately birth (within 24 hrs.)	[1]
Below 2 weeks	[2]
Between 2 weeks and 6 weeks	[3]
Beyond 6 weeks	[4]

22. What mode of Infant feeding is been practiced currently?

Exclusive breastfeeding (baby given only breast milk, no other forms of liquids or food ate given other that prescribed medications)	[1]
Exclusive replacement feeding (commercial infant formula milk)	[2]
Mixed feeding (infant below 6 months of age is given other liquids and/or foods together with breast milk.	[3]
Other – Specify	[4]

Appendix iv: Questionnaire

Date: ___/___/2022 Facility name: __

Mothers Unique Code: ☐☐-☐☐☐-☐☐☐-☐☐☐

Dear ……

My name is Jane Mumbi, I am a health professional working at Kericho County Hospital. I am currently studying at Maseno University for a Master degree which involve a research work. I am conducting a research to help understand more about ways by which infants may get HIV passed to them infants by their mothers who are already taking HIV medicines. I am currently collecting information from several selected patients, and therefor requesting you to be part of this research.

The findings will help in planning the best ways to prevent many more children from being infected as they breastfeed.

If you agree to take part in this research, my research assistant and I will ask you a list of questions related to the problems we want to understand.

Accepted participation: Yes: ☐ No: ☐

In case of any questions please feel free to contact me at:

Telephone number: 0716430201 or by Email: jan.mumbi@gmail.com

Thank you.

Jane Mumbi

Section A: Maternal sociodemographic factors

Let's start by you answering questions about yourself.

1. What is your age? ☐

2. What is your Marital status?

Married monogamous	[1]
Married polygamous	[2]
Single (never married)	[3]
Widow	[4]
Separated or divorced	[5]

3. How many children do you have (Parity) - Tick as appropriate?

Primiparous (one child)	[1]
Multiparous (2 – 3 children)	[2]
Multiparous (4 or children)	[3]

4. Which is the highest level of education you have attained.

None	[1]
Incomplete primary	[2]
Completed primary	[3]
Secondary	[4]
Tertiary/college	[5]
Other	[6]

5. What is your current occupation?

Formal employment	[1]
Business person	[2]
Unemployed / house wife	[3]
Farming	[4]
Daily wages/casual labourer	[5]

6. Where do you reside?

Urban (within a town or city)	[1]
Peri- urban (surrounding areas of a town)	[2]
Rural (outside the town)	[3]

7. What is your average monthly income?

≤ Ksh. 5000	[1]
Ksh. 5,000 and above	[2]
Other	[3]

8. Where was the baby born in?

Hospital	[1]
Home	[2]
Any other (specify)	[3]

9. Antenatal profile:

13.1 Did you have the following tests conducted in the clinic during your last pregnancy?

	Yes [1]	No [0]
Hemoglobin (HB) Levels		
VDRL		

If Yes, please indicate the results in 9.2 and 9.3, if No skip to 10

13.2

	Positive (1)		Negative [2]
VDRL results			

13.3 Hemoglobin Results

Normal blood levels >11g/dl	[1]
Mild anemia 10 -10.9 g/dl	[2]
Moderate 9.9 – 7.0 g/dl	[3]
Severe <7 g/dl	[4]

10. When did you realize you were HIV positive?

Before last pregnancy	[1]
When I was pregnant with this child	[2]
During the delivery of this child	[3]
During the period of breastfeeding this child (post child birth)	[4]

Section B: Infant feeding practices

I would like to ask you some questions about how you feed the baby you have brought to the clinic today.

11. How old is your baby? ☐

12. Did you ever breastfeed your baby?

If "Yes" go to question 13, if "No" skip to question 14

Yes	[1]
No	[2]

13. After birth how long did you wait to breast feed the baby?

Immediately	[1]
Less than 1 hour	[2]
Less than 24 hours	[3]
> 1 day	[4]
Can't remember	[5]

14. In the first three days after birth, was the baby given anything to drink?

If the answer is "Yes" go to question 15. If "No "skip to question 17

Can't remember	[0]
Yes	[1]
No	[2]

15. What was the baby given to drink in the first three days after birth? Record all liquids mentioned

Milk (other than breast milk)	[1]
Plain water	[2]
Sugar or glucose water	[3]
Gripe water	[4]
Sugar-salt- water solution	[5]
Fruit juice	[6]
Infant formula	[7]
Tea/infusions	[8]
Coffee	[9]
Honey	[10]
Others (specify)	[11]

16. What are the reasons the baby was given other drinks other than breast milk? Record all mentioned

Not enough breast milk	[1]
Baby cried too much	[2]
Cultural reasons	[3]
Work related obligations	[4]
Weather too hot	[5]
First milk not good for babies	[6]
Other X (Specify)	[7]

17. Are you still breastfeeding your baby?

Yes	[1]
No	[2]

If "Yes" skip to question 19, If "No" go to question 18.

18. For how many months did you breastfeed the baby?

<1 month	[1]
1-2 months	[2]
3-4 months	[3]
5-6 months	[4]
> 6 months	[5]

19. Have you ever given the baby anything to drink from a bottle with a nipple?

Yes	[1]
No	[2]

If "Yes" go to question 20
If 'No', skip to question 21

20. What was the baby given to drink using the bottle with a nipple? Record all liquids mentioned

Milk (other than breast milk)	[1]
Plain water	[2]
Sugar or glucose water	[3]
Gripe water	[4]
Sugar-salt- water solution	[5]
Fruit juice	[6]
Infant formula	[7]
Tea/infusions	[8]
Coffee	[9]
Honey	[10]
Others (specify)	[11]

21. I would like to ask you about everything that your child ate yesterday during the day or the night. I am interested in foods your child ate whether at home or somewhere else.

Only breast milk	[1]
Milk (other than breast milk)	[2]
yogurt or other yogurt like drinks	[3]
Bread with tea	[4]
Ugali and milk	[5]
Mashed potatoes	[6]
Fish with ugali or rice	[7]
Meat with ugali or rice	[8]
Vegetables	[9]
Juice	[10]
Others (specify)	[11]

22. What are some of the challenges you face when choosing how to feed your baby?

Lack of enough money	[1]
Stigma	[2]
Family pressure	[3]
Other- specify	[4]
None	[5]

Section C: Intervening factors that are likely to influence the outcome of mother to child transmission of HIV

23. Tell me how you feel about the statements , this is a shorter version of assessing HIV stigma (Reinius et al., 2017). Please respond by stating whether

1 – Strongly disagree, 2 – disagree, 3 - neutral, 4 – agree and 5 – strongly agree

No.	Statement	1	2	3	4
27.1	**Stigma** **a) Internalized stigma** In the last 12 months, have you experienced any of the following feelings because of your HIV status?				
	• I feel ashamed				
	• I feel guilty				
	• I blame myself				
	• I blame others				
	• I have low self-esteem				
	• I feel I should be punished				
	• I feel suicidal				
	b) Perceived stigma				
	• People think that having HIV is shameful and they should not be associated with me				
	• Fears about how other people (for example, your friends, family, employer, or community) would respond if you or your child tested HIV-positive make you hesitate to get tested				
	c) Experienced stigma				
	• In the last 12 months, have you been aware of being gossiped about because of your HIV status?				
	• In the last 12 months, have you been denied any health services because of your HIV status?				
	• In the last 12 months, have you been excluded from social events or gatherings because of your HIV status?				
27.2.	**Perceived Self-Efficacy** Please tell me how you rate yourself under the following statements.				
	• I am responsible for maintaining my health by taking ARV medications consistently and correctly as advised by my doctor				
	• I am able to feed my baby with only breast milk for the first six months.				
	• My baby's health depends on how well I look after her/him by giving him the prescribed medications correctly and consistently.				
	• My baby and I are able to keep all the clinic appointments without fail				

Appendix v: Checklist of study activities for participants

	PARTICIPANTS (SUBJECT IDENTIFICATION) NO.				
ACTIVITIES	**1**	**2**	**3**	**4**	**5**
Informed consent	**X**				
Records abstraction.	**X**				
Administration of questionnaire	**X**				

Appendix vi: Research Assistant Confidentiality Agreement.

This agreement is between: _____ (name of Investigator) and

_____ (name of research assistant) for a study on determinants of mother to child transmission of HIV among HIV exposed infants in Kericho county referral hospital,

I agree to:

1. Keep all the study information shared with me confidential. I will not share any of the study information with anyone other than with the researcher or others identified by the researcher.

2. Keep all study information secured while it is in my custody. I will observe the instructions of the researcher about requirements to manually and/or electronically secure records.

3. Not allow any personally identifiable information to which I have access to be accessible to anyone outside of the research team except under written instructions by the researcher.

5. Return all research information to the researcher when I have concluded the research activities and/ or upon request whichever comes earlier.

Research Assistant's Name: _____Signature: _____ Date:

Appendix vii: Sample size determination table for a finite Population

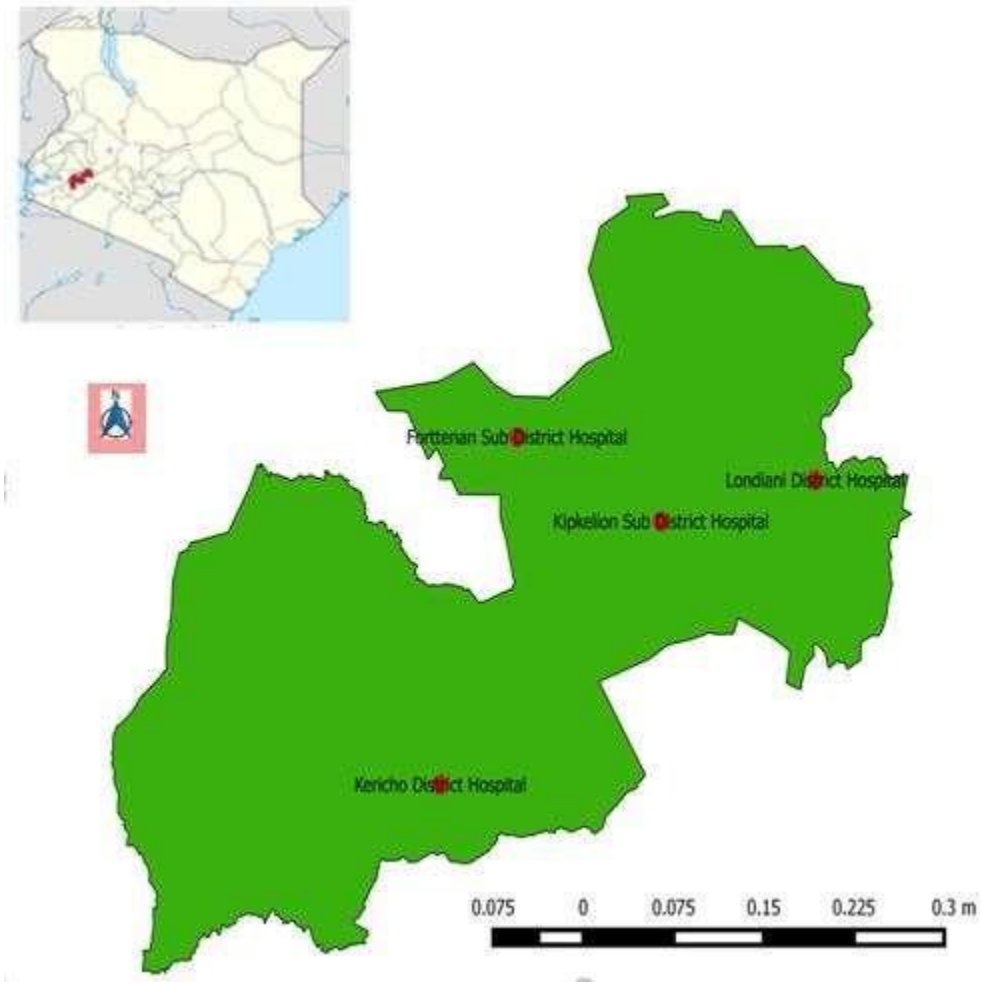
N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

http://www.kenpro.org/wp-content/uploads/2013/08/krejcie-and-morgan-table-of-determining-sample-size.png

Appendix viii: Study map



Ref: (Kigen et al., 2018)

Appendix ix: School of Graduate Studies Approval letter

MASENO UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Office of the Dean

Our Ref: MPH/PH/0001/13

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 14th July, 2021

TO WHOM IT MAY CONCERN

RE: PROPOSAL APPROVAL FOR JANE MUMBI MULI — MPH/PH/0001/2013

The above named is registered in the Master of Public Health in the School of Public Health and Community Development, Maseno University. This is to confirm that her research proposal titled "Determinants of Mother to Child Transmission of HIV among Exposed Infants in Kericho County Referral Hospital, Kenya" has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

SCHOOL OF GRADUATE STUDIES MASENO UNIVERSITY 14 JUL 2021 P.O. Box PRIVATE BAG

Prof. J.O. Agure
DEAN, SCHOOL OF GRADUATE STUDIES

Appendix x:Maseno university Ethics Review Certificate

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221
Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

REF: MSU/DRPI/MUERC/01010/21 **Date**: 26th November, 2021

TO: Jane Mumbi Muli
PG/MPH/PH/00001/2013
Department of Public Health
School of Public Health and Community Development
Maseno University
P.O. Box, Private Bag, Maseno, Kenya

Dear Madam,

RE: Determinants of Mother to Child Transmission of HIV among Exposed Infants in Kericho County Referral Hospital, Kenya

This is to inform you that **Maseno University Ethics Review Committee (MUERC)** has reviewed and approved your above research proposal. Your application approval number is MUERC/01010/21.The approval period is 26th November, 2021 – 25th November, 2022.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by Maseno University Ethics Review Committee (MUERC).
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to Maseno University Ethics Review Committee (MUERC) within 24 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to Maseno University Ethics Review Committee (MUERC) within 24 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to Maseno University Ethics Review Committee (MUERC).

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely

Prof. Philip O. Owuor, PhD, FAAS, FKNAS
Chairman, MUERC

MASENO UNIVERSITY IS ISO 9001: CERTIFIED

Appendix vii: NACOSTI licence

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **419671**

Date of Issue: **21/December/2021**

RESEARCH LICENSE

This is to Certify that Ms.. Jane Mumbi Muli of Maseno University, has been licensed to conduct research in Kericho on the topic: DETERMINANTS OF MOTHER TO CHILD TRANSMISSION OF HIV AMONG EXPOSED INFANTS IN KERICHO COUNTY REFERRAL HOSPITAL, KENYA for the period ending : 21/December/2022.

License No: **NACOSTI/P/21/14815**

419671

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix xii: Kericho County Commissioner authorization

THE PRESIDENCY
MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

Telegrams: .....
Telephone: Kericho 20132
When replying please quote
kerichocc@yahoo.com

COUNTY COMMISSIONER
KERICHO COUNTY
P.O. BOX 19
KERICHO

REF: MISC.19 VOL.VII (220)

6th January, 2022

Ms. Jane Mumbi Muli
Maseno University,
KISUMU

RE: RESEARCH AUTHORIZATION-REF NO.419671

I am pleased to inform you that you are authorized to undertake research vide letter Ref. No. NACOSTI/P/21/14815 dated 21st December, 2021 on "***Determinants of Mother to Child Transmission of HIV Among Exposed Infants in Kericho County Referral Hospital, Kenya***" for a period ending 21st December, 2022.

COUNTY COMMISSIONER
KERICHO COUNTY

JAMES NYAMWAMU
FOR: COUNTY COMMISSIONER
KERICHO COUNTY

Appendix xiii: Ministry of Education Approval

REPUBLIC OF KENYA

MINISTRY OF EDUCATION
State Department of Early Learning and Basic Education

Email:cdekerichocounty@gmail.com
When Replying Please Quote:

Ref: KER/C/ED/GC/2/VOL.II1/16

County Education Office
P.O BOX 149
KERICHO
6th January 2022

TO WHOM IT MAY CONCERN.

RE: RESEARCH AUTHORIZATION: MS. JANE MUMBI MULI LICENCE NO.NACOSTI/P/21/14815.

I refer to the Director General NACOSTI Letter Ref: No. 419671 dated 2Sst December 2021 granting the above student authority to proceed for field work. Her area of study is titled: **"DETERMINANTS OF MOTHER TO CHILD TRANSMISSION OF HIV AMONG EXPOSED INFANTS IN KERICHO COUNTY REFERRAL HOSPITAL, KENYA"** for the period ending 21/12/2022.

This is to request your office to accord her the necessary support during the data collection process.

Thank you.

COUNTY DIRECTOR OF EDUCATION
06 JAN 2022
P.O. Box 149-20200 KERICHO

ROSE K SAGARA
COUNTY DIRECTOR OF EDUCATION
KERICHO COUNTY.

Appendix xiv: Kericho County Director of Health approval

COUNTY GOVERNMENT OF KERICHO
DEPARTMENT OF HEALTH SERVICES

Kericho County Hospital Grounds,
Administration Block, 2nd Floor.

Hospital Road
P.O. Box 112 - 20200
KERICHO

Ref: P/21/14815

Date: 06/01/2022

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION:
MS. JANE MUMBI MULI.

This is to confirm that the above named has been authorized by National Commission for science, Technology and Innovation and County Government of Kericho; Department of Health Services to carry out research on "***determinants of mother to child transmission of HIV among exposed infants in Kericho County Referral Hospital***" for a period ending 21st December, 2022.

Kindly accord her the necessary assistance.

Thanks.

MINISTRY OF HEALTH
COUNTY HEALTH DIRECTOR
06 JAN 2022
KERICHO COUNTY
P.O. Box 11-20200 KERICHO
Tel:052-31191

Dr. Betty Langat; **HSC**
County Director of Health
KERICHO COUNTY

Appendix viii: Kericho County Referral hospital approval

COUNTY GOVERNMENT OF KERICHO
KERICHO COUNTY REFERRAL HOSPITAL

Telegrams: "MEDICAL", Kericho
Telephone: Kericho (0734) 758 102
e-mail: kerichodistricthospital@yahoo.com
When replying please quote

Medical Superintendent
Kericho County Referral Hospital
P. O Box 11
KERICHO

Ref: 21/14815

Date: 06/01/2022

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORITY: MS. JANE MUMBI MULI.

This is to confirm that the above named has been authorized by Kericho County Referral Hospital research and Ethics Committee to carry out research on ""***determinants of mother to child transmission of HIV among exposed infants in Kericho County Referral Hospital***".

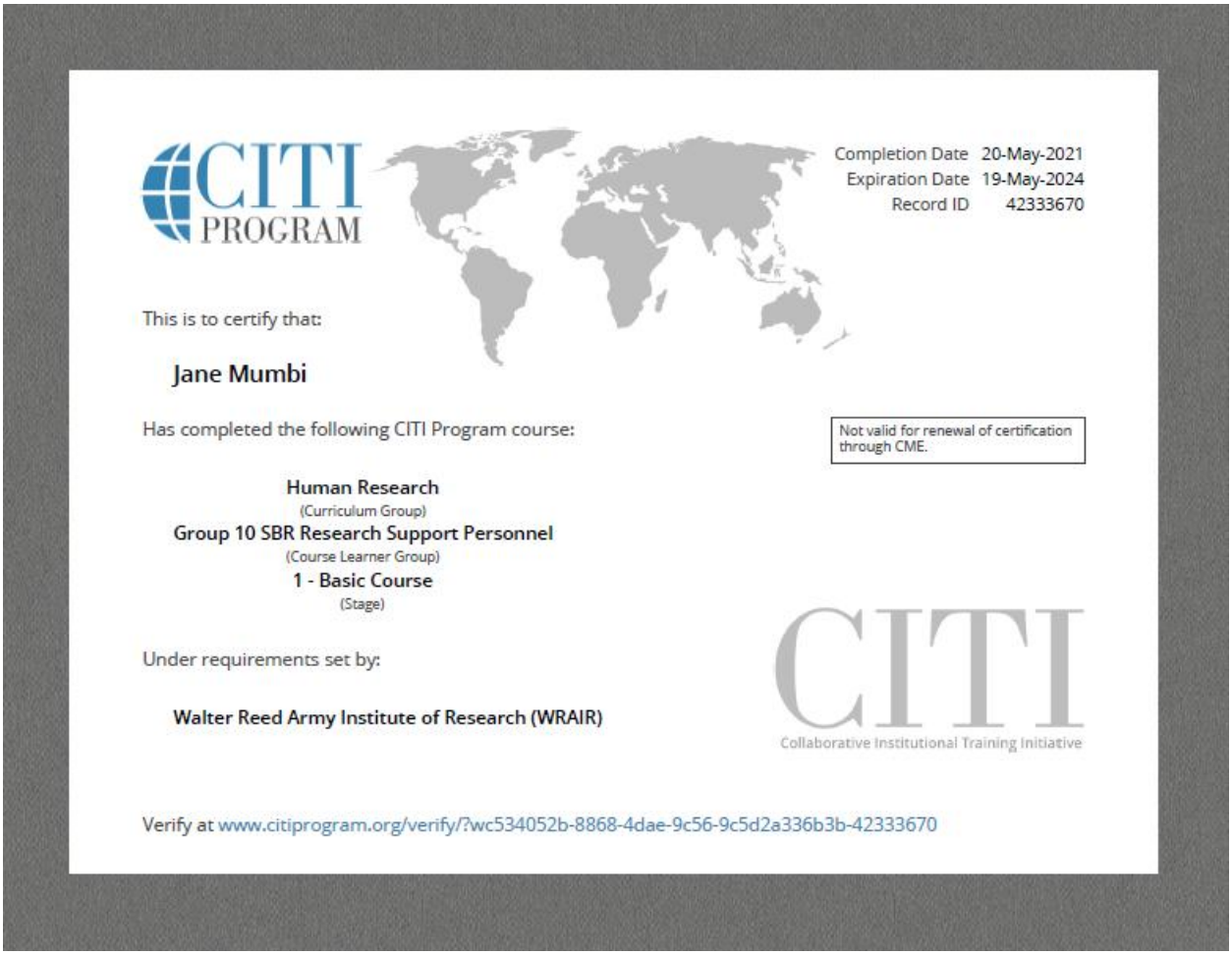
Kindly accord her the necessary assistance.

Thanks.

KERICHO COUNTY REFERRAL HOSPITAL
06 JAN 2022
MEDICAL SUPERINTENDENT

Dr. Japhet Cheruiyot
Medical Superintendent
KERICHO COUNTY REFERRAL HOSPITAL

Appendix xvi: CITI Certificate



CITI PROGRAM

Completion Date 20-May-2021
Expiration Date 19-May-2024
Record ID 42333670

This is to certify that:

Jane Mumbi

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Human Research
(Curriculum Group)
Group 10 SBR Research Support Personnel
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Walter Reed Army Institute of Research (WRAIR)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wc534052b-8868-4dae-9c56-9c5d2a336b3b-42333670