UNIVERSITY FOR DEVELOPMENT STUDIES

BREASTFEEDING, COMPLEMENTARY FEEDING AND NUTRITIONAL STATUS OF CHILDREN (0-23MONTHS) OF HIVINFECTED MOTHERS COMPARED TO NON-HIV INFECTED MOTHERS

BY

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JUNE, 2016

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate Signature ..... Date 31st Aug. 2016

MARY ALI MAAKA

Supervisor:

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

Infant feeding recommendations for HIV-positive mothers differ from those for mothers of unknown HIV-status. The aim of this study was to compare the effect of the feeding practices, including breastfeeding and complementary feeding on the nutritional status of young children of HIV-infected mothers and uninfected mothers. A cross sectional case control study was conducted among HIV-positive and HIV-negative mothers with infants aged 0-23 months visiting health facilities for post natal care in the Bolgatanga Municipality. A total number of 182 mothers were interviewed with 32 mothers being HIV-positive whilst 150 were HIV-negative. Data was collected using quantitative methods. The mean age of the respondents was 26 ± 7.2 (mean ± SD) with a range of 15-47 years. About 66% (21/32) of the HIV-positive mothers were within the age group of 26-35 years. Irrespective of HIV status mothers without any level of formal education were more likely to breastfeed their children than those with formal education ($P<0.001$). However the practice of exclusive breastfeeding increased with increasing educational level ($P<0.003$). Younger mothers were less likely to breastfeed their children exclusively as compared to older mothers ($P<0.000$) irrespective of their HIV status. Also, 17.8% (31/174) of HIV-positive mothers fed their children with the first yellowish milk (colostrum) after delivery as compared to 82% (143/174) of HIV-negative mothers who did so. Only 7.4% (7/95) of HIV-positive mothers initiated breastfeeding earlier within the first hour of delivery as compared to 92.6% (88/95) of their HIV-negative counterparts. Complementary feeding was initiated before six months by 23.3% (7/30) of the HIV-positive mothers compared to 76.7% (23/30) of the HIV- negative mothers. HIV status of mothers had influence on the birth weight of the children because 2.7% (4/150) children whose mothers were HIV-negative were born with low birth weight whilst only 3.1% (1/32) children who were born to HIV-positive mothers had low birth weight. Underweight

was significantly higher among children born to HIV-positive mothers as compared to children of HIV-negative mothers (15.6% versus 11.1%, p<0.002). Moreover, stunting was significantly higher among the children born to HIV-positive mothers as compared to children of HIV-negative mothers (25.0% versus 12.3%, p<0.001) and also that of wasting was much significantly higher among the children of HIV-positive mothers as compared to HIV-negative mothers (20.0% versus 4.05%, p<0.001). It is recommended that health workers should provide appropriate education on breastfeeding and also educate women on the effect of complimentary feeding practices on the nutritional status of children.

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DEDICATION

I dedicate this work to my family especially my mum, my late brother Haruna Ali, my son RayanBaako and Mr.IssahBaako for their support during the period of my study.

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LIST OF ABBREVIATIONS

AAP – American Academy of Paediatric

ACC/SCN – Administrative Committee on Coordination/ Subcommittee on Nutrition

AFASS- Acceptable Feasible Affordable Sustainable and Safe

AFATVRH – Age, Frequency, Amount of food, Texture of food, Variety of food, Responsive feeling, and Hygiene

AIDS – Acquired Immune Deficiency Syndrome

ARV - Anti-Retro Viral

CD4 – Cluster of Differentiation 4

CDC – Centres for Disease Control

CF - Complementary Feeding

CI – Confidence Interval

DHMT - District Health Management Team

EBF - Exclusive Breast Feeding

ERF - Exclusive Replacement Feeding

FF - Formula Feeding

GDHS- Ghana Demographic and Health Survey

GHS- Ghana Health Service

GIT- Gastro -Intestinal Tract

HAART - Highly Activated Antiretroviral Therapy

HAZ - Height-for-Age *z* score

HIV – Human Immunodeficiency Virus

HIV/AIDS- Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome

IBM – Integrative Bio-regulatory Medicine

IYCY- Infant and Young Child Feeding

JHS –	Junior High School
MCH-	Mother/Child Health
MDG –	Millennium Development Goals
MDG-	Millennium Development Goal
MOHP-	Ministry of Health and Population
MTCT –	Mother-To-Child Transmission
OR –	Odds Ratio
PAHO-	Pan American Health Organization
PMTCT-	Prevention of Mother to Child Transmission
RCH-	Reproductive and Child Health
RR –	Relative Risk
SD-	Standard Deviation
SHS –	Senior High School
SPSS –	Statistical Package for Social Sciences
STIs-	Sexual Transmitted Infections
TZ -	*Tuozafi*
UK –	United Kingdom
UN-	United Nations
UNAID –	United Nations Agency for International Development
UNFPA –	United Nations Fund for Population Activities
UNICEF-	United Nations Children Fund
URT-	United Republic of Tanzania
USA-	United States of America
USAID-	United State Agency for International Development
WAZ-	Weight-for-Age *z* score
WHO-	World Health Organization

WHZ-	Weight-for-Height	z	score

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This section gives the general overview of the thesis and also consists of the background, problem statement, the main and specific objectives of the research, not excluding the relevance and the conceptual framework.

1.1 Background to the study

Exclusive Breast Feeding (EBF) which is defined as giving the infant no other food or drink, not even water, apart from breast milk (including expressed breast milk), with micronutrient supplements or prescribed medicine; when it is practiced for the first six months of an infant's life, is a beneficial intervention in saving children's lives. When infants are exclusively breastfed for the first six months of life, their immune system is stimulated and this goes hand in hand with protecting them from diseases like diarrhea and acute respiratory infections, which are considered to be two of the major causes of infant mortality in the developing world. Growing commitment and resources are helping to create a new focus on women's and children's health in the context of HIV. Four of the Millennium Development Goals (MDGs) with targets for 2015 are related to nutrition (MDG1), child survival (MDG4), maternal health (MDG5) and HIV/acquired immunodeficiency syndrome (AIDS) (MDG6) (UNICEF, 2009).

The United Nations Secretary General's Global Strategy for Women's and Children's Health (UN, 2002) sets out key areas to enhance financing, strengthen policy and improve service delivery for these vulnerable groups. Important interventions include exclusive breastfeeding and other feeding practices for improved child survival and nutrition, and integrated care for HIV/ AIDS (including prevention of mother-to-child transmission of HIV – PMTCT).Prevention of HIV transmission through breastfeeding should be considered against a backdrop of promoting appropriate feeding for all infants and young children, as set out in the Global Strategy for Infant and Young Child Feeding(WHO, 2002). The aim of infant feeding practices in the context of HIV should not just be the prevention of HIV transmission but also ensuring the health and survival of infants – referred to as HIV-free survival. The operational objectives of this Strategy include: ensuring that exclusive breastfeeding for six months is protected, promoted and supported, with continued breastfeeding up to two years or beyond; promoting timely, adequate, safe and appropriate complementary feeding; and providing guidance on feeding infants and young children in exceptionally difficult circumstances, including infants of HIV-positive women.Transmission of HIV from mother to child is higher among the mixed fed infants than exclusively breast fed infants. It is estimated that, with Exclusive Breastfeeding (EBF), 13% to 15% deaths of children under 5 years could be prevented in low and middle income countries. (Iliff,*et al.,* 2005). WHO recommends EBF to both HIV exposed and non-exposed infants for the first six months of life, but still EBF rates remain low throughout the world. Globally it is estimated that prevalence of exclusive breastfeeding is 35% (Mekuria and Edris, 2015).

In 2009, an estimated 2.5 million children under 15 years of age were living with HIV/ AIDS (2.3 million in sub-Saharan Africa), and 370 000 children were newly infected with HIV through mother-to-child transmission (UNAIDS, 2010). Over 1,000 children are newly infected with HIV every day; out of this number more than half will die as a result of AIDS because of lack of access to HIV treatment. Exclusive breastfeeding during the first months of life carries less risk of HIV transmission than mixed feeding because it brings considerable protection against infectious diseases, and provides other benefits to the health of the infant. When breastfeeding is practiced exclusively among HIV infected mothers, it is associated with a lower risk of HIV transmission than mixed feeding. Coovadia,*et al.,* (2007) in their study reported that the greatest risk of HIV transmission from mother to child lies with those infants for whom mixed feeding is practiced, that is feeding on both breast milk and other liquids (such as water, tea, formula, animal milk) or foods (such as porridge or rice) than in those exclusively breastfed. Mixed feeding has been associated with diarrhea and other infections due to unhygienic conditions in which infant food is prepared. In a study carried out in South Africa, infants who were exclusively breastfed were half as likely to be HIV infected by six months of age compared to infants who were given formula milk (UNAIDS, 2010). Studies carried out in othercountries have also demonstrated that exclusive breastfeeding carries a lower risk than all types of mixed feeding (Illiff,*et al.,* 2005).Despite the benefits which results from its practice, EBF rates remain low throughout the world, where globally it is estimated at 35%. However, exclusive breastfeeding in Ghana was reported at 62% in 2008, according to the World Bank (World Bank, 2010). Complementary feeding which is supposed to be practiced at the age of six months has been reported to start early, in some instances as early as below two months of age. Among the various options of infant feeding in the context of HIV/AIDS, the safest option is exclusive replacement feeding (ERF); ERF

stands out since when it is practiced, the infant will not be exposed to the virus present in the breast milk hence no HIV infection.

However, International guidelines currently recommend replacement feeding only when it is acceptable, feasible, affordable, sustainable and safe (AFASS). If these conditions can be met then an HIV infected mother is advised to avoid all breastfeeding, otherwise, EBF is recommended due to the challenges that accompany exclusive replacement feeding. EBF for the first six months of life has favorable outcome of not conveying excess HIV transmission over formula feeding; it is reported that in Africa, replacement feeding that is acceptable, feasible, affordable, sustainable and safe is uncommon, and therefore HIV-positive women are reported to choose breastfeeding.The World Health Organization (WHO) guidelines on Human Immunodeficiency Virus (HIV) and Infant Feeding 2010 is to provide guidance to governments on key priority actions, related to infant and young children feeding, that covers the special circumstances associated with Human Immunodeficiency Virus (HIV). The aim of this guidance is to create and sustain an environment that encourages appropriate feeding practices for all infants and young children, while scaling-up interventions to reduce HIV transmission. This Frameworkaims at building a link and synergies between maternal and child health and investments, economic and human, in HIV prevention and control. This will bring additional benefits for all children, not just for those who are HIV-exposed. In Ghana, almost 3 percent of pregnant women are infected with HIV and 15 percent of infants born to them acquire the infection through breastfeeding (National HIV/AIDS Reports, 2011).

In 2001, mother and Child Health services in Ghana adopted the world health organization infant feeding guidelines for HIV women. The guidelines call for the avoidance of breastfeeding by HIV-positive mothers when exclusive replacement feeding is acceptable, feasible, affordable, sustainable and safe (AFASS). Other feeding options recommended are the use of heat-treated expressed breast milk or wet nursing of the newborn by HIV-negative women when the AFASS criteria are not possible. When AFASS criteria cannot be met, mothers are advised to exclusively breast-feed and avoid mixed feeding. Since these guidelines have been adopted, little has been done with respect to assessing the implications of this for HIV-positive mothers, as well as the enabling environment needed for effective implementation.Although there is a reported increased trend of EBF in most regions the rates varies in the regions for instance; in Sub-Saharan Africa the increase was reported from 22% in 1996 to 30 % in 2006, East Asia /Pacific, (excluding China) from 27% in 1996 to 32% in 2006; Latin America and the Caribbean, (excluding Brazil and Mexico) from 30% in 1996 to 45 % in 2006. Yet, still these rates are low according to WHO recommendations despite the observed increase.

There are number of factors that have been reported to hinder EBF, these include socio cultural and norms, family and social pressures to mixed feed, customs that require giving water to newborn since every stranger entering the house is to be given water, the belief that exhaustion and thirst that the infant gets after birth necessitate giving it water and giving infants concoctions just after delivery for protection, (Iliff, *et al.,* 2005).This thesis is aimed at determining the effects of breastfeeding and complementary feeding practices on the nutritional status of children (0-23 months) of HIV infected mothers including the factors that influence initiation of breast feeding, colostrum feeding and at what age complementary foods are introduced among the HIV breastfed infants up to their first

birthday. It is also meant to explore and assess the nutritional sufficiency of these breast feeding and complementary foods to the health and growth of the infants.

1. 2 Problem Statement

The current international and national guideline inspires a known HIV positive mother to exclusively breastfeed while the infant receives prophylaxis for the first six months of life. Continuation of breastfeeding up to two years and beyond is done in cases when child is diagnosed HIV negative whereas if the child is HIV infected breastfeeding is done up to 12 months and is stopped gradually ensuring that under both circumstances complementary feeding is introduced at sixth month. In Ghana it is a policy that all women who attend ante-natal care should be provided with free HIV counseling and testing. Moreover, free provision of Antiretroviral (ARV) is made if their test results are positive. With these national and International efforts, the factors that influence EBF and complementary feeding practices among HIV positive mothers and its effects on the nutritional status of their children 0-23 months in general in the country and specifically the Upper East Region are not well known. The prevalence of malnutrition among children under five in the Upper East Region stands as ; 17.9%, 10.4% and 10.8% for stunting, wasting and underweight respectively (GDHS, 2014).

1.3 Objectives of the Study

1.3.1 Main Objective

The purpose of this study was to examine breastfeeding, complementary feeding initiation and nutritional status of children (0-23months) of HIV infected mothers compared to non-HIV infected mothers.

1.3.2 Specific Objectives:

1. To assess the breast feeding practices of HIV infected mothers compared to their non-HIV counterparts
2. To determine the time of initiation of complementary feeding of HIV infected mothers compared to their non-HIV counterparts
3. To evaluate the nutritional status of children whose mothers are HIV infected compared to children of their non-HIV counterparts
4. To measure the difference between breast feeding practices/Complementary Feeding initiation and the nutritional status of children whose mothers are HIV infected compared to children of their non-HIV counterparts

1.4 Relevance of the Study

The study has the potential to facilitate policy direction and intervention to improve health and feeding practices of infant and young children of mothers living with HIV.

The findings could inform stakeholders on scientifically and culturally appropriate health messages for optimal infant and young child feeding practices among mothers living with HIV. The results of the study could serve as a basis for further research among mothers

living with HIV.The study was conducted based on the framework presented below in figure 1.1. The framework gives direction to the interrelationships of the various variables of study.

1.5 Conceptual Framework of the study

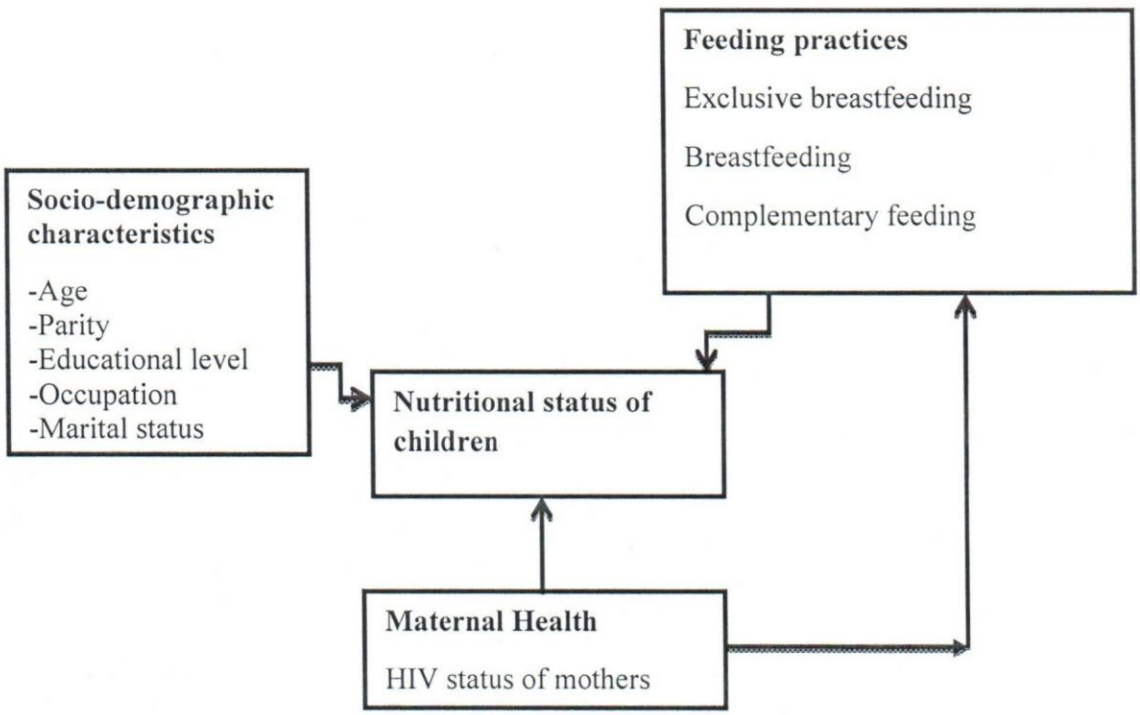

Figure 1.1: Conceptual Framework of the study

Source: Author's construct

Numerous features have been found to facilitate or hinder adherence to EBF and CF in the context of HIV infected mothers. Socio-demographic characteristics, mothers HIV status and feeding practices have effect on the nutritional status of children. But again, the mother whose breast has problems like engorgement, mastitis, cracked or sore nipples will not

manage breastfeeding even if her previous decision was to practice EBF. On the other hand, significant others (husband/ spouse, mother-in-law, sister, grandmothers, friends and community members) have great role to play in infant feeding, especially in the practice of exclusive breastfeeding and this will in turn affect the nutritional status of the child. Inappropriate introduction of complementary feeding, early or late initiation of complementary feeding has effect on the nutritional status of the child. Complementary feeding should be taken into consideration as AFATVRH, that is A for age, F for frequency, A for amount of food, T for texture (thickness and consistency), and V for variety of food, R for responsive feeding and H for hygiene.The maternal health can have an adverse effect on the nutritional status of their children. An HIV infected mother if not managed proper can infect their children either through delivery or breastfeeding.

1.6 Limitation of Study

Though the study targeted 91 HIV-positive mothers (*case group*) and 91HIV-negative mothers (*control group*) to ensure balanced proportion, only 32 HIV-positive mothers were included in analysis; access to HIV-positive motherswas a challenge, possibly due to societal stigmatization and the unwillingness of some to complete their questionnaire. The number HIV-negative motherswas adjusted to make up for the shortage in the *case group*. Thus, the comparative ratio of 1:5 considered for HIV-positive to HIV-negative respondents instead of the 1:1 ratio originally approved.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This aspect of the chapter consists of the varied research and studies conducted in a similar work by others researchers. It involves the review of others research and surveys carried out in similar regard. It consist of the literature on what has already been done in a related field of study and also to ascertain on what is yet to be done, it involves data on infant and young child feeding practices in the context of HIV infected mothers and their counterparts.

Feeding information was based on WHO definitions and recommendations (Gaillard, *et al.*, 2001), as follows; exclusive breastfeeding: giving breast milk only, except for medicines and vitamin or mineral supplements; predominant breastfeeding: breast milk is nutritionally dominant, but with the possible addition of water-based fluids, fruit juices, tea without milk or oral rehydration salts; mixed feeding: non-human milk, semi-solids or other solids given in addition to breast milk; replacement feeding: breastfeeding stopped or never being given any breast milk. Exclusive replacement feeding was defined as never having given any breast milk. Pre-lacteal feeding was defined as any food item or liquid other than breast milk given to the infant during the first 3 days after delivery.

2.1 Breastfeeding

Almost all mothers can breastfeed successfully, which includes initiating breastfeeding within the first hour of life, breastfeeding exclusively for the first 6 months and continuing breastfeeding (along with giving appropriate complementary foods) up to 2 years of age or beyond.Exclusive breastfeeding in the first six months of life is particularly beneficial for mothers and infants. Positive effects of breastfeeding on the health of infants and mothers are observed in all settings.Breastfeeding reduces the risk of acute infections such as diarrhoea, pneumonia, ear infection, *Haemophilus influenza*, meningitis and urinary tract infection (WHO, 2005). It also protects against chronic conditions in thefuture such as type I diabetes, ulcerative colitis, and Crohn's disease. Breastfeeding during infancy isassociated with lower mean blood pressure and total serum cholesterol and with lower prevalence of type-2 diabetes, overweight and obesity during adolescence and adult life (WHO, 2007). Breastfeeding delays the returnof a woman's fertility and reduces the risks of post-partum haemorrhage, pre-menopausal breast cancerand ovarian cancer.Nevertheless, a small number of health conditions of the infant or the mother may justify recommending that she does not breastfeed temporarily or permanently. These conditions, which concern very few mothers and their infants, are listed below together with some health conditions of the mother that, although serious, are not medical reasons for using breast-milk substitutes.Whenever stopping breastfeeding is considered, the benefits of breastfeeding should be weighed against the risks posed by the presence of the specific conditions listed.

The World Health Organization (WHO, 2002) and the United Nations Children's Fund have recently advocated for increased commitment to appropriate feeding practices for all infants and young children in order to achieve optimal growth, development and health

(WHO, 2002). As a global public health recommendation, international guidelines stress that infants should be exclusively breastfed for six months, then frequent and on-demand breastfeeding should continue to 24 months and should be coupled with the gradual introduction of complementary feeding adapted to the child's requirements and abilities.Nevertheless, this issue is particularly complex in high human immunodeficiency virus (HIV) prevalence and resource constrained settings where HIV infected pregnant women face a dilemma regarding the feeding practices of their forthcoming infant. Indeed, in these settings where breastfeeding is widely practiced and usually prolonged one year after birth, the overall risk of HIV transmission through breast milk was estimated to be 8.9 new cases per 100 child-years of breast-feeding (WHO, UNICEF &UNAIDS, 1998).Several nutritional strategies are conceivable in urban settings to reduce this risk. One of them consists in the combined promotion of exclusive breastfeeding and early cessation of breastfeeding. Indeed, the shorter the breastfeeding period, the lower the cumulative risk of HIV transmission through breast milk. Moreover, some observational evidence shows that exclusive breastfeeding carries a lower postnatal risk of transmission of HIV than breastfeeding with early introduction of other fluids or foods. To be fully assessed, the benefits of such a nutritional intervention in terms of reduction of postnatal HIV transmission have to be balanced with their potential risks for infant health. Indeed, this nutritional intervention could also have potential adverse effects. One of these was that complementary feeding taking over breast milk would not be nutritionally appropriate, whereas international guidelines stress that such a strategy should be coupled with the introduction of nutritionally adequate and safe complementary foods.

A research study launched in 2001 aimed at the prevention of mother-to-child transmission of HIV in Abidjan, Côte d'Ivoire, proposing to HIV-infected pregnant women willing to breastfeed to do it exclusively and to initiate early weaning. The study previously shown that among these breastfeeding mothers, the median duration of breastfeeding was reduced to four months, which was shorter than it was usually practiced in this population.The purpose of the study was first to describe the nature and ages of introduction of complementary feeding among breastfed infants up to their first birthday; and second to assess the nutritional adequacy of these complementary foods by creating a child feeding index, and to investigate its association with child nutritional status.

2.1.1 Breastfeeding and HIV

Breastfeeding is a pillar of child survival; it reduces morbidity and mortality in children worldwide. However, since the early 1980s when it was discovered that HIV could be transmitted to infants through human milk, the healthfulness of breastfeeding has been questioned, because of the risk of mother-to-child transmission of HIV (MTCT). A note on terminology: The International AIDS Society has been advised, in particular by networks of women living with HIV, that the term "prevention of vertical transmission" should be used instead of "preventing mother-to-child transmission (PMTCT)".The concern is that "PMTCT" can sound stigmatizing in that it assigns blame to the mother. When the term PMTCT is used by UN agencies, it is understood to describe 4 pillars of preventing vertical transmission. In this study, it use the terms PMTCT and MTCT in this broad sense of prevention and without any implication of culpability. Indeed, scientists, policymakers, and program managers have spent the last several decades struggling to characterize the proportion of risk of MTCT attributable to breast milk and to develop

appropriate and feasible guidelines on infant feeding in settings where HIV is present. For this reason, it has been said that the HIV pandemic has threatened to "knock breastfeeding off its pedestal as a pillar of child survival", (Young, *et al.,* 2010.)

The survey then contextualize the 2010 recommendations by discussing biomedical, social, and economic issues surrounding their current implementation. In the second part of this study, the study suggest areas for future research in infant feeding and related prevention of MTCT (PMTCT), recommendations that the study reflection could have the biggest effect on improving the health of HIV-exposed infants. Basic, clinical, behavioral, and programmatic research questions are outlined for each area. It should not be forgotten, however, that infant feeding behaviors are only one aspect of vertical transmission and that the prevention of vertical transmission, in turn, is only 1 of the 4 components of the WHO's comprehensive strategic approach to the prevention of HIV infection in infants and young children.Eradication of vertical transmission of HIV must include the prevention of infection among women of reproductive age, prevention of unintended pregnancies among HIV-infected women, and provision of adequate treatment, care, and support to HIV-infected women and their families. In this review, however, we limit our discussion to PMTCT issues, with a particular emphasis on postnatal PMTCT strategies.

2.1.2 Benefits and Risks of Breastfeeding

2.1.2.1 Beneficial Components of Human Milk

The short-term and long-term benefits of breastfeeding have been well documented for both the mother and her infant. In the short-term, breastfeeding decreases postpartum blood loss and promotes bonding between mother and child. Longer term, for women, it is

associated with reduction in risks of breast and ovarian cancers, retained gestational weight gain, type 2 diabetes, myocardial infarction, and metabolic syndrome as well as delayed resumption of menses (lactational amenorrhea), which is important for birth spacing. For infants, breastfeeding is unequalled in its role in reducing morbidities and improving child growth, development, and survival in developing and industrialized countries. In addition to the well-established role of breast milk in preventing infectious diseases in infants, it reduces the risks of childhood obesity, type 1 (Gerstein HC,1994)and type 2 diabetes(Perez-Bravo, *et al.,* 1996);Leukemia, and sudden infant death syndrome(Horne, *et al.,*2004; Mosko, *et al.,*1997).The protective effects of human milk are due in part to its optimal nutritional composition. Breast milk typically provides most of the protein and energy needs of infants even in the latter part of the first year of life as well as a majority of several critical micronutrients such as vitamins A, C, and B-12 and foliate and copper (Gibson, *et al.,* 1998). These nutrients are not easily replaced by complementary feeding in the best of circumstances and less so in low-income populations.

Human milk is also beneficial because of its important and myriad immunological and anti-infective factors(Chirico, *et al.,* 2008). They include, among many others, proteins with antimicrobial properties such as secretory IgA, lysozyme, and lacto ferrin; lacto ferrin provides immune-modulating properties in addition to its better-known anti-infective properties. Oligosaccharides in breast milk inhibit bacterial adhesion, further protecting against pathogens, and white blood cells provide passive immune protection. Nucleotides and cytokines also assist with T-cell maturation and immune system modulation, evidenced by, e.g. the more robust immune response that breast-fed infants exhibit after vaccination. Breast milk also promotes healthful gastrointestinal microbiota.

2.1.2.2 Health risks of breast milk

Because lactation is a metabolically luxurious process, there was initial concern that breastfeeding could be venomous to HIV-infected mothers' health. Several studies have since been unable to demonstrate any adverse consequences for maternal health. Furthermore, a meta-analysis conducted by the Breastfeeding and HIV International Transmission Study Group indicated that mothers' mortality during the 18-months period after delivery did not differ considerably according to children's feeding modality (ever vs. never breast-fed) (Acquired Immune Deficiency Syndrome, 2005). The apparent mortality and other health risks in HIV-infected breastfeeding women were explained by confounding. That is, HIV-infected women with lower CD4 counts were less likely to initiate breastfeeding and healthier women were able to breastfeed longer. However, because superior fat loss (Papathakis, *et al.,* 2006) and micronutrient deficiencies (Papathakis, *et al.,* 2007) has been observed during lactation among HIV-infected compared to uninfected women, some concerns remain about potentially unmet nutritional requirements of lactating HIV-infected women. However, in general, the major risk of breastfeeding is vertical transmission of HIV and not adverse health effects for the mother. In 2008, approximately 430,000 (240,000–610,000) children became infected with HIV; 90% of these were owing to vertical transmission (UNAIDS, WHO; 2009). Vertical transmission can take place during pregnancy, labour, and delivery, as well as postpartum, through breastfeeding. The risk of transmission depends on many factors, including the timing of maternal infection, maternal viral load, immune function, nutritional status of both the woman and baby, antiretroviral (ARV) use, breast health (nipple pathology, mastitis), type of breastfeeding (exclusive, mixed, or replacement feeding), duration of any breastfeeding, and presence of oral lesions in the infant (Coutsoudis, *et al.,* 2004).

In the absence of interventions to prevent transmission, 5–10% of infants born to HIV-positive mothers become infected with HIV during pregnancy and 10–20% becomes infected around the time of delivery (UNAIDS/WHO, 2009; De Cock, 2000). Estimates of the risks of HIV infection via breast milk have varied due to the multifactorial nature of risk of transmission, including the difficulty of quantifying the instantaneous hazard rate of infection (Kuhn L, Aldrovandi G, 2010). In 1990, De Cock, *et al.*,(2000) calculated that between 5 and 20% of infants would become infected if breastfed beyond 18 months. A meta-analysis by the Breastfeeding and HIV International Transmission Study Group found that 42% of infections were attributable to breast milk (Kourtis, *et al.*, 2003). Calculated that without any intervention, ~6% of HIV-negative but exposed infants would become infected via breastfeeding if they were Exclusively Breastfed (EBF) for 6 months and rapidly weaned, 11% would become infected if they were mixed fed for 6 months then rapidly weaned, and 15% of infants would become infected if they were breastfed for 2 year.With currently implemented prenatal and perinatal interventions, one-third to one-half of all MTCT is estimated to occur in the postpartum period, i.e. through breastfeeding (WHO, UNICEF, UNAIDS, UNFPA, 2007). Although the proportion of postnatal transmission attributable to breastfeeding is not known exactly, it is likely steadily increasing as prenatal and peripartum ARV prophylaxis continues to have increased availability and use in sub-Saharan Africa.

2.2 Health Risks of Not Breastfeeding: Increased Morbidity and Mortality

In general pediatric populations, i.e. those not specifically HIV exposed, replacement of breastfeeding with formula milks, animal milks, and other foods is attended by increased mortality, morbidity, poor growth, and development in both developing(Jones, 2003) and (Black, 2003) and industrialized (Duijts et al, 2010) and (McNiel, 2010) countries. Pooled

analyses of data from developing countries demonstrated that breastfeeding was strongly protective against mortality from infectious disease. The OR of survival among breast-fed infants 0–1 month old was high and lower among for 2–3 month old children. It was further found to be lower among children above 4 months. For second-year deaths, the pooled OR ranged between 1.6 and 2.1. The protective effects of breastfeeding are most striking in developing countries, but they are clear in industrialized settings as well. Pooled analyses of mortality by breastfeeding modality in industrialized countries is not available, but post neonatal infant mortality rates in the United States were 21% lower among ever breast-fed infants (Chen A, Rogan WJ, 2004).

Specifically among HIV-exposed children, multiple studies in low-income settings have documented increased morbidity and mortality associated with earlier cessation of breastfeeding compared to continued breastfeeding. In Uganda, a mean duration of any breastfeeding of 4.0 month compared to 9.3 month in a later trial was associated with higher rates of severe gastroenteritis (8.0 vs. 3.1 episodes/1000 child-months; $P < 0.001$)Onyango, *et al.,* 2009). Similarly, cessation of breastfeeding by 6 months of age compared to prolonged breastfeeding in Malawi resulted in greater rates of hospitalization for gastroenteritis (2.9 vs. 0.1% at 7–9 mo and 1.6 vs. 0.2% at 10–12 month; $P < 0.001$) and higher gastroenteritis related mortality (19 vs. 7/1000 infants at 9 month and 24 vs. 12/1000 infants at 12 month; $P= 0.0002$) (Kafulafula, *et al.,* 2010). In Zambia, a significantly greater decrease in weight-for-age Z-scores between 4 and 16 month was reported among HIV-exposed, uninfected infants who stopped breastfeeding at 4 month compared to those who continued. In Zimbabwe, infants whose mothers opted to cease breastfeeding at 9 month after receipt of an HIV-PCR-negative result were fed grossly inadequate diets compared to those who continued to receive breast milk. During an

outbreak of diarrhea in Botswana in 2006, HIV-exposed infants who were receiving formula provided free of charge were at much greater risk of death than their breast-fed peers. In summary, not breastfeeding increases morbidity and mortality in HIV-exposed and unexposed children in developing and industrialized countries.

2.3 Exclusive Breastfeeding (EBF) in the context of HIV

In 1999, Coutsoudis, *et al.,* reported the striking finding that the risk of MTCT with EBF was significantly lower than that associated with mixed feeding. In 2001 they reported that cumulative probability of HIV detection in infants was similar for babies never breastfed and those EBF (0.194), whereas the risk of HIV infection in infants fed breast milk and other foods was much higher (0.261) (Coutsoudis, *et al.,* 2001). The greatly elevated risk of MTCT associated with mixed feeding and the protective benefits of EBF were subsequently demonstrated in other studies. Furthermore, lower non-HIV morbidity and mortality rates are observed among HIV-exposed, EBF infants compared to their mixed fed counterparts (Piwoz, *et al.,* 2007; Taha, 2006). The mechanisms by which EBF is associated with lower MTCT are not fully understood. They are likely numerous and have been described at length elsewhere. Briefly, EBF may promote maintenance of the integrity of the infant's gastrointestinal barrier, which is thought to be the primary mode of infection. The immunological factors in breast milk likely reduce viral activity in human milk. Additionally, EBF maintains the integrity of the mammary epithelial lining and promotes overall breast health. For all these reasons, the 2010 Guidelines recommend 6 month of EBF in the absence of AFASS replacement feeding.

Policy formulation on appropriate breastfeeding practices and duration of exclusive breastfeeding is based on knowledge of the relationship between breastfeeding, morbidity and growth in infancy. The recommended period of exclusive breastfeeding is 6 months (WHO, 2001). In developing countries infants from birth to 5 months of age who are not breastfed are five and seven times more likely to die from diarrhoea and pneumonia, respectively (Victora, *et al.,* 1989). Nonexclusively breastfed infants of the same age are about twice as likely to die from diarrhoea or pneumonia (Arifeen, *et al.,* 2001). It has been estimated that breastfeeding could reduce under-five deaths by as much as 13% (Jones, *et al.,* 2002). Conversely, prolonged breastfeeding can be detrimental by reducing consumption of complementary foods (Brakohiapa, *et al.,* 1988; Tangermann, *et al.,* 1988), although this conclusion has been challenged (Marquis, *et al.,* 1997). It may also increase the risk of micronutrient deficiency as human milk has low concentrations of iron and zinc (Brown et al., 1998). Breastfeeding prolongs the period of exposure to the HIV virus in babies of HIV infected mothers (Miotti, *et al.,* 1999) and early introduction of complementary foods, including water, has been associated with increased morbidity from diarrhoeal disease (Popkin, *et al.,* 1990), linear growth faltering (Caulfied, *et al.,* 1996) and increased risk of mother to child HIV transmission (Coutsoudis, *et al.,* 2001).

2.3.1 Abrupt cessation of EBF

Because of the relatively low risk of HIV transmission during EBF compared to mixed feeding, it was thought that abrupt cessation of breastfeeding might offer infants the maximum health benefit with minimum risk. However, the sole randomized trial to investigate the effects of abrupt weaning (defined as "as soon as possible;" 68.8% weaned within 2 d) indicated that the health risks of rapid weaning (e.g. higher viral load in milk

with abrupt weaning, inadequate nutritional intake thereafter, and death) outweighed the health benefits of PMTCT. Data from a number of other studies also support these findings. Women are now advised to stop breastfeeding gradually within a month.

Another change in the 2010 guidelines is the recommended duration of breastfeeding in the absence of AFASS conditions. The recommended duration of breastfeeding for HIV-exposed infants is slowly approaching that for the general population. Women are now encouraged to breastfeed for a minimum of 12 months and breastfeeding should then only stop once a nutritionally adequate and safe diet without breast milk can be provided. Although the risk of HIV transmission continues for as long as breastfeeding continues, HIV-free survival of HIV-exposed infants who breastfed beyond 6 month was similar to that of infants who received no breast milk after 6 month. Infants given replacement foods after a period of breastfeeding also suffered increased serious infections, including diarrhea and pneumonia, growth faltering, and death. The importance placed on maximizing an infant's continued access to breast milk in the 2010 recommendations reflects the immunological benefits of breast milk as well as the importance of breast milk in providing adequate nutrition to infants > 6 month of age.

2.3.2 The removal of barriers to EBF

Current rates of EBF are well below targeted levels in both HIV-affected and unaffected populations around the world. Increasing rates of EBF is one of the most powerful interventions to save child lives; the promotion of breastfeeding could prevent 13–15% of child deaths in low-income countries. Other benefits of the promotion of EBF include that it is also a healthful behaviour for HIV-unexposed infants and their mothers, is helpful for

birth spacing, requires minimal preparation, is not dependent upon outside materials, and breast milk does not need purchased. Additionally, the fact that breastfeeding is a common behaviour means it is unlikely to flag the mother's HIV status. Although there are many advantages of EBF, a woman's initial decision to EBF can be stymied by a range of societal, household, and individual factors. At the individual or household levels, poverty is a risk to EBF when women need to return to income-generating activities. Perceptions at the community level that breastfeeding always leads to HIV infection in the infant have dissuaded some women from EBF. At the macro-level, women from across the entire socioeconomic spectrum are thwarted in their efforts to EBF by well-meaning community members who insist that it is not appropriate. They may suggest that colostrum is harmful, that the infant is not getting all the nutrients and or liquid she needs from breast milk alone, or that formula is somehow superior. Women themselves may decide they are unable to EBF because of either perceived or actual (which is uncommon) insufficient milk production; in low-income settings this is frequently associated with perceived inadequate nutritional intake. An additional barrier to EBF is misunderstanding what it is; women may think they EBF when in fact they do not. In Malawi, e.g., mothers did not understand that feeding warm water to infants was in conflict with EBF; it was done to prepare the infant gut such that the intestines can open up.

In summary, any efforts to increase EBF must first focus on local community expectations about infant feeding for all women as well as experienced and perceived barriers to EBF. They must also consider women's own perceptions of the consequences of breastfeeding when infected with HIV. Only once the reasons for not EBF are identified should approaches to increasing rates be implemented. There are a variety of interventions for improving rates of EBF, from education to cash transfers to mass media messages; the

application of these to HIV-infected populations or general populations in countries with high HIV prevalence will be informative. Similarly, the evaluation of the high-priority strategies for protecting, promoting, and supporting EBF detailed in the Global Strategy for Infant and Young Child Feeding would be useful in the context of HIV. If the mother is HIV positive, more uncertainty is added. New evidence recommends HIV-positive mothers should breastfeed. Until recently, the World Health Organization (WHO) advised HIV-positive mothers to avoid breastfeeding if they were able to afford, prepare and store formula milk safely. But research has since emerged, particularly from South Africa that shows that a combination of exclusive breastfeeding and the use of antiretroviral treatment can significantly reduce the risk of transmitting HIV to babies through breastfeeding.

On 30 November 2009, WHO released new recommendations on infant feeding by HIV-positive mothers, based on this new evidence? For the first time, WHO recommended that HIV-positive mothers or their infants take antiretroviral drugs throughout the period of breastfeeding and until the infant is 12 months old. This means that the child can benefit from breastfeeding with very little risk of becoming infected with HIV. Prior research had shown that exclusive breastfeeding in the first six months of an infant's life was associated with a three- to fourfold decreased risk of HIV transmission compared to infants who were breastfed and also received other milks or foods. Instrumental in guiding the new recommendations were two major African studies that announced their findings in July 2009 at the fifth International AIDS Society conference in Cape Town. The WHO-led Kesho Bora study found that giving HIV-positive mothers a combination of antiretroviral during pregnancy, delivery and breastfeeding reduced the risk of HIV transmission to infants by 42%. The Breastfeeding, Antiretroviral and Nutrition study held in Malawi also

showed a risk of HIV transmission reduced to just 1.8% for infants given the antiretroviral drug nevirapine daily while breastfeeding for 6 months.

In spite of these findings it will be a challenge to change the ingrained culture of formula feeding in South Africa. Existing attitudes have been influenced by the country's high HIV-prevalence – 18% of the adult population is HIV positive, according to 2008 estimates from the Joint United Nations Programme on HIV/AIDS. The 2003 South African Demographic Health Survey found that fewer than 12% of infants are exclusively breastfed during their first three months and this drops to 1.5% for infants aged between three and six months. Some health workers themselves are yet to be convinced of the benefits of breastfeeding, even for mothers who aren't HIV positive. Yet, the risks of not breastfeeding often go unrecognized. Most children born to HIV-positive mothers and raised on formula do not die of AIDS but of under-nourishment, diarrhea, pneumonia and other causes not related to HIV. Breastfeeding not only provides babies with the nutrients they need for optimal development but also gives babies the antibodies they need to protect them against some of these common but deadly illnesses. WHO recommends that all mothers, regardless of their HIV status, practice exclusive breastfeeding – which means no other liquids or food are given – in the first six months. After six months, the baby should start on complementary foods. Mothers who are not infected with HIV should breastfeed until the infant is two years or older.

Literature available indicates that breast feeding reduces the risk of obesity in childhood and in later life (Owen, *et al*., 2005; Arenz, *et al*., 2004; WHO, 2007). In one meta-analysis the odds ratio (OR) was 0.78 CI 95% confidence interval (CI): 0.72- 084) (WHO, 2007). Other studies have also documented a dose – response effect of the duration of breast feeding in relation to risk of obesity (Arenz, *et al*., 2004; Harder, *et al*., 2005; WHO, 2007). The mother's milk contains certain hormones which could be responsible for lowering the risk of obesity among children who breast feed though the mechanism in breast milk which protects the breast fed child against obesity is not clear. However, it is been suggested that hormones contained in the breast milk could also be involved in lowering the risk of obesity in children who breast feeding (Savino, *et al*., 2009). It is also reported that breast feeding protects the child against type 2 diabetes in later life. A review of 76,744 subjects by Owen,*et al.,* (2006) revealed that the odds ratio of developing type 2 diabetes was 0 – 61 (95% CI: 0.41 – 0. 85) in those breast fed compared to those not breast fed. The same authors in a meta-analysis reported evidence of lower glucose and insulin levels in those breasts fed during infancy and concluded that insulin levels in those who were breast fed are marginally lower later in life suggesting a programming effect on insulin metabolism which could possibly influence the risk of getting type 2 diabetes in adulthood. During the period of complementary feeding the mother's breast milk is important in the development of the immune system and reducing infections and morbidity among infants a (Chantry, *et al*., 2006; Chirico, *et al.,* 2008).

The WHO (2001c) recommendation on exclusive breast feeding for the first early months of the child's life and then followed with the introduction of complementary foods at age 6 months was mainly based on the data of the PROBIT study as cited (Kramer, *et al*., 2003) which compared 2862 infants who were exclusively breastfed for 3 months (with

continued mixed feeding through to 6 months and beyond) with 621 infants who were also exclusively breastfed for 6 months and/ or more. The infants who were exclusively breastfed for at least 6 months experienced reduced gastrointestinal infection than those who were mixed breastfed 3-4 months of life, during the period 3-6 months. But then the results show that the protective effect did not persist at 6 – 12 months (adjusted IDR: 0. 90 [0.46-1.783]), however, the study did not detect any difference on the risk of respiratory infections in the two groups. Other studies conducted in the USA and Europe have also reported on the role of exclusive breastfeeding for at least 6 months in decreasing the risk of infections in infants (Chantry, *et al.,* 2006; Talayero, *et al.,* 2006; Quigley, *et al*., 2007; Rebhan, *et al.,* 2009).Continued breastfeeding for more than 6 months is also documented to have protective effection the child against other forms of infections and morbidity (Quigley,*et al*., 2007)

At six months of age and beyond it becomes difficult for only the mothers' breast milk to provide adequate nutrition for the infants (WHO/UNICEF, 1998) and at this age many infants are developmentally ready to receive other foods in addition to the mother's breast milk (Naglor and Morrow, 2001). The mother's breast milk continues to impact greatly on the infant's nutritional status. So, if complementary feeding starts at 6 months of the child's life, the mother is expected to continue with on demand breast feeding to complement the other nutrient requirements of the child. According to (Dewey and Brown 1999) continues breast feeding at 12-23 months of age receive about 35-40% of the total energy intake from breast milk. The mothers' breast milk is an important source of energy and essential fatty acids. The fat in breast milk is relatively higher than what is contained in most complementary foods. A study conducted in the Gambia by Prentice and Paul

(2000) have shown that human breast milk provides about 70% of Vitamin A, 40% of calcium and 37% of riboflavin of children at 15-18 months of age.

Brown, *et al.*, (1990) observed that the nutritional impact of breast milk is much realized at periods of illness when the child's appetite for other foods is demising which in most cases breast milk is maintained. Thereby contributing significantly minimizing rates of dehydration in infants which increasing the recovery rate from and infections. Continued breastfeeding at a year of the child's life reduces the risk of morbidity and mortality in infants and young children whiles delaying maternal postpartum there contributing to population control which is good for a fast growing population society especially communities that are resource constraint (Molbak, *et al.,* 1994; Who collaborative study team on the role of breast feeding on the prevention of infant mortality, 2000).Even though the real importance of breast feeding at through to one year and beyond on infant growth has been controversial (Canfield, *et al.,* 1996, Habicht, 2000), studies by Onyango, *et al.,* (1999) and Simondon, *et al.*, (2001) have observed that a longer duration of breast feeding is associated with greater linear growth. Other studies also reported that the longer the duration of breast feeding the lesser the risk of childhood chronic illness (Davis 2001; Butte, 2001). A link between improvements in cognitive developments to longer breast feeding durations was also reported by Reynolds (2001).

2.3.3 Exclusive breastfeeding in Ghana

The Exclusive breastfeeding (% of children under 6 months) in Ghana was reported at 62.80 in 2008, according to the World Bank. Exclusive breastfeeding refers to the percentage of children less than six months old who are fed breast milk alone (no other

liquids) in the past 24 hours.Mahama, *et al.*,(2012) found out that EBF among infants less than six months was 92.1% in Tamale metropolis using 24hr recall.

2.3.4 Breastfeeding in high-income settings.

As additional data demonstrate the safety of breastfeeding with either maternal HAART or infant ARV prophylaxis, it is inevitable that HIV-infected women in high-income settings will express a desire to breastfeed their infants (D. Cohan, unpublished observations; C. Chantry, unpublished observations). Although HIV-infected mothers in such countries who choose to breastfeed may be prevented from doing so or even be charged with child endangerment if they persist, there is growing recognition that breastfeeding may be the only acceptable mode of infant feeding for some of these women. Clinicians will need to be prepared to help women make informed decisions about the relative risks of the variety of feeding modalities. Indeed, the UK Department of Health advises that "Under exceptional circumstances, and after seeking expert professional advice on reducing the risk of transmission of HIV through breastfeeding, a highly informed and motivated mother might be assisted to breastfeed. Currently, there is minimal data on women in industrialized countries who feed infants their own breast milk [notable exceptions include.

It is therefore informative to follow the health status of high-income, HIV-infected women who opt to breastfeed their infants, together with the health of their infants. It is also useful to characterize current infant feeding preferences among women in high-income settings and to track how this change as our understanding of PMTCT evolves. Such predictors of desired infant feeding modality could include, but should not be limited to: *1*) country of origin and time since immigration; *2*) HIV disclosure to partner/family

members/community; *3*) time since HIV diagnosis; *4*) clinical disease progression; *5*) infant feeding experience with prior children; *6*) access to formula/human banked milk; *7*) self-perceived community standards/expectations; *8*) experience with ARV during pregnancy and/or the postpartum period; and *9*) socioeconomic characteristics of women and the households in which they live.

2.4 HIV-free survival

Given that on one hand, breast milk can be a vector for HIV, but on the other hand, infants, particularly those in low-income settings, are at increased risk of malnutrition, diarrhea, acute respiratory infection, and death if they are not breastfed, any treatment of the issue of infant feeding and HIV must necessarily address the concept of balanced risks. The concept of HIV-free survival is one that captures the risks of both outcomes and is therefore a more balanced metric of success (safety) of an infant feeding modality. In using this concept, it is important to emphasize, however, that it reflects the desired outcome of a baby staying HIV-negative and alive. It does not imply that an HIV infection is equivalent to a death. One disadvantage to using this measurement is that it can "stack the deck in favor of interventions that prevent HIV transmission and neglect the range of other nonfatal, but potentially serious, adverse outcomes associated with limiting breastfeeding". Studies typically report HIV-free survival to 18 month with some reporting up to 24 month of age. Because of the limitations of the concept of HIV-free survival, the health of a population might better be measured in terms of HIV-free "thrival" (survival + thriving), which is a more comprehensive metric, because it captures not just if the child is alive, but how well she or he is doing. In this context, thriving could be operationalized as normal growth, i.e. no stunting or wasting. Thus, thrival measures some of the outcomes that may be associated with recurrent illnesses or malnutrition arising from early cessation of

breastfeeding and is therefore not biased toward interventions that simply prevent death or HIV infection, as is the concept "HIV-free survival".

2.5 Evolution of Strategies for Risk Mitigation

2.5.1 Replacement feeding

The WHO has long championed the importance of breastfeeding. This is evidenced in numerous publications and consensus statements, e.g. the Innocenti Declaration, the Baby-Friendly Hospital Initiative, and the International Code of Marketing of Breast milk Substitutes. In the early 1990s, great emphasis became placed on avoiding MTCT through breastfeeding. To that end, in 1998, WHO, UNICEF, and UNAIDS issued a series of documents stating that replacement-fed, HIV-exposed infants were less at risk of illness and death so long as they had uninterrupted access to nutritionally adequate breast milk substitutes that are safely prepared and fed to them. Although the importance of breastfeeding was underscored in the absence of satisfactory substitutes, these guidelines, together with the plans to conduct several trials of formula feeding among HIV-exposed infants, were perceived by many to be a major shift in WHO policy from the decades of promotion of "breast is best".

The WHO introduced the acceptable, feasible, affordable, sustainable, and safe (AFASS) criteria into their infant feeding guidelines in 2001. They recommended that all breastfeeding by HIV-infected mothers should be avoided when replacement feeding was considered to be AFASS. It was recommended that each mother, with appropriate counseling support, make the determination of whether the AFASS criteria were met. In

the absence of AFASS, it was recommended that infants should be EBF for the first months of life; a time at which EBF or any breastfeeding should cease was not specified. The 2010 recommendations did not use the AFASS language but instead defined in more detail the environmental (personal, household, and health service) conditions that make replacement feeding safer. They also shift decision-making away from counselors and mothers. They state that national health authorities should decide which infant feeding practice will be primarily promoted and supported by Maternal and Child Health services but that information about other practices should be made available.

2.5.2 Modified animal milk

At the time the 1998 recommendation was issued, the 2 main replacement milks were modified animal milks and commercial infant formula. Modified animal milk is typically powdered or fresh cow or buffalo milk to which water, sugar, and micronutrients are added. It is, however, no longer recommended for feeding infants < 6 months because of insufficient macro- and micronutrient content, concerns about the safety of storage, and occult bleeding those non-human milks can cause. Indeed, data from the main study of replacement feeding with nonformula modified animal milks indicated that Indian infants who were primarily fed modified animal milks had a greatly increased rate of hospital admission than those who were breastfed, mainly due to gastroenteritis with dehydration.

2.5.3 Commercial infant formula

Commercial infant formula has been the most frequently discussed and provisioned replacement milk. It has been made available to HIV-positive mothers for free as part of

government PMTCT policy [e.g. South Africa, Botswana] through nongovernmental organizations [e.g. Partners in Health programs in Haiti, Rwanda, Lesotho; UNICEF] in 8 African countries and as part of numerous research studies. In industrialized countries, replacement feeding has been AFASS for most HIV-positive women, and it is now standard practice for women there to feed their infants formula. Indeed, in the United States, the CDC has recommended since 1985 that HIV-positive women not breastfeed, which they reiterated in 2010. Replacement feeding, together with ARV medicines and other intensive obstetric prevention strategies for infected mothers, has undoubtedly contributed to the very low rates of PMTCT in high-income countries. Replacement feeding in low- and middle-income countries, however, has not yielded the same positive health outcomes as it has in high-income countries.

Indeed, replacement feeding ensures that HIV is not transmitted to the infant via breast milk and an initial study suggested that HIV-free survival was improved with replacement feeding. However, the analytical strategy was problematic, including the assignment of mixed feeders to the breastfeeding group and the results have not been replicated since. More recent data from 9 studies in sub-Saharan Africa suggest that reductions in HIV transmission achieved with formula feeding are offset by increases in HIV-unrelated mortality. In short, current data suggests there is no net benefit of replacement feeding with formula to HIV-free survival in sub-Saharan Africa, even when formula is provided for free.

Furthermore, the promotion of replacement feeding can have negative health consequences for infants who are not at risk of vertical transmission. Because there is no (further) risk of vertical transmission, HIV-positive babies should not be fed replacement milks. However, the promotion of replacement feeding to HIV-positive mothers can result in HIV-infected infants not receiving breast milk. As for HIV-unexposed infants, the promotion of replacement feeding has led some women who do not know their status to opt not to breastfeed for fear of infecting their infant; this has been termed the spillover effect; (Latham and Kisanga, n.d. 1999).In addition to detrimental health consequences, replacement feeding has had negative economic, social, and reproductive consequences for some infants and mothers. A major burden of replacement feeding is the expense. In 2009, a 6-mo supply of formula had an estimated cost of $174; this figure does not include the cost of clean, safe water or the time to prepare it. This expense is beyond the reach of the many individuals and governments in the areas where the majority of MTCT occurs, namely sub-Saharan Africa. The social consequences of replacement feeding have also been staggering. In places where breastfeeding is common and expected, a woman's use of other feeding modalities frequently flags her as HIV-positive to both family members and the community at large. This can have serious consequences for the mother-infant dyad, e.g. divorce, ostracization, and abandonment of the child. All of these potential consequences, in turn, can dramatically change the economic calculus associated with decisions related to child feeding and care, e.g. ostracized women may lose traditional employment options or their asset bases and hence may choose not to participate in PMTCT programs, perhaps to safeguard the futures of children not affected by HIV. Replacement feeding has also had unintended reproductive consequences, because the absence of lactational amenorrhea can lead to unintended pregnancies and consequently an increased number of HIV-exposed infants.

In conclusion, formula feeding in low-income settings often leads to serious negative health, economic, and social consequences for both child and mother and when formula has been provided in real-world conditions, HIV-free survival rates have generally been worse.Hill, *et al.,*(2005), conducted a randomized control trial of breast-feeding infants less than six months with colic. 74% 0f the experimental group reported 25% reduction in colic and 37% in the control group after feeding their infant with eggs, soy, peanut among the experimental.

2.5.4 Other Optimal Breastfeeding Practices

Although the 2010 guidelines recommend continued breastfeeding to 12 months with extended ARV prophylaxis, the optimal duration of breastfeeding for HIV-exposed infants, i.e. one that balances the health risks of virus and ARV exposure with the nutritional and immunologic benefits of breastfeeding is not yet clear. Environmental factors, such as inadequate sanitation and quality of complementary feeding, are sure to modify the risk: benefit ratio, but their effect size in HIV-exposed populations is currently unquantified. We also do not know what the relative risk: benefit ratio is for HIV-positive infants who have consumed non-breast milk foods to initiate or resume breastfeeding from their HIV-infected mother. The differences in risk associated with vertical transmission during mixed feeding vs. complementary feeding have also not been made clear, because in much of the HIV literature, complementary feeding has not been differentiated from mixed feeding. Elucidation of the basic science behind the mechanisms of transmission would be immensely useful in answering these questions.

When evaluating optimal duration of breastfeeding, it is worth considering that the 2010 recommendation of 12 month of breastfeeding is contrary to the recommended duration of breastfeeding in HIV-unexposed infants, which is through the second year of life and beyond. The shorter recommended period of breastfeeding duration among HIV-positive compared to HIV-negative mothers may trigger another spill over effect, whereby uninfected mothers shorten the duration of breastfeeding. The field of postnatal PMTCT-HIV is experiencing a number of exciting breakthroughs, which present important opportunities for research and programming to improve the welfare of HIV-affected women and their children. Recently developed interventions and methods with demonstrated effectiveness have the potential to prevent HIV infection and promote the growth of healthy infants more effectively than was previously possible. But much remains to be discovered about their biological, psychosocial, and economic consequences. We therefore strongly suggest that future research focus on holistic evaluations of these practices in order to help policy makers choose the most feasible, cost-effective ways to reduce vertical transmission and promote the development and growth of children of HIV-positive mothers. Furthermore, prioritization of research that will increase the coverage of those interventions with the most promise, especially toward increasing rates of EBF, ARV coverage, and breast milk pasteurization, will certainly maximize the HIV-free thrival of the next generation of HIV-exposed infants.

2.6 Complementary feeding defined

Complementary feeding and breastfeeding are two most critical aspects of infant and young child feeding. Complementary feeding is so important during the period of infancy and early childhood because at 6 months of age of a child's life breast milk alone is no longer enough to provide the child with adequate energy and nutrients for an active healthy

life (WHO and UNICEF, 2003; WHO, 2001; UNICEF and WHO, 2008; Mukuria, 2006). Optimal infant and young child feeding (IYCF) is an important public health intervention which requires that babies are introduced to breast feeding within the first hour of birth and continue to exclusively breast feed for up to 6 months and are then introduced to appropriate complementary foods while increasing the amount and variety of foods and frequency of feeding as the child gets older, and maintaining frequent on demand breastfeeding up to two years and sometimes beyond (PAHO/WHO, 2003; Daelmans, *et al*., 2003; WHO, 2005).

According to PAHO/WHO, (2003) complementary feeding is defined as ''the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants and therefore other foods and liquids are needed along with breast milk''. Such foods fed to infants are considered as complementary foods. As cited by Amarra and Chan, (2013), in 2008, the World Health Organization (WHO) released the revised infant and young child feeding indicators based on practices shown to be capable of improving child nutritional status and supported by current scientific evidence. The documents: Indicators for Assessing Infant and Young Child Feeding Practices Part I (Definitions) and Part2 (Measurement) identified 8 core and 7 optional indicators for assessing infant and young child feeding practices, and provided guidelines for their operationalization in household surveys (WHO, 2008; 2010). The recommended use of these indicators for measuring feeding practices of children at 0-23 months is to enable the assessment of the situation regarding breastfeeding and complementary feeding practices (UNICEF, 2011)''. Complementary feeding practices that fall short of these indicators are considered inappropriate.

However, there appear to be a certain level of discrepancy regarding the exact age of a child's life deemed appropriate for the introduction of other foods in addition to breast milk for the breast fed infant. The argument stretches from 4- 6 months of the child's life when other foods are considered appropriate for the child in addition to the mother's breast milk but not earlier than age of 4 months and not later than age of 6 months. Meanwhile, Ghana is committed to the introduction of other foods to infants at age 6 months as recommended by the World Health Organization (2008). The recommended age of a child life considered appropriate for the introduction of complementary foods is 6 months (WHO, 2001d). Infants and young children are the increased risk of under nutrition during the complementary feeding period (Shrimpton, *et al.,* 2001).

2.6.1 Importance of optimal complementary feeding practices and on-demand breast Feeding

Introducing complementary foods into an infant's main diet (breast milk) is recommended at age of 6 months of life because at this age breast milk alone is no longer adequate in meeting the child's nutritional needs for attaining optimal growth (UNICEF and WHO, 2003; WHO, 2001c, WHO and UNICEF, 2008). Often at this time, breast milk is not sufficient to meet the energy, protein and micronutrient requirements of most infants and young children (UNICEF and WHO, 2003; WHO, 2001c; WHO and UNICEF, 2008; Federal Ministry of Health, 2008). This therefore necessitates the addition of locally available foods rich in energy and nutrients which are hygienically prepared (UNICEF and WHO, 2003; Mukuria, *et al.*, 2006). Ensuring adequate nutrition in infancy and early childhood is of great interest because of its numerous benefits to their growth, nutrition, health, development and survival. According to Marttorell (1999), Heaver and Hunt

(1995), Gunnel (1999) and Lucas (1999) early nutrition influences cognitive development and also impacts directly on health. A country that invests in the nutrition of its children will invariably experience an increase in its economic development (Heaver and Hunt, 1995). Appropriate infant and young child feeding practices is very important for the nutrition, growth, development, health and the overall survival of infants and young children (Bhutta, *et al.,* 2008; Black, *et al*., 2003; Saha, *et al*., 2008;) hence, must be the priority of every nation.

According to Jones, *et al*., (2003) timely introduction of complementary feeding has the potential of preventing about 6% under five deaths. The authors further reported that if 90% infants and young children receive a package of intervention to promote, protect and support optimal feeding practices, then about one-fifth of the total deaths among the under-five can be averted. Appropriate complementary feeding practices are key public health interventions to achieving some of the Millennium Development Goals for example goals 1 and 4, which among others seek to address child component of the targets and mortality respectively (Sinhababu, *et al*., 2010). Adequate infant and young child nutrition is basic but critical for the development of the child's full human potential. It is very well observed that from birth to two years of life is a "critical window" for ensuring optimal and adequate growth, health and development. Studies have reported that malnutrition rates including growth faltering peak at this period of life with an increased incidence of infections including diarrhea and it's very difficult to reverse stunting in children after age of two year (Martorell, *et al*., 1994). There is the need to further strengthen the campaign against malnutrition especially during infancy and early childhood. UNICEF and WHO (2003) and WHO and UNICEF (2008) reported that during the transitional period of

complementary feeding, on-demand breastfeeding should continue so that infants can receive all the benefits of breastfeeding.

Optimal infant and young child complementary feeding practices remain one of the major three (3) of infant and young child feeding (breast feeding, complementary feeding and weaning). The target age group of complementary feeding is generally considered to be six (6) months to two years of the child's life, though breast feeding may continue beyond age two years of the child's life (PAHO/WHO, 2002). American Academy of Pediatrics (2004) and Pelto, *et al*., (2003) also defined complementary feeding from a similar point of view in that they also have said complementary feeding is the gradual addition of foods and beverages to the diet (breast milk) of infant and young children which should reflect their physical, intellectual and behavioral stages. When this is done properly the child's nutrition, health, growth and development will improve significantly. Complementary foods that are timely introduced and are appropriate in quality in terms of energy and nutrient density without compromising the safety of the foods and are fed to the child in amounts and frequency that are age and development appropriate will go a long way to ensuring adequate child nutrition. Adequate nutrition during infancy and early childhood is very important to promoting optimal growth, health and development of children. The first two years of infancy and childhood is an opportunity period of ensuring adequate growth and development through optimal infant and young child feeding practices such as complementary feeding (World Bank, 2006). Appropriate complementary feeding practices contribute significantly in reducing mortality rates in children under-five years. A study conducted by Jones (2003) reported that appropriate complementary feeding practices would result in a 6% reduction in under five mortality worldwide:

It is significant that when the child attains the age of 6 months and complementary foods are introduced, the mother still continue to breastfeed the child because breastfeed according to (WHO, 2004) has a unique biological and emotional influence on the child's health and even the mother, whiles the complementary foods also contribute greatly to filling the gap in energy and nutrient requirements of the child (Dewey and Brown, 2003). Complementary foods are necessary because certain nutrients in the mothers' breast milk decline in concentration to significant levels considered inappropriate to meet the requirements of infants such as Zinc (Institute of Medicine, 2001; Clinical Nutrition Services, 2002). Adequate nutrition during infancy and early childhood is also important because of the role it plays in reducing the prevalence of anemia (Hallberg, 2001). For example a review by Centers for Disease Control (1998) has shown that rates of iron declining are high in children under 2 years especially those at 9-18 months of life.

According to Birch and Fisher (1998) much of learning about food and eating occurs during the transition from exclusive breast milk diet of infancy to the Omnivore's diet consumed by early childhood." The authors are of the view that parents play important role for their infants and young children in ensuring good eating behaviors that contribute to preventing overweight and obesity in their later life. Parents (American Academy of Pediatrics, 2004) and other care-givers ought to be reminded that they are role models and teachers who should help young children to learn and adopt healthful eating and life style behaviors. As much as safety and adequate complementary foods are required during infancy and early childhood the importance of breast milk on the other hand should not be downplayed. That is why the world Health Organization recommends a continued on demand breast feeding till the child attains age 24 months and sometimes beyond.

2.6.2 Amount of complementary food needed

At six months of age the child is expected to be fed with small amounts of food and increase the quantity as the child gets older, while still maintaining a frequent breastfeeding. Infants in developing countries with an "average" breast milk intake require approximately 200 kcal per day (by feeding 2-3 times on complementary foods) at 6-8 months of age, 300 kcal per day (by feeding 3-4 times on complementary foods) at 9-11 months of age (by feeding 3-4 times on complementary foods) and 550 kcal per day at 12-23 months of energy from complementary foods by feeding for about 3-4 times a day. However, in the industrialized countries these estimates vary due to differences in average breast milk intake observed among infants. Unlike developing countries, infants in industrialized countries need approximately 130, 310 and 580 kcal/d at 6-8, 9-11 and 12-23 months, respectively from complementary foods (WHO/UNICEF, 1998). The total energy requirements of healthy, breastfed infants are approximately 615 kcal/d at 6-8 months, 686 kcal/d at 9-11 months, and 894 kcal/d at 12-23 months of age (Dewey and Brown, 2002). Energy needs from complementary foods are estimated by subtracting average breast milk energy intake from total energy requirements at each age. Among breastfed children in developing countries, the average breast milk energy intake is 413, 379 and 346 kcal/d at 6-8, 9-11 and 12-23months, respectively (WHO/UNICEF, 1998). The equivalent values for industrialized countries (for breastfed children only) are 486, 375 and 313kcal/d respectively. These estimates are based on children receiving average amounts of breast milk at such stated age.

Energy and nutrient requirements from complementary foods depend on the infant's average breast milk consumption. In practice, it is difficult for caregivers to know the precise amount of breast milk consumed by the child, nor will they be measuring the energy content of complementary foods to be fed to the child. Thus, the amount of food to be offered should be based on demand while assuring that energy and nutrient density, and meal frequency are adequate to support optimal growth and development. It is advisable not to be overly prescriptive regarding the amount of complementary foods to be fed to infants because each child's nutrient and energy needs vary due to differences in breast milk intake and variability in the rate of growth and development. Additionally, children recovering from illness or with very high physical activity like playing by moving or crawling may require more energy than the average quantities mentioned above. If the amounts and frequency of meal is greater than necessary that may lead to excessive displacement of breast milk. For instance a research conducted in Guatemala reports that, a social marketing campaign to promote feeding complementary foods five times per day had the unintended consequence of reducing breastfeeding frequency in children 19-24 months of age (from an average of 6.9 daytime feedings prior to the intervention, to 3.7 daytime feedings after the intervention (Rivera, *et al.,* 1998).

2.6.3 Factors associated with complementary feeding practices

The woman's decision of what infant feeding option or practice to adopt in a society is determined by a wide range of factors. There is evidence of a lot of research work on infant and young child feeding practices of which all are aimed at improving on child nutrition, health and survival yet rates of malnutrition and infections remain consistently high in the Sub-Saharan Africa (ACC/ SCN, 2000). This is largely due to the fact that most of the policies and strategies seeking to improve infant and young children feeding

practices are often directed to thinking that the mother is free to make her own choices regarding the feeding options to adopt. But in all cultures there are a wide range of beliefs and other factors that inform the mother's decisions on how to feed her infant (Matusiak, 2005).

Complementary feeding practices are more often than not influenced by varied and complex socio-cultural factors including the child's own age, sex, behavior and level of appetite and all these differ from one society to other and from child to child. Due to these uniqueness in societies and individual mothers and their infants it puts a huge challenge on the quality of breastfeeding and complementary feeding practices which add to the problem of malnutrition in children especially in developing countries and resource constraint societies. Research works on the association between maternal age on the initiation and duration of breast feeding have shown varied results (Ford and Labbok, 1990). However, some studies have reported a positive correlation between the mother's age and educational level and breastfeeding initiation and duration? It is observed that older and more educated women tend to breast feed for longer duration than younger and less educated women (AAP, 1997; Scott and Binnss, 1999). Older women are more likely to exclusively breast feed for up to six months, implying older women are most likely to start feeding complementary foods to their infants at the recommended age of six months (Arora, *et al.,* 2000).Adolescent mothers are more unlikely to breast feed their infants compared to older ones (Volpe and Bear, 2000). It seemed to suggest that mothers who do not want to breastfeed their children wean them too early thereby introducing them too early to complementary foods.

The woman's intention to return to work and her intention to enrol in school are possible factors that affect her choice of infant feeding practices (Spisak and Gross, 1991). Another study observed that marital status of a woman is positively associated with breast feeding and other infant feeding choices. Married women are more likely to start complementary feeding at the recommended age of 6 months because they are more likely to practice exclusive breast feeding for at least 6 months (Arora, *et al.,* 2000). Most mothers are more likely to feed their infants the same way they themselves were fed during their infancy and childhood (Meyerink and Marquis, 2002). Ford and Labbok (1990) report that health professionals are key in influencing a mothers infant feeding options based on the kind of information they make available to mothers at health centres. This therefore means that inadequate knowledge on the part of health professionals on appropriate infant feeding practices can be a huge barrier to successful infant feeding practices (Black, *et al.,* 1990).

Cultural practices and beliefs are major predictors of infant feeding practices such as complementary feeding. For example, in some societies liquids and foods are offered to new borns as a way of welcoming them into the world (Federal Ministry of Health, 2005; Fjeld, *et al.*, 2008; Ingunn, *et al.,* 2007). In some cultures also they consider colostrum as unclean and often discard it whiles inappropriately introducing the child to other liquids and foods in the first early days after birth (Kruger and Gericke, 2002; Bohler, *et al.,* 2001). It is often observed in the developed world that support at work place and insurance regulations are some reasons for the early introduction of complementary foods. There is that perception that when infants are taken to the work place they may reduce the mothers' decision to introduce complementary foods at too early months in the child's life (UNICEF/WHO, 2009; Tones and Raju, 2006). This practice puts infants and young

children on an increased risk of infections and mortality as often observed especially in Africa (UNICEF and WHO, 2008; UNICEF/WHO, 2009).

The mothers' own perception about the insufficiency of breast milk to adequately meet their infants nutritional requirements greatly influence their choice of the early introduction of complementary foods to their infants and young children (Daelmans, *et al.*, 2003; Raiten, *et al.,* 2007; Bohler, *et al.,* 2001; Federal Ministry of Health, 2007). This therefore suggests that mothers and lactating women need some packages of interventional programs to help curb the situation (Daelmans, *et al.*, 2003; Pelto, 2003). Some mothers also opt for early complementary feeding due to physiological reasons (Federal Ministry of Health, 2005; WHO, 2001c). Complementary foods are recommended at age 6 months of the child's life at a period that breast milk alone is inadequate nutritionally for supporting optimal growth and development (Federal Ministry of Health, 2005; WHO, 2001c; UNICEF and WHO, 2008). At 6 months infants ought to be introduced to locally available complementary foods rich in energy and nutrients (Mukuria, *et al.*, 2006). This transition from infant's chief diet as breast milk to addition of complementary foods should still go with on-demand and frequent complementary feeding due to the health and nutritional role of breast milk in the child's growth, health, development and overall survival (WHO/UNICEF, 2003; Federal Ministry of Health, 2007). Families confronted with poverty and other difficulties risk inappropriately breast feeding their infants and subsequently face an increased risk of inappropriately practicing complementary feeding. In difficult situations such as poverty and food insecurity the quality, quantity and frequency of the infant's dietary intake are negatively affected (Daelmans, *et al.*, 2003). Mothers in such difficulties need support (Daelmans, *et al.,* 2003; Tones and Raju, 2006).

2.7 Breast milk pasteurization

Because of the importance of breast milk to young children and the lack of alternatives in low-income settings, efforts have been shifting toward mitigating the risk of MTCT by making a mother's own breast milk safer. There are 2 methods for doing so that are currently implementable; one is breast milk pasteurization, the second is extended ARV use. Pasteurization can occur through a variety of techniques. Holder pasteurization (62.5°C for 30 min), the pasteurization technique used by most milk banks, is not possible in most homes, although a single-bottle Holder pasteurizer has been developed. Several other pasteurization methods have been suggested for in-home use. These include outright boiling of expressed breast milk, Pretoria pasteurization (a jar of expressed breast milk is placed in water that has been brought to a boil immediately after removal from the heat source), and Flash-heat (a jar of expressed breast milk is heated in a pan of water until the water boils and then the jar is removed from the water and heat source). Research has demonstrated that these heat-treatment techniques inactivate HIV and bacteria in breast milk while retaining the majority of its nutritional, immunological, and antimicrobial properties. Pretoria and Flash-heat pasteurization preserve nutritional and immunological properties of milk better than breast milk boiling does, and the Flash-heat technique may be superior to the Pretoria method at inactivating viral activity.

In the 2001 WHO guidelines, heat treatment of expressed breast milk was one of the main options (along with EBF and replacement feeding) to be explained in counseling sessions with HIV-infected women. It is worth noting that the guidelines were never explicit about which technique to use for heat treatment. After 2006, heat-treated breast milk was no longer considered a main feeding option but rather one that may only be AFASS for a select group of women. This recommendation was likely made based on the unavailability

of population-level studies of the methods. The 2010 guidelines listed feeding expressed, heat-treated breast milk as a possible "interim strategy" in 4 situations: *1*) for low-birth weight or sick infants unable to suckle; *2*) for mothers temporarily unable to breastfeed due to illness or mastitis; *3*) to assist mothers to stop breastfeeding; and *4*) in situations in which ARV are temporarily not available (the age of infant is not specified, i.e. it is not clear if heat-treated breast milk was recommended during EBF or only once complementary feeding had begun). Home pasteurization was not recommended for extended replacement feeding. Of the 4 situations listed in the 2010 WHO recommendations during which heat-treated breast milk can be a possible interim strategy, the most is known about its use during the period of transition from EBF to complementary feeding. Field research from South Africa, Tanzania and Zimbabwe has indicated that Flash-heating breast milk is feasible, i.e. it can be accomplished by women in low-income households in rural sub-Saharan Africa during the transition from EBF to complementary feeding.

In Zimbabwe, with weekly home visits from nurses, HIV-infected mothers of HIV-exposed, uninfected children 6–12 month old could safely express and heat-treat breast milk for long periods of time (4.5 month; range 1–11 month). Children who consumed a higher proportion of energy from expressed and heat-treated milk compared with complementary foods showed more improvement in weight and length. In a study in Tanzania, more than one-half of HIV-infected mothers with HIV-uninfected children that were counselled by community health workers on the option of expressing and heat-treating their milk upon the introduction of complementary foods chose to do so at least once; the median volume of breast milk pasteurized was 300 mL/d for a median duration of 9.7wk (1 day to 12 month) (Chantry, *et al.*, n. d). Furthermore, in Rwanda, a program

supported by the Ministry of Health is underway to evaluate the inclusion of Flash-heat training and support within a comprehensive fortified complementary foods program for HIV-exposed infants. Preliminary results from this study suggest that integration of heat treatment counseling and support is possible at the PMTCT programmatic level. Despite the promising laboratory and feasibility data, the WHO expert committee declined to recommend in-home breast milk pasteurization except as an interim strategy, citing the need for more data on scalability, sustainability, and health system requirements for supporting breast milk pasteurization

2.8 Nutritional status

The most widely used classification which was introduction by Gomez et al, in 1956 and modified by Jelliffe uses weight-for –age as the unique nutritional indicator. The approach has certain draw backs since chronic under-nutrition not only influences the weight but also the height of a child. More recently, attempts have been made to include the relationships weight-for-height and height-for-age. In the present study the measurements of weight and height have been used to form the following nutritional indicators: weight-for-height, weight-for-age and height-for age. In order to gain information on the degree and a need to compare the data obtained with those for a reference population and to use a standardized method for selecting a representative sub-sample of sufficient size to make valid comparisons. The UNAID/AIDS Epidemic update UNAID, (2003) reported that 29% were stunted and 18% were wasted with HIV infection associated with an adjusted 4 fold higher risk of mortality with [Relative Risk (RR) =3.92, 95% (CI) 2.34-6.55, $p<0.0001$].

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This section of the work looked at the methods that were employed in data collection. Questionnaires, observation, anthropometric measurement were all used in data collection. It consist of the study area, design, study population, sampling size, sampling technique, data collection methods, qualitative data, variable (dependent and independent), ethical consideration and data/statistical analysis.

3.1 Study Area

The study was conducted in the Bolgatanga Municipal area which is one of the three Municipalities in Upper East Region with an estimated population of 961,246 projected from 2010 census, with growth rate of 1.1%. The Municipal has 9 sub-districts and 13 health facilities. Health service delivery in Bolgatanga Municipal Health Directorate are based on curative, preventive and promotive health care and rehabilitative services provided by either private or government owned health facilities. These include 1 regional hospital, 7 health centers, and 6 clinics (government and private). The Bolgatanga Municipal was chosen purposefully as it is the first Municipal with highest number in clients seen and also the only facility that provides ARV to its clients in the region. The study was conducted in one health facility namely: Bolgatanga Hospital, which is the referral hospital in the region and one of the highly populated wards.

3.2 Study Design

This study was cross-sectional in design. In terms of content the study employed both quantitative and qualitative methods in data collection. It is called cross-sectional because the information which is collected represents what is going on at only one point in time.

3.3 Study Population

The study population comprised of HIV positive mothers who were 16 years or older with infants aged 0–23 months at the time of the study attending RCH. The control group comprised of HIV negative mothers with similar characteristics also attending the RCH.

An exclusion criterion was mothers with very sick children.

3.4 Sample Size

The health facility (Bolgatanga Regional Hospital) in which the study was conducted had a total of 91 HIV positive mothers registered at the time of the study. This number was automatically considered, and the fact it was a comparative study, it required an equal number of HIV negative mothers as the control group on a ratio of 1:1. This resulted in a total number of 182 comprising both HIV positive and HIV negative mother pairs with their children included in the study.

3.5 SamplingTechnique

Both non-probability and probability sampling techniques were used in the selection of the health facility and the respondents.

The selection of the health facility of which HIV positive mothers were in attendance was purposively selected since not all health facilities in the Bolgatanga Municipality had HIV positive mothers visit RCH sessions. Therefore Bolgatanga Regional Hospital was selected since it had the highest HIV-RCH attendance in the Municipality. The Bolgatanga Regional Hospital was selected in consultation with the Bolgatanga Regional HIV Coordinator because: it serves majority of the HIV-positive mothers as the major referral center and also has readily available PMTCT and RCH services for mothers and exposed infants. An estimated 100% response rate was targeted with HIV-positive to HIV-negative ratio of 1:1 (91 HIV-positive: 91 HIV-negative) in order to achieve a desired sample size of 182 for the study. The HIV-negative mothers were then selected using simple random sampling technique while the HIV-positive mothers were selected using snowball sampling technique.

3.6 Data CollectionTechnique

A semi-structured questionnaire was used to interview mothers. Before commencing the interview, mothers were approached by RCH clinic nurses, informed of the study and asked to participate voluntarily. Upon giving their consent the mothers were interviewed until the required number of study respondents was reached. Though all the 91 HIV-positive clients in attendance to the RCH sessions were ear marked for the study, it was realized that only 32 questionnaires were fully and satisfactorily completed, resulting in a 35.1% response rate; the remaining 64.9% of incomplete questionnaires were eliminated. In view of the low response rate in the case group, the ratio of HIV-positive to HIV-negative mothers targeted for the study was adjusted to (1 HIV-positive: 5 HIV-negative) in order to make up for desired sample size of 182 ear marked for the study. A total of 182 mothers were interviewed; thirty two (32) HIV-positive mothers as the *case group* and 150

HIV-negative as the *control group* (i.e. 32 HIV-positive: 150 HIV-negative). Quantitative data collection was conducted using the structured questionnaire to obtain all of the required information. The questionnaire was developed in English but *Gruni* speaking enumerators were trained to administer the questions in the local dialect to the majority of respondents who were not literates of the English Language. The questions were designed to allow mothers to express their ideas on various issues related to exclusive breastfeeding and initiation of complementary feeding.

3.7 Variables and Measurements

3.7.1 Dependent variable

The outcome variables were exclusive breastfeeding, complementary feeding and nutritional status.

3.7.2 Independent variables

The independent variables in this study were;

- Socio demographic characteristics (age, education level, marital status, parity, occupation and nutritional status)
- Maternal knowledge on exclusive breast feeding,
- Complementary feeding practices
- HIV status of mothers and children

3.8 Data Analysis

Data gathered were usually checked for inconsistencies and errors before coding. Data was analyzed using Statistical Package for Social Science (SPSS) version 20.0 by IBM SPSS Statistics for Windows. Only the 32 completed questionnaires from the *case group* and the 150 *controls* were considered for data analysis. The individual questions in each set of questionnaire were coded and treated as nominal variables. During the analysis, categorical variables such as respondent's sex, educational status, marital status, religion, and occupation of care givers, for which data was gathered, were not presented in any ordered form. They were treated as nominal variables whereas other categorical variables such as daily feeding pattern, dietary diversity score for which data were gathered were analyzed and presented in an ordered manner, and as such treated as ordinal. In each case the responses to these variables were predetermined and coded.

All variables, such as height, weight, length, and age, were primarily treated as continuous variables and the raw values gathered during data collection were used for analysis. Univariate and bivariate analyses were done for the variables of study. Univariate analyses were done to present the socio demographic characteristics, bivariate analyses was done to assess the relationship between HIV and nutritional status, age, marital status, educational level and occupation of the mothers/caregivers. Chi square values of these bivariate analysis were considered to be statistically significant with $P < 0.05$ and a confidence level of 95% for all main outcome measures that met the normality and homogeneity criteria.

Data on child anthropometry was analyzed using the procedure stipulated by the WHO Anthro software (2005). The researcher and the research team ensured adherence to this procedure. The following protocols were ensured: Chi-square test was used to establish possible associations between consumption of different food groups and demographic and socioeconomic status of the households. Analyzed data was presented in the form of frequency distribution tables and charts and narratives. Weight-for-age, height for age, and weight-for-length z scores were calculated on the basis of the gender- and age-specific growth chart references (revised) that were developed by the National Center for Health Statistics and the Center for Disease Control and Prevention and recommended for international use by (WHO, 2006).

3.8.1 Quality Control Measures

Training: There was a training session for the research assistants who assisted in the data collection to ensure that valid and reliable data were collected. The training gave the data collectors much insight into the questionnaires and what it sought to achieve.

Pre-testing of questionnaires:

Pre-testing of the tool was done to check clarity of items, ambiguity of the language and feasibility of the tool. Formal permissions were obtained from the Bolgatanga Regional and Municipal Health Directorates as well as the Regional HIV Coordinator, the Hospital Medical Director, the President of the Regional Chapter of the National Association of People Living with HIV/AIDS (NAP+) and the selected participants. The structured items were administered to the caregivers/mothers who were selected by probability sampling methods. The time taken by each respondent to answer the questions varied from 20-30

minutes. The tool was found to be clear feasible and there was no ambiguity in the language.

Double entries of data: The data was entered into two equally coded SPSS templates by two trained data analyst and two sets were compared to check inconsistencies to enhance quality.

3.9 Ethical Considerations

The study protocol was sought and approved by the Ethical Board of the Ghana Health Services and the hospital in Bolgatanga. A sample size of 182 (1HIV-positive: 1HIV-negative) was submitted to the Ethical Committee and was approved. Information about the objectives and principles of the study was given to participants in their own language. All individuals surveyed were required to give their oral consent to participate in the study. They however reserved the right not to answer any questions they felt uncomfortable about and also the right to withdraw from the study at any time the felt it necessary.

CHAPTER FOUR

RESULTS

4.0 Introduction

This section gives a descriptive analysis of the variables. The results in this section are displayed in simple tables of numbers and their proportions, contingency tables with Fisher Exact values and their corresponding p-values.

4.1 Socio-demographic Characteristics of Respondents

The mean age of the respondents was 26 ± 7.2 (mean ± SD) with a range of 15-47 years. The results showed that majority of the respondents representing 72% (131) were formally educated. The results further showed that the proportion of HIV-negative mothers who received formal education were more than their HIV-positive counterparts thus (78.7% versus 40.6%).There were variations in the level of formal education attained by the respondents. About 46.3% of the entire study sample received post-secondary education (University and College education). The proportion of HIV-negative mothers with post-secondary level was 40% whilst that of their HIV-positive counterparts was 6.3% as shown in table 4.1 below. The study found that majority of the HIV-positive mothers was within the age group of 26-35 years and formed 65.6% of the proportion of HIV-infected mothers in the study sample. Only 12.5% of the HIV-positive mothers were below 25 years whilst 21.9% were above 45 years. The results also showed that majority of the HIV-positive who represented 84.4% mothers were married whilst 82% of the HIV-negative mothers were married. Table 4.1 below shows the socio-demographic characteristics of the respondents.

Table 4.1 Socio demographic characteristics of respondents

Variable	HIV status		
	HIV-negative N (%)	HIV-positive N (%)	Total N (%)
Education			
No formal education	32 (21.3)	19 (59.3)	**51**(28.0)
Formal education	118 (78.7)	13 (40.6)	**131**(72.0)
Level of education			182 (100.0)
Primary	17 (11.3)	6 (18.8)	23(12.6)
JHS	27 (18.0)	7 (21.9)	34(18.7)
SHS	27 (18.0)	2 (6.3)	29(15.9)
Higher	60 (40.0)	2 (6.3)	62(46.3)
None	19 (12.7)	15 (46.9)	34(18.7)
Total	**150 (100.0)**	**32 (100.0)**	**182(100.0)**
Mothers Age			
15-25	44 (29.3)	4 (12.5)	48(26.4)
26-35	86 (57.3)	21 (65.6)	107(58.8)
36-45	11 (7.3)	0 (0.0)	11 (6.0)
46+	9 (6.1)	7 (21.9)	16 (8.8)
Total	**150 (100.0)**	**32 (100.0)**	**182 (100.0)**
Marital Status			
Married	123 (82.0)	27 (84.4)	150(82.4)
Single	27(13.3)	5 (15.6)	32(13.7)

4.2 Relationship between Socio-Demographics and Breastfeeding

The study assessed the relationship between the practice of breastfeeding and the socio-demographic characteristics of respondents (mothers). The study found that the level of education was generally associated with the practice of breastfeeding. It was established that mothers without any level of formal education were more likely to breastfeed their children than those with formal education ($P<0.001$, $F=17.5$). However, after the stratification of the level of education attained by respondents, it was found that the practice of breastfeeding increased with increasing educational level. Mothers who were educated to the tertiary level were more likely to exclusively breastfeed their children as compared to those with secondary or basic education. This implies that exclusive breastfeeding practice increased with increasing level of education of the mother ($P<0.003$,

F=13.9). Again, age of the mother was found to be significantly associated with the practice of exclusive breastfeeding. As the age of the mother increased, the practice of exclusive breastfeeding also increased. All the mothers who were above 45 years exclusively breastfed their children irrespective of their HIV status. Younger mothers were less likely to breastfeed their children exclusively as compared to older mothers (P<0.001, F=17.93) as shown in table 4.2 below.

It was further established that employment status of the mother was associated with the practice of exclusive breastfeeding. Majority of the mothers who were unemployed breastfed their children exclusively as compared to those who were employed. Further stratification of the employment status of the mothers also showed that self-employed mothers practiced exclusive breastfeeding than those who were employed by other people in their private institutions or companies. Also, mothers employed in the public sector were found to practice exclusive breastfeeding than those employed in the private sector. These findings show a significant relationship between exclusive breastfeeding practice and employment status of mothers (P<0.001, F= 21.32). Table 4.2 below shows the relationship between the employment status of respondents and the practice of exclusive breastfeeding.

Table 4.2 Socio-demographic Characteristics of Mothers and its relationship with exclusive breastfeeding practice

Variable	Exclusive breastfeeding		Test Statics	
	Yes	No	Fisher's test	P value
Education				
No formal Education	44 (86.3)	7 (13.7)		
Formal education	69(52.7)	62 (47.3)	17.5	< 0.001
Level of education				
Primary	19(82.6)	4(17.4)		
JHS	17 (50.0)	17(50.0)		
SHS	10 (34.5)	19(65.5)		
Tertiary	38(61.3)	24(38.7)	13.9	0.003
Age				
15-25	17(35.4)	31(64.6		
26-35	73(68.2)	34(31.8)		
36-45	9(81.8)	2(18.2)		
46+	1(100.0)	0(0.00)	17.93	< 0.001
Marital status				
Single	12(37.5)	20(62.5)		
Married	101(67.3)	49 (37.2)	9.92	0.002
Occupation				
Unemployed	40 (85.4)	8(14.6)		
Self-employed	60(80.0)	15(20.0)		
Private employed	14(77.7)	4(22.3)		
Government employed	35(83.3)	6(16.7)	21.32	0.001

4.3 Breast Feeding Practices of HIV Infected Mothers Compared To Their Non-HIV Counterparts

The study compared the breastfeeding practices among HIV-negative mothers and HIV-positive mothers. The results showed that majority of HIV-negative mothers ever breastfed their children than HIV-positive mothers (77% versus 23%). Also, 82% of HIV-negative mothers fed their children with the first yellowish milk (colostrum) after delivery whilst 17.8% of HIV-positive mothers fed their children with colostrum. It was again established that HIV-negative initiated breastfeeding earlier in the first hour of delivery as compared to their HIV-positive counterparts (92.6% versus 7.4%). Most of the HIV-positive mothers (28.7%) initiated breastfeeding after the first hour of delivery. Mixed feeding was also practiced by both HIV-negative and positive mothers. The results showed that 66.7% of HIV-negative mothers practiced mixed feeding whilst 33.3% of the HIV-positive mothers also practiced mixed feeding. They fed their children on other foods (either liquid or semi-solid foods) in the first one week of delivery.Proportionally, it was found that majority of the HIV-positive mothers were counselled thoroughly on breastfeeding practice. Only 2 of the HIV-positive mothers reported that they were not counselled on breastfeeding as shown in table 4.3 below.

Table 4.3 Comparison of Breastfeeding practices among HIV-negative and positive mothers

Variable	HIV Status		Fisher Exact	P-value
	Negative	Positive		
Ever breastfed				
Yes	87 (77.0)	26(23.0)		
No	63(91.3)	6(8.7)	6.02	0.014
Feeding on colostrum				
Yes	143(82.2)	31 (17.8)		
No	7(87.5)	1(12.5)	0.15	0.690
Initiation of breastfeeding				
0-1 hour	88 (92.6)	7 (7.4)		
above 1 hour	62 (71.3)	25(28.7)	14.23	<0.001
Mixed Feeding				
Yes	16(66.7)	9 (33.3)		
No	132(85.2)	23(14.8)	5.37	0.020
Counseling on breastfeeding				
Yes	146(83.0)	30(17.0)		
No	4(66.7)	2(33.3)	1.06	0.030

4.4 Complementary Feeding Practices among HIV Infected and Uninfected Mothers

The initiation and practice of complementary feeding varied among HIV-negative and positive mothers. It was found that some of the HIV-infected and uninfected mothers gave other foods to their children as early as the first three days after delivery. About 67% of HIV-uninfected mothers fed their children with other foods within the first three days after delivery whilst 33% of HIV-infected mothers fed their children with other foods within the first three days after delivery. Complementary feeding was initiated before six months by 76.7% of the HIV-uninfected mothers whilst 23.3% of the HIV-infected mothers initiated complementary feeding before six months after delivery. The proportion of HIV-uninfected mothers who initiated complementary feeding late or after 6 months was 71.4% whilst 28.6% of HIV-infected. The mothers who initiated complementary feeding after 6

months, it was again found that 15.9% of HIV-infected mothers initiated complementary feeding at exactly 6 months whilst 84.1% of the HIV uninfected initiated complementary feeding at 6 months as shown in table 4.4

A 24-hour dietary recall showed that none of the HIV-infected mothers fed their children with any other type of milk whilst 9 of the HIV-uninfected mothers fed their children with milk other than breast milk. Porridge and TZ were the foods that were mostly or highly used as complementary foods by both HIV-infected and uninfected mothers. About 68% of HIV-uninfected mothers fed their children with porridge and TZ whilst 32.3% of HIV-infected mothers fed their children with porridge and TZ. Table 4.4 shows the complementary feeding practices among HIV-uninfected and HIV-infected mothers.

Table 4.4 Complementary feeding practices among HIV-infected and uninfected mothers

Variable	HIV Status		Fisher Exact	P-value
	Negative	Positive		
Mixed Feeding in first 3 days				
Yes	18 (66.7)	9 (33.3)		
No	132 (85.2)	23 (14.8)	5.39	0.020
Initiation of complementary feeding				
Before 6 months	23 (76.7)	7 (23.3)		
At 6 months	122 (84.1)	23 (15.9)		
After 6 months	5 (71.4)	2 (28.6)	1.84	0.450
24 hr/7 days recall				
Milk (other than breast milk)	9 (100.0)	0 (0.0)		
Plain water	29 (96.7)	1 (3.3)		
Sugar or glucose	4 (100.0)	0 (0.0)		
Gripe water	9 (100.0)	0 (0.0)		
Infant formula	15 (93.8)	1 (6.2)		
Tea/infusion	4 (100.0)	0 (0.0)		
Porridge/TZ	44 (67.7)	20 (32.3)	16.90	0.005

4.5 Nutritional status of children of HIV infected mothers compared to childrenof their non-HIV counterparts

The nutritional status of children whose mothers were HIV-positive and those whose mothers were HV-negative was assessed. The results showed that the HIV status of mothers did not have any significant influence on the birth weight of the children because 4 out of 150 (2.7%) children whose mothers were HIV-negative were born with low birth weight whilst only one (3.1%) of the 32 children who were born to HIV-positive mothers was born with low birth weight. This implies that HIV-status of the mother did not significantly influence the birth weight of the child ($P<0.175$, $F=0.62$). The same trend was also found for the height of the children. Children who were born to HIV-positive mothers did not have lower height than those who were born to HIV-negative mothers. This also shows that the HIV-status of a mother did not significantly influence the height of their children ($P<0.15$, $F= 1.68$) as shown in table 4.5 below.

Table 4.5 Relationship between HIV status of mothers and the weight & height of their children

Variables	HIV status		Fisher	P-value
	Negative	Positive		
Weight of child (kg)				
2.6-5.8	32(78.0)	9(22.0)		
5.9-8.1	65(91.5)	6(8.5)		
8.2-10.4	39(76.5)	12(23.5)		
10.5-12.7	9(69.2)	4(30.8)		
12.8-15.0	1(100.0)	0(0.00)	0.62	0.175
Height of child (cm)				
46—55	7(70.0)	3(30.0)		
56-65	60(88.2)	8(11.8)		
66-75	63(84.0)	12(16.0)		
76-85	18(75.0)	6(25.0)		
86-95	2(50.0)	2(50.0)	1.68	0.150

4.5.1 Prevalence of Stunting, Underweight and Wasting among Children of HIV-Negative and Positive Mothers.

The study assessed the prevalence of the three indicators of malnutrition (stunting, wasting and underweight) among children of HIV-negative and positive mothers. The results showed that underweight was high among children born to HIV-positive mothers as compared to children of HIV-negative mothers (15.6% versus 11.1%) (P<0.002, F=10.4). The same trend was also found for stunting among the children because 25% of children of HIV-positive mothers were found to be stunted as compared to 12.3% of children of HIV-negative mothers (P<0.001, F=26.6). Similar trend was again found for wasting among the children as more children of HIV positive mothers were wasted as compared to those of HIV-negative mothers (20.0% versus 4.3%). Table 4.6 below shows the prevalence of malnutrition indicators among children of HIV-negative and positive mothers.

Table 4.6 Prevalence of malnutrition indicators among children of HIV-positive and negative mothers

Nutrition Indicators against HIV status					
Indicator	Nutritional Status	Negative No. (%)	Positive No. (%)	Fisher Exact	p- value
WAZ	Normal	138(88.9)	27 (84.4)	10.4	0.002
	Underweight	12(11.1)	5(15.6)		
HAZ	Normal	137(87.7)	24(75.0)	26.6	0.001
	Stunted	13(12.3)	8(25.0)		
WHZ	Normal	122(95.7)	28(80.0)	20.6	0.001
	Wasted	6(4.3)	4(20.0)		

4.6 Relationship between feeding practices and the nutritional status of children

The study assessed the feeding practices of the mothers and their influence on the nutritional status of the children while controlling for their HIV status. The study found that 77.9% of the mothers who initiated breastfeeding in the first hour after delivery had children with normal weight whilst 25.7% of those children were malnourished. Majority (86.7%) of children who were fed on other foods before 6 months were found to have normal nutritional status. The study also found that mothers who practiced optimal feeding had majority (90.3%) of their babies with normal nutritional status as compared to those with sub-optimal feeding. Table 4.6 shows the relationship between feeding practices and the nutritional status of children.

Table 4.6 Relationship between feeding practices of HIV negative and children's nutritional status

Variables	Nutritional Status of Children whose mothers are HIV Negative		Fisher Exact	P-value
	Malnourished	Normal		
Ever breastfed				
Yes	29(25.7)	84 (74.3)		0.870
No	17(24.6)	52(75.4)	0.024	
Initiation of breastfeeding				
0-1 hour	21(22.1)	74(77.9)		0.340
Above 1 hour	25(28.7)	62(71.3)	1.05	
Colostrum				
Yes	43(24.7)	131(75.3)		0.004
No	3(37.5)	5(62.5)	15.4	
Mixed feeding				
Yes	43(24.4)	133(75.6)		0.030
No	3(50.0)	3(50.0)	18.4	
Age of complementary feeding				
before 6 months	4(13.3)	25(86.7)		
At 6 months	37(25.5)	108(74.5)		0.006
Above 6 months	5(71.4)	2(28.6)	7.17	
Frequency of feeding				
Sub optimal feeding	21(19.1)	89(80.9)		0.001
Optimal Feeding	7(9.7)	65(90.3)	24.54	

Table 4.7 Relationship between feeding practices of HIV positive and children's nutritional status

Variables	Nutritional Status of Children whose mothers are HIV positive		Fisher Exact	P-value
	Malnourished	Normal		
Ever breastfed				
Yes	8(40.0)	12 (60.0)		
No	4(33.3)	8(66.7)	0.32	0.38
Initiation of breastfeeding				
0-1 hour	7 (21.9)	25(78.1)		
Above 1 hour	25(28.7)	62(71.3)	1.05	0.34
Colostrum				
Yes	20(62.5)	12(37.5)		0.004
No	3(37.5)	5(62.5)	15.4	
Mixed feeding				
Yes	43(24.4)	133(75.6)		
No	3(50.0)	3(50.0)	18.4	0.03
Age of complementary feeding				
before 6 months	7 (23.3)	23(76.7)		
At 6 months	5 (71.4)	2 (28.6)		0.024
Above 6 months			1.54	
Frequency of feeding				
Sub optimal feeding	21(19.1)	89(80.9)		0.001
Optimal Feeding	7(9.7)	65(90.3)	24.54	

CHAPTER FIVE

DISCUSSION

5.0 Introduction

The discussion of the results of the study is presented in this chapter. The findings have been discussed in relation to findings of similar studies in Ghana and the entire world. It lays emphasis on the explanations, interpretations and linkages of results. It compares the influences of the effective feeding practices, such as breast feeding and complementary feeding practices on the nutritional status of children (0-23months) of HIV- infected mothers and their counterparts.

5.2 Socio Demographic Characteristics of mother

Some of the mothers were found to be below 20 years or in their teen ages. This is consistent with report of the Ghana Health Service and Ghana Statistical Service (2008) in the Demographic and Health Survey that was conducted in 2008 which found that some of the mothers were teenagers and this was more prevalent in the three northern regions of Ghana. In the GDHS, it was found that 13% of teenagers were already mothers or had given birth. The mean age of the respondents was 26 ± 7.2 (mean ± SD) with a range of 15-47 years. The results showed that majority of the mothers; representing 72% (131) were formally educated. The results further showed that the proportion of HIV-negative mothers who received formal education were more than their HIV-positive counterparts thus (78.7% versus 40.6%).There were variations in the level of formal education attained by the respondents. About 46.3% of the entire study sample received post-secondary education (University and College education). The proportion of HIV-negative mothers with post-secondary level was 40% whilst that of their HIV-positive counterparts was

6.3%. This could possibly be due to the fact that the educated women have an advantage of formal exposure to information about the HIV disease and would have been more informed and guided unlike their uneducated counterparts.

The study found that majority of the HIV-positive mothers was within the age group of 26-35 years and formed 65.6% of the proportion of HIV-infected mothers in the study sample. Only 12.5% of the HIV-positive mothers were below 25 years whilst 21.9% were above 45 years. The high proportion of younger mothers in the study sample could be attributed to the fact that the regional capital of the upper east is surrounded by lots of village and peri-urban with majority of its communities being rural and also happens to be one of the poorest regions. Bolgatanga municipal hospital is the only referral hospital regional.Rural communities have been reported to have teenage and young mothers and high fertility rates (Ethiopian Demographic and Health Survey, 2006 and AbouZhar, *et al.,* 2010). This corroborates the assertion by the UNICEF (2011) in its Multiple Indicators Cluster Survey Report that women who are more than 40 years have declining fertility and most of them were not found to be breastfeeding mothers. It is also consistent with the results of a study conducted by Stephenson, *et al.,* (2007) in Kenya which states that as the age of women increases, there is a decline in child bearing because most of them especially those from the rural areas start child bearing early and their interest in sex and child bearing reduces or declines after 40 years.

The results of the study showed that majority of the HIV positive mothers who represented 84.45% and 82% of the HIV negative mothers were married. This percentage of married women is higher than the national figure of 42.9% in Ghana as found by the 2010. The

study assessed the relationship between the practice of breastfeeding and the socio-demographic characteristics of respondents (mothers). The study found that the level of education was generally associated with the practice of breastfeeding. It was established that mothers without any level of formal education were more likely to breastfeed their children than those with formal education ($P<0.001$, $F=17.5$). However after the stratification of the level of education attained by respondents, it was found that the practice of breastfeeding increased with increasing educational level. Mothers who were educated to the tertiary level were more likely to exclusively breastfeed their children as compared to those with secondary or basic education. This implies that exclusive breastfeeding practice increased with increasing level of education of the mother ($P<0.003$, $F=13.9$). Again, age of the mother was found to be significantly associated with the practice of exclusive breastfeeding. As the age of the mother increased, the practice of exclusive breastfeeding also increased.

All the mothers who were above 45 years exclusively breastfed their children irrespective of their HIV status. Younger mothers were less likely to breastfeed their children exclusively as compared to older mothers ($P<0.001$, $F=17.93$). This study is consistent with the report of the finding that have a positive correlation between the mother's age and educational level and breastfeeding initiation and duration? It is observed that older and more educated women tend to breast feed for longer duration than younger and less educated women, this is consistent with the finding contain in (AAP, 1997; Scott and Binnss, 1999). Older women are more likely to exclusively breast feed for up to six months, implying older women are most likely to start feeding complementary foods to their infants at the recommended age of six months. This is consistent with the finding of (Arora, *et al.,* 2000). It was further established that employment status of the mother was

associated with the practice of exclusive breastfeeding. Majority of the unemployed mothers breastfed their children exclusively as compared to those who were employed. Further stratification of the employment status of the mothers also showed that self-employed mothers practiced exclusive breastfeeding than those who were employed by other people in their private institutions or companies. Also, mothers employed in the public sector were found to practice exclusive breastfeeding than those employed in the private sector. These findings show a significant relationship between exclusive breastfeeding practice and employment status of mothers ($P<0.001$, $F= 21.32$).

5.3 Breast Feeding Practices of HIV Infected Mothers Compared To Their Non-HIV Counterparts

The study compared the breastfeeding practices between HIV-negative mothers and HIV-positive mothers. The results of the study showed that majority of HIV-negative mothers ever breastfed their children than HIV-positive mothers (77% versus 23%). Also, 82.2% of HIV-negative mothers fed their children with the first yellowish milk (colostrum) after delivery whilst 17.8% of HIV-positive mothers fed their children with colostrum. It was again established that HIV-negative mothers initiated breastfeeding earlier in the first hour of delivery as compared to their HIV-positive counterparts (92.6% versus 7.4%). . Most of the HIV-positive mothers (28.7%) initiated breastfeeding after the first hour of delivery. This finding in the context of the HIV negative mothers supports that of GDHS (2003), UNICEF (2011) who found that over 65% of mothers initiated breastfeeding within the first hour after delivery.Mixed feeding was also practised by both HIV-negative and positive mothers. The results showed that 66.7% of HIV-negative mothers practiced mixed feeding whilst 33.3% of the HIV-positive mothers also practised mixed feeding. They fed their children on other foods (either liquid or semi-solid foods such as plain

water, herbal concoctions, D5 and gripe water) in the first one week of delivery. This is not consistent with the findings with that of Mahama and Iddrisu (2013) who found that 16% of caregivers/mothers from rural areas in northern Ghana practiced pre-lacteal feeding. The discrepancy in the practice of pre-lacteal feeding between this current study and their study could be attributed to the sample size and level of education among these women.Proportionally, it was found that majority of the HIV-positive mothers were counselled thoroughly on breastfeeding practice. Only 2 of the HIV-positive mothers reported that they were not counselled on breastfeeding.

5.4 Complementary Feeding Practices among HIV Infected and Uninfected Mothers

The initiation and practice of complementary feeding varied among HIV-negative and positive mothers. This study found that some of the HIV-infected and uninfected mothers gave other foods to their children as early as the first three days after delivery. About 67% of HIV-uninfected mothers fed their children with other foods within the first three days after delivery whilst 33% of HIV-infected mothers fed their children with other foods within the first three days after delivery. This is consistent with the findings of Khadduri, *et al.,* (2008) who reported that infants in Pakistan were fed on available foods for the entire households. The proportion of caregivers who fed their babies on commercially produced infant formulas was about 18% which supports the findings of Hill, *et al.,* (2005) in their study in rural Ghana.Complementary feeding was initiated before six months by 76.7% of the HIV-uninfected mothers whilst 23.3% of the HIV-infected mothers initiated complementary feeding before six months after delivery. This is consistent with the findings of (Kruger and Gericke, 2002; Bohler, *et al.,* 2001) who reported that some cultures consider colostrum as unclean and often discard it whiles inappropriately introducing the child to other liquids and foods in the first early days after birth.

The proportion of HIV-uninfected mothers who initiated complementary feeding late or after 6 months was 71.4% whilst 28.6% of HIV-infected. The mothers who initiated complementary feeding after 6 months, it was again found that 15.9% of HIV-infected mothers initiated complementary feeding at exactly 6 months whilst 84.1% of the HIV uninfected initiated complementary feeding at 6 months. This study is consistent with the reported finding, introducing complementary foods into an infant's main diet (breast milk) is recommended at age of 6 months of life because at this age breast milk alone is no longer adequate in meeting the child's nutritional needs for attaining optimal growth (UNICEF and WHO, 2003; WHO, 2001c, WHO and UNICEF, 2008). Often at this time, breast milk is not sufficient to meet the energy, protein and micronutrient requirements of most infants and young children (UNICEF and WHO, 2003; WHO, 2001c; WHO and UNICEF, 2008; Federal Ministry of Health, 2008). This therefore necessitates the addition of locally available foods rich in energy and nutrients which are hygienically prepared (UNICEF and WHO, 2003; Mukuria, *et al.*, 2006). Ensuring adequate nutrition in infancy and early childhood is of great interest because of its numerous benefits to their growth, nutrition, health, development and survival.

A 24-hour dietary recall showed that none of the HIV-infected mothers fed their children with any other type of milk whilst 9 of the HIV-uninfected mothers fed their children with milk other than breast milk. Porridge and TZ were the foods that were mostly or highly used as complementary foods by both HIV-infected and uninfected mothers. About 68% of HIV-uninfected mothers fed their children with porridge and TZ whilst 32.3% of HIV-infected mothers fed their children with porridge and TZ.

5.5 Nutritional status of children of HIV infected mothers compared to childrenof their non-HIV counterparts

The nutritional status of children whose mothers were HIV-positive and those whose mothers were HIV-negative was assessed. The results showed that the HIV status of mothers did not have any significant influence on the birth weight of the children because 4 out of 150 (2.7%) children whose mothers were HIV-negative were born with low birth weight whilst only one (3.1%) of the 32 children who were born to HIV-positive mothers was born with low birth weight. This implies that HIV-status of the mother did not significantly influence the birth weight of the child ($P<0.175$, $F=0.62$). The same trend was also found for the height of the children. Children who were born to HIV-positive mothers did not have lower height than those who were born to HIV-negative mothers. This also shows that the HIV-status of a mother did not significantly influence the height of their children ($P<0.15$, $F= 1.68$).

5.6 Prevalence of Stunting, Underweight and Wasting among Children of HIV-Negative and Positive Mothers.

The study assessed the prevalence of the three indicators of malnutrition (stunting, wasting and underweight) among children of HIV-negative and positive mothers. The results showed that underweight was high among children born to HIV-positive mothers as compared to children of HIV-negative mothers (15.6% versus 11.1%) ($P<0.002$, $F=10.4$). The same trend was also found for stunting among the children because 25% of children of HIV-positive mothers were found to be stunted as compared to 12.3% of children of HIV-negative mothers ($P<0.001$, $F=26.6$). Similar trend was again found for wasting among the children as more children of HIV positive mothers were wasted as compared to

those of HIV-negative mothers (20.0% versus 4.3%). This is consistent with UNAID Epidemic update. Geneva: UNAID 2003. Who reported that 29% were stunted and 18% were wasted with HIV infection associated with an adjusted 4 fold higher risk of mortality with [Relative Risk (RR) =3.92, 95% (CI) 2.34-6.55, p<0.0001]

5.7 Relationship between feeding practices and the nutritional status of children

The study assessed the feeding practices of the mothers and their influence on the nutritional status of the children while controlling for their HIV status. The study found that 77.9% of the mothers who initiated breastfeeding in the first hour after delivery had children with normal weight whilst 25.7% of those children were malnourished. Again, majority (86.7%) of children who were fed on other foods before six months were found to have normal nutritional status. The study also found that mothers who practiced optimal feeding had majority (90.3%) of their babies with normal nutritional status as compared to those with sub-optimal feeding.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This section of the study comprises the conclusion and recommendation of the thesis. Based on the data analysis and result generated, one can confidentially make a conclusion and also give some recommendations.

6.1 CONCLUSIONS

Malnutrition and HIV affects children across the West African sub-region and other developing countries of the world. In conclusion, the results of the study showed that the causes of poor nutritional status of children are versatile.

These are the key findings of the study;

- HIV negative mothers received formal education than HIV positive counterparts, thus 78.7% versus 40.6%
- The study found that mothers without any level of formal education were more likely to breastfeed than mothers who were formally educated ($p<0.001$, $F=17.5$)
- The analysis also showed that majority of the HIV negative mothers ever breast fed than HIV positive mothers (77% versus 23%)
- 92.6% of the HIV negative mothers initiated breastfeeding earlier in the first one hour of delivery as compared to HIV positive counterparts with 7.4%

- The study also revealed that 82.2% of HIV negative mothers fed their children with the first yellowish milk(colostrums) after delivery whilst 17.8% of HIV positive mothers fed with colostrums

- Exclusive Breast Feeding increased with increased level of education of mother.($P<0.003$, $F=13.9$)

- The results showed that 66.7% of HIV negative mothers practiced mixed feeding whilst 33.3% of HIV positive mothers also practiced mixed feeding

- 67% of HIV negative mothers fed their children with other foods within the first three days after delivery whilst 33% of HIV positive mothers fed within the first three days after delivery.

- The study again showed that 76% of the HIV negative mothers initiated Complementary Feeding before six months whilst 23.3% of HIV positive mothers fed Complementary Feeding before six months

- The study further showed that the proportion of HIV negative mothers who initiated Complementary Feeding late or after 6 months was 71.4% whilst 28.6% of HIV positive mothers did.

- Again, 15.9% of HIV positive mothers initiated Complementary Feeding at exactly 6 months whilst 84.1% of HIV negative did.

- The results also showed that the HIV status of mothers did not have any significant influence on the birth weight of children because 2.7 % of children whose mothers were HIV negative were born with low birth weight whilst 3.1% of HIV positive mothers were born with low birth weight ($p<0.175$, $F+0.62$), same trend was also found for the height of children.($p<0.15$, $F= 1.68$)

- The study assessed the prevalence of the three indicators of malnutrition (stunting, wasting and underweight) among children born to HIV positive mothers compared to HIV negative mothers.

- The results showed that underweight was high among children born to HIV positive mothers compared to HIV negative mothers (15.6% versus 11.1%) (P<0.002, F=10.4)

- The same trend was found for stunting, 25% of children of HIV positive mothers compared to 12.3 % of children of HIV negative mothers. (P<0.001, F=26.6)

- Similar trend was again found for wasting among children of HIV positive mothers compared to Children of HIV negative mothers (20.0% versus 4.3 %).

- The mothers who were HIV positive had low level of education, that below SHS (56% versus 12.6).

- The practice of breastfeeding increased with increasing educational level.The mothers who were educated to the tertiary level were more likely to exclusively breastfeed their children as compared to those with secondary or basic education. This implies that exclusive breastfeeding practice increased with increasing level of education of the mother (P<0.003, F=13.9).

- There was low initiation of breastfeeding amongst HIV negative mothers than their counterpart mothers who were HIV positive (92.6% versus 7.4%).

- Few of the HIV positive mothers fed their children with colostrums than their counterpart HIV negative mothers (82.2% versus 17.8%).

- Most of the HIV negative mothers gave pre-lacteal feeds to their children than their counterparts HIV positive (67% versus 33%).
- 23.3% and 76.7% of the HIV positive and negative respectively initiated complementary feeds before six months.
- Most of the mothers who were HIV negative initiated complementary feeding than their HIV negative counterparts (84.1% versus 15.9%).
- HIV status of mothers did not have any significant influence on the birth weight of the children because 2.7% of children whose mothers were HIV-negative were born with low birth weight whilst only one (3.1%) of the 32 children who were born to HIV-positive mothers was born with low birth weight.
- Stunting, underweight and wasting was high among the children of HIV positive mothers than the HIV negative mothers (25% versus 12.3%), (15.6% versus 11.1%) and (20% versus 4.3%) respectively.

The findings of the study reject the null hypothesis since it was found out that after having controlled for confounding factors minimum diet diversity a proxy for feeding practices still showed a significant association with child's nutritional status using the weight-for-age Z-scores classification. The findings of the study therefore accept the alternative hypothesis that there is significant statistical association between breastfeeding, complementary feeding practices and child nutritional status. The high prevalence of inappropriate breast feeding, complementary feeding indicators found in the district demonstrates the need to further raise awareness on optimal feeding practices.

6.2 RECOMMENDATIONS

The following section presents recommendations which are meant to address practice, policy and further research: Recommendation for practice

- The District Health Management Team (DHMT) and other health professionals may have to intensify nutrition education aimed at improving on breastfeeding initiation practices in the municipal, emphasis on exclusive breastfeeding and also channel nutrition campaigns to demystify inappropriate breastfeeding practices. Emphasis should also be laid on the importance of giving the colostrums.
- The District Health Management Team (DHMT) and other health professionals may have to intensify nutrition education aimed at improving on complementary feeding practices to mothers in the district and also channel nutrition campaigns to demystify inappropriate complementary feeding practices. Stress on timely initiation of complementary feeding to scale up its practice.
- The District Health Management Team (DHMT) ought to champion and intensify nutritional surveillance so that malnutrition outcomes could be identified at early stages and possibly prevent complications that could come as a result so that children are able to reach their natural growth and development potentials.
- It is therefore recommended that health workers should help address beliefs of breast milk being insufficient to meet infant's body requirements from 0-6 months, Mothers should be discouraged from introducing pre-lacteal feeding but rather immediate initiation of Exclusive Breast Feeding within the first hour after birth. Early or late initiation of complementary feeding should also be discouraged.

- Government policies ought to aim at ensuring WHO guide line on infant feeding in the context of HIV and the continued supply of ARV drugs to mothers who are HIV positive and their infants.

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APPENDIX

UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

This research Instrument is designed to collect data for special study on the Topic

The Effects Of Breastfeeding And Complementary Feeding On The Nutritional Status Of Children (0 – 23 Months) Of HIV Infected Mothers

For The Award of M.Sc. Community Health and Development.

Ask the mother if she has a child under 24 months who lives with her. If yes, proceed with interview, if no thank the mother and end the interview.

ALL QUESTIONS ARE TO BE ADDRESSED TO MOTHERS WITH A CHILD LESS THAN 24 MONTHS OF AGE

IDENTIFICATION	
CLUSTER NUMBER	☐☐
HOUSEHOLD NUMBER	☐☐
RECORD NUMBER	☐☐☐

Community	
Name of Mother	

	1	2	3	Final Visit		
Interview date	___/___/___ day/mm/year	___/___/___ day/mm/year	___/___/___ day/mm/year	*For Supervisor* Day		
Name of				Month		

Interviewer				Year				
Result Code*				Result Code				

*Result Codes:

Completed — Postponed

Respondent not at home — Refused

Other (Specify) _____

Form checked by	Supervisor:	Signature
Data Entered by	1.	Date: ___/___/____
	2.	Date: ___/___/____

INFORMED CONSENT

Hello. My name is _____, and I am working with Ghana Health Services and a student of UDS. I am conducting a survey and would appreciate your participation. I would like to ask you about your health and the health of your youngest child under the age of two. This information will help plan health services and assess whether it is meeting its goals to improve children's health. The survey usually takes 60 minutes to complete. **Whatever information you provide will be kept strictly confidential.**

Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. You can stop the survey at any time. However, we hope that you will participate in this survey since your views are important.

Will you participate in this survey? YES NO At this time, do you want to ask me anything about the survey?

SIGNATURE OF INTERVIEWER: _____ Date: ____/_____/_____

RESPONDENT AGREES TO BE INTERVIEWED **1** RESPONDENT DOES NOT AGREE TO BE INTERVIEWED **2**	→ END

I. RESPONDENT BACKGROUND CHARACTERISTICS

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
1	For how many years have you attended school?[1] What is your level of education? IF NEVER, RECORD '00'.	Years In School ☐☐ Primary, JSS, secondary, or higher	
2	When were you born?		
3	What is your current marital status		
4	What is the housing system (walls, roof and flour)?		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
5	How many people are living in your household?		
6	What is your source of water?		
7	What kind of latrine are you using?		
8	Where do you dispose your garbage?		
9	What is the name, sex, date of birth of your youngest child that you gave birth to and that is still alive?	YOUNGEST CHILD NAME _____ _____ SEX MALE..... FEMALE ..... DATE OF BIRTH DAY MONTH	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
		YEAR	
10	What are the dates of birth of your two youngest children?"	__ __ / __ __ / __ __ DD MM YY __ __ / __ __ / __ __ DD MM YY Youngest Older	
11	What is the name of your child?		
12	What is the sex of (name)		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
13	Do you work outside of the home to earn money? IF NO, CIRCLE "A" (NO OUTSIDE WORK) IF YES, What kind of work do you do?	No Outside Work..... Handicrafts ..... Harvesting ..... Selling Foods..... Shop Keeper/Street Vendor... Servant/Household Worker... Salaried Worker..... Other_____ __ ..... (Specify)	
14	Who takes care of (NAME) when you are away from home?	Mother (Respondent) ..... Husband/Partner ..... Older Children..... Other Relatives _____..... (Specify) Neighbors/Friends..... Maid ..... Nursery School ..... Other……..._____ _____..... (Specify)	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
Child Immunizations			
15	Do you have a card or child health booklet where (Name's) vaccinations and Vitamin A (capsules) are written down? IF YES: May I see it please?	YES ..... NO..... DON'T KNOW	 → 13 → 13

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
16	COPY VACCINATION DATES and VITAMIN A, FROM THE CARD OR BOOKLET. IF VACCINES ARE NOT RECORDED IN CHILD HEALTH CARD OR BOOKLET, FILL IN 99/99/9999.		
		DAY MONTH YEAR	
A	BCG		
B	POLIO 0 (GIVEN AT BIRTH - BEFORE 6 WkS)		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
C	POLIO 1		
D	POLIO 2		
E	POLIO 3		
F	Diph/PERT/TET/HEP B/HAEMO INF B 1		
G	Diph/PERT/TET/HEP B/HAEMO INF B 2		
H	Diph/PERT/TET/HEP B/HAEMO INF B 3		
G	VITAMIN A (6 months)		
H	MEASLES (9 months)		
I	YELLOW FEVER (9 months)		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
17	Has (NAME) received any vaccinations that are not recorded on this card, including vaccinations given during immunization campaigns?	YES ..... NO..... DON'T KNOW	 → 16 → 16
18	Has (NAME) received a DTP vaccination, that is, an injection given in the thigh, sometimes at the same time as polio drops?	YES ..... NO..... DON'T KNOW	 → 16 → 16
19	How many times?	NUMBER OF TIMES	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
20	Did (Name) ever receive an injection in the arm to prevent Measles?	YES ..... NO..... DON'T KNOW	
Antenatal care			
21	Did you see any one for ANC during your pregnancy with(name)	Yes No	
22	Whom did you see?	Doctor Nurse Auxiliary midwife TBA Community health worker Others(specify)	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
23	How many times did you receive antenatal care when you were pregnant with (name)?		
24	Do you have a maternal card from when you were pregnant with (name)? (If mother answers yes then ask, may I see the) card	Yes, seen by interviewer Yes, but not available/lost/misplaced Never had a card Don't know	
25	Record the number of ANC visit listed on the maternal card	Number of ANC visits	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
26	How many months pregnant were you when you first received ANC for this pregnancy? (check in maternal card if available)	3 months or less…. 4 months or more…. dont know….	
27	As part of your ANC during this pregnancy, were any of the following done at least once;	+Was your blood pressure measured? Was your weight taken? Were you tested HIV	
28	Are you aware of HIV/AIDS?	Yes No	
29	Do you know your HIV status?	Yes No	
30	Do you know a mother can transmit HIV to her child?	Yes No Don't know	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
	IF HIV POSITIVE		
31	Were you given medication during pregnancy to PMTCT of HIV		
32	Were you given medicine at birth?	Yes No Don't know	
33	How long were you given the medicine?		
34	Was (name) given medication?	Yes No Don't know	
35	Were you counseled on breastfeeding?	Yes No	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
36	Were you given option to either breastfeed or give formula feeds to(name)?	yes no don't know	
The following questions refer to the youngest child shortly after birth			
37	After (Name) was born, did any health care provider or traditional birth attendant check on (Name's) health?	YES ..... NO..... DON'T KNOW	 ➔8 2 ➔8 2

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
38	Sometimes newborns, within the first month of life, have severe illnesses and should be taken immediately to a health facility. What types of symptoms would cause you to take your newborn to a health facility right away? ASK: Anything else? DO NOT READ RESPONSES. RECORD ALL THAT ARE MENTIONED.	CONVULSIONS ..... FEVER ..... POOR SUCKLING OR FEEDING ..... FAST/DIFFICULT BREATHING ..... BABY FEELS COLD ..... BABY TOO SMALL/TOO EARLY ..... YELLOW PALMS/SOLES/EYES ..... SWOLLEN ABDOMEN ..... UNCONSCIOUS ..... PUS OR REDNESS OF THE UMBILICAL STUMP, EYES OR SKIN ..... OTHER _____ ..... (SPECIFY)	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
39	What kind of preparations did you make before the birth of (NAME)? Anything else? RECORD ALL MENTIONED	SAVED MONEY ..... BOUGHT CLEAN DELIVERY KIT..... FOUND BLOOD DONOR ... ARRANGED OF TRANSPORT..... CONTACTED HEALTH WORKER TO HELP WITH DELIVERY ..... OTHER _____..... (SPECIFY) NO PREPARATION	
NUTRITION Breastfeeding/ Infant and Young Child Feeding			

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
40	Did you ever breastfeed (NAME)?	YES	→9
		NO	1
		DON'T KNOW	→9
			1
41	How long after birth did you first put (NAME) to the breast?	IMMEDIATE	
	IF LESS THAN 1 HOUR, RECORD '00' HOURS. IF LESS THAN 24 HOURS, RECORD HOURS. OTHERWISE, RECORD DAYS.	HOURS.....	
		DAYS.....	
		DON'T REMEMBER.....	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
42	During the first three days after delivery, did you give (NAME) the liquid (Colostrum) that came from your breasts?	YES ..... NO ..... DON'T KNOW	
43	Is (name) still being breastfed?	YES NO DON'T KNOW	
44	Have you received counseling on exclusive breastfeeding for the first 6 months?	YES NO DON'T KNOW	
45	Is (name) exclusively breastfed, mixed fed or artificially fed?		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
46	In the first three days after delivery, was (NAME) given anything to drink other than breast milk?	YES ..... NO ..... DON'T KNOW	→ 89 → 89
	At what age will you first give solid or liquid food to (name)?	Before 6 months At 6 months After 9 months Already started Don't know	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
46	What was (NAME) given to drink or eat in the past 24hrs and 7 days recall? Anything else? DO NOT READ THE LIST RECORD ALL MENTIONED BY CIRCLING LETTER FOR EACH ONE MENTIONED	MILK (OTHER THAN BREASTMILK) ..... PLAIN WATER ..... SUGAR OR GLUCOSE WATER..... GRIPE WATER ..... SUGAR-SALT-WATER SOLUTION ..... FRUIT JUICE ..... INFANT FORUMULA ..... TEA / INFUSIONS ..... HONEY ..... OTHER (SPECIFY) _____	
47	How many times in a day before 24hrs recall history and how frequently in the past 7days was (name) fed?		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
48	Are you still breastfeeding (NAME)?	YES ..... NO..... DON'T KNOW	➔9 1
49	For how many months did you breastfeed (NAME)? IF LESS THAN ONE MONTH, RECORD "00" MONTHS.	MONTHS ☐☐	
50	Did (NAME) drink anything from a bottle with a nipple yesterday or last night?	YES ..... NO..... DON'T KNOW	
51	What is the (name) weight?(to the nearest 0.1kg)		
52	What is (name) height?(to the nearest 0.1cm)		