

CHAPTER I

BACKGROUND AND LITERATURE REVIEW

1.1. Introduction

This study discusses the Prevention of Parent-to-child Transmission (PPTCT) of HIV (human immune-deficiency virus). It particularly addresses challenges associated with infant feeding in PPTCT in resource limited setting in Odisha State in India. It addresses the factors associated with the HIV transmission in growing children. The general purpose of this study is to generate knowledge on infant feeding practices in the context of HIV/AIDS and to reduce the mother to child transmission.

1.1.1. HIV/AIDS in Global context

There are 34 million people living with HIV at the end of 2011 and ten million people died of AIDS-related causes since the beginning of the epidemic. Of those, there 1.6 million people died of AIDS in 2012, a 30 per cent decrease since 2005. This decline is due in part to antiretroviral treatment (ART) scale-up. HIV is a leading cause of death worldwide and the number one cause of death in Africa

The global prevalence rate (the per cent of people aged 15-49 years who are infected has leveled since 2001 and it was 0.8 per cent in 2012, although the incidence of the epidemic continues to vary between countries and regions. New HIV infections have declined by 33 per cent since 2001 and in 26 low- and middle-income countries, new infections have declined by 50per cent or more. Still, there were about 2.3 million new infections in 2012 or more than 6,300 new HIV infections per day. Most new infections are transmitted heterosexually, although risk factors vary. In some countries, men who have sex with men, injecting drugs and sex workers are at significant risk.

Women represent about half (52per cent) of all people living with HIV worldwide. HIV is the leading cause of death among women of reproductive age. Gender inequalities, differential access to services and sexual violence increase women's vulnerability to HIV, and women, especially younger women, are biologically more susceptible to HIV.

Young people aged 15–24 years account for approximately 39 per cent of new HIV infections (among those 15 years and over). Globally, young women are twice likely to become infected with HIV than their male counterparts. In some areas young women are more heavily impacted than young men.

Globally there were 3.3 million children living with HIV in 2012, 260,000 new infections among children, 210,000 AIDS deaths, and in 2011 approximately 17.3 million AIDS orphans (children who lost one or both parents to HIV), and most of them lived in sub-Saharan Africa (88 per cent).

Table 1.1 HIV Prevalence & Incidence by Region

Region	Total No. (per cent Living with HIV), 2012	Newly Infected, 2012	Adult Prevalence Rate, 2012
Global Total	35.3 million (100 per cent)	2.3 million	0.80 per cent
Sub-Saharan Africa	25.0 million (71 per cent)	1.6 million	4.70 per cent
South/South-East Asia	4.0 million (11 per cent)	2,70,000	0.30 per cent
Latin America	1.5 million (4 per cent)	86,000	0.40 per cent
Eastern Europe/Central Asia	1.3 million (4 per cent)	1,30,000	0.70 per cent
North America	1.3 million (4 per cent)	48,000	0.50 per cent
Western/Central Europe	860,000 (2 per cent)	29,000	0.20 per cent
East Asia	880,000 (2 per cent)	81,000	<0.1 per cent
Middle East/North Africa	260,000 (0.7 per cent)	32,000	0.10 per cent
Caribbean	250,000 (0.7 per cent)	12,000	1.00 per cent
Oceania	51,000 (0.1 per cent)	2,100	0.20 per cent

Source: Global AIDS Report, 2012.

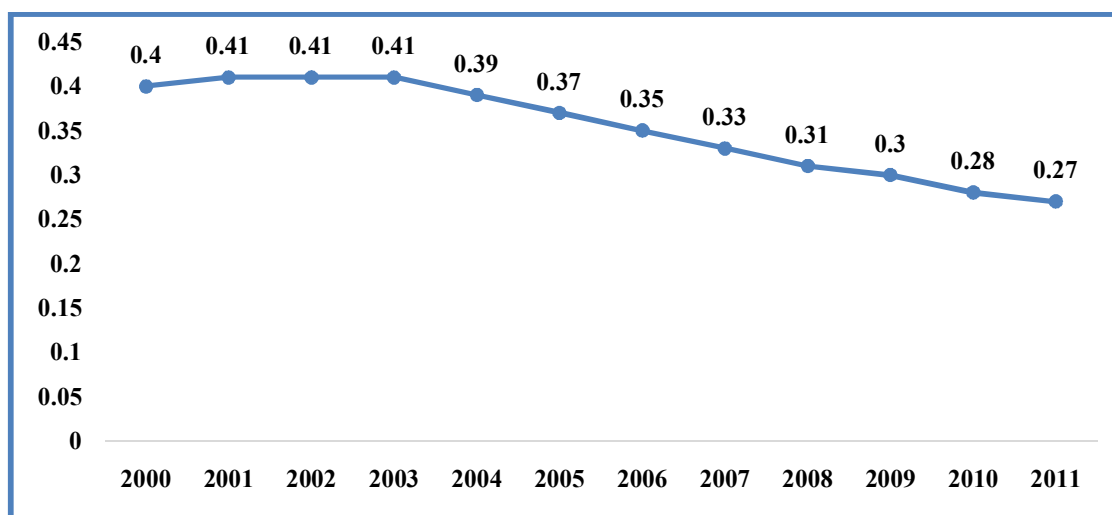
1.2. Overview of HIV Epidemic in India

HIV epidemic in India is dynamic with trends varying at national, regional, state and district levels by population groups and geographical locations. The vulnerabilities that drive the epidemic are different in different parts of the country. Overall trends of HIV portray decline at national level with inter-state variations. India is the second most populous country in the world and has the third largest number of people living with HIV/AIDS. The total number of people living with HIV/AIDS was estimated around 20.9 lakh in 2011 (India HIV estimates, 2012).

The adult HIV prevalence at national level has continued its steady decline from an estimated level of 0.41 per cent (0.34 per cent-0.48 per cent) in 2001 through 0.33 per cent (0.29 per cent-0.37 per cent) in 2007 to 0.27 per cent (0.22 per cent-0.33 per cent) in 2011 (Figure 1.1). Similar consistent declines are noted among both men and women at national

level. Declining trends in adult HIV prevalence are sustained in all the high prevalence States (Andhra Pradesh, Karnataka, Maharashtra, Manipur, Nagaland and Tamil Nadu) and other States such as Mizoram and Goa. Some States in the North such as Odisha, Chhattisgarh, Jharkhand and Uttarakhand, others in the North-west region including Punjab, Chandigarh and Delhi, and some low prevalence States of North-east including Assam have, however, shown rising trends in estimated adult HIV prevalence (Source: *India HIV Estimates, 2012*).

Fig 1.1 Estimated adult HIV prevalence, India, 2000-11

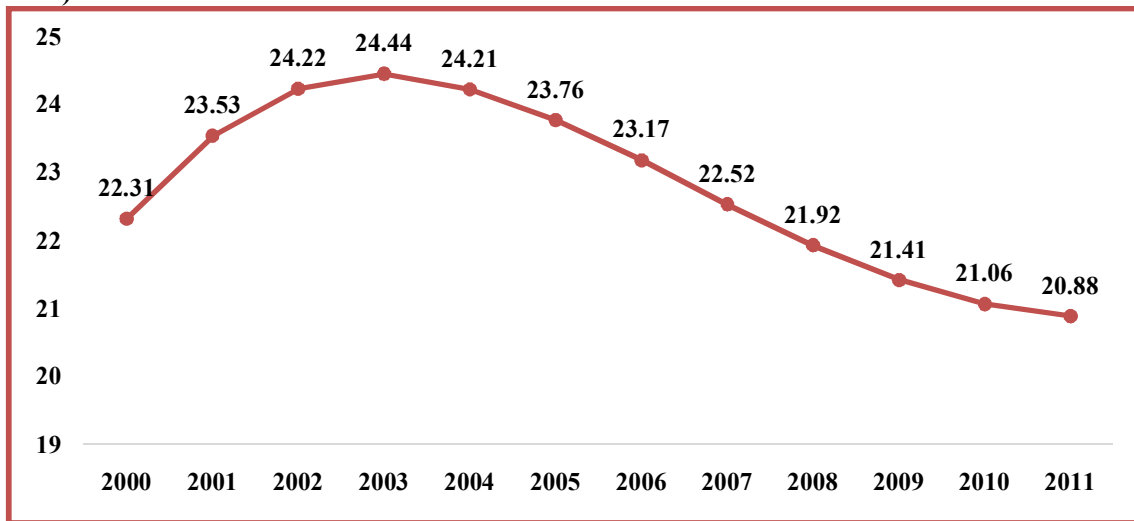


Source: Technical Report India, HIV Estimates-2012, NACO

Children less than 15 years of age account for 7 per cent (1.45 lakh) of all infections, while 86 per cent of age group between 15-45 years do so. Of all HIV infections, 39 per cent (8.16 lakh) are among women. The estimated number of PLHIV in India maintains a steady declining trend from 23.2 lakh in 2006 to 20.9 lakh in 2011.

India is estimated to have around 1.16 lakh annual new HIV infections among adults and around 14,500 new HIV infections among children in 2011. Of the 1.16 lakh estimated new infections, six high HIV prevalence States Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Manipur and Nagaland account for 31 per cent of new infections, whereas some low prevalence States Odisha, Jharkhand, Bihar, Uttar Pradesh, West Bengal, Gujarat, Chhattisgarh, Rajasthan, Punjab and Uttarakhand together account for around 57 per cent of new infections.

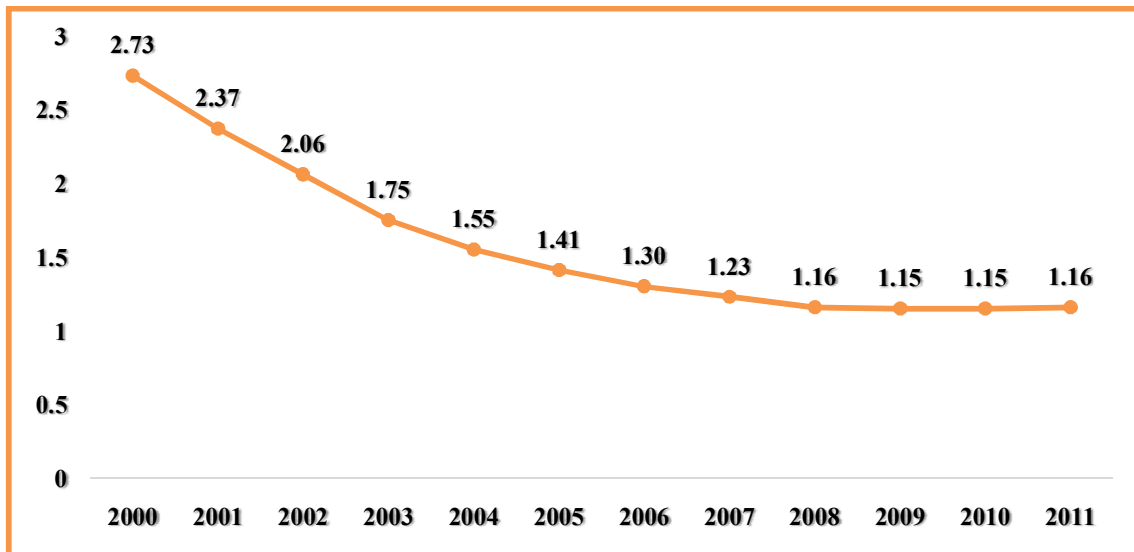
Figure 1.2 Estimated Number of People Living with HIV (PLHIV), India, 2000-11 (in lakh)



Source: Technical Report India, HIV Estimates-2012, NACO.

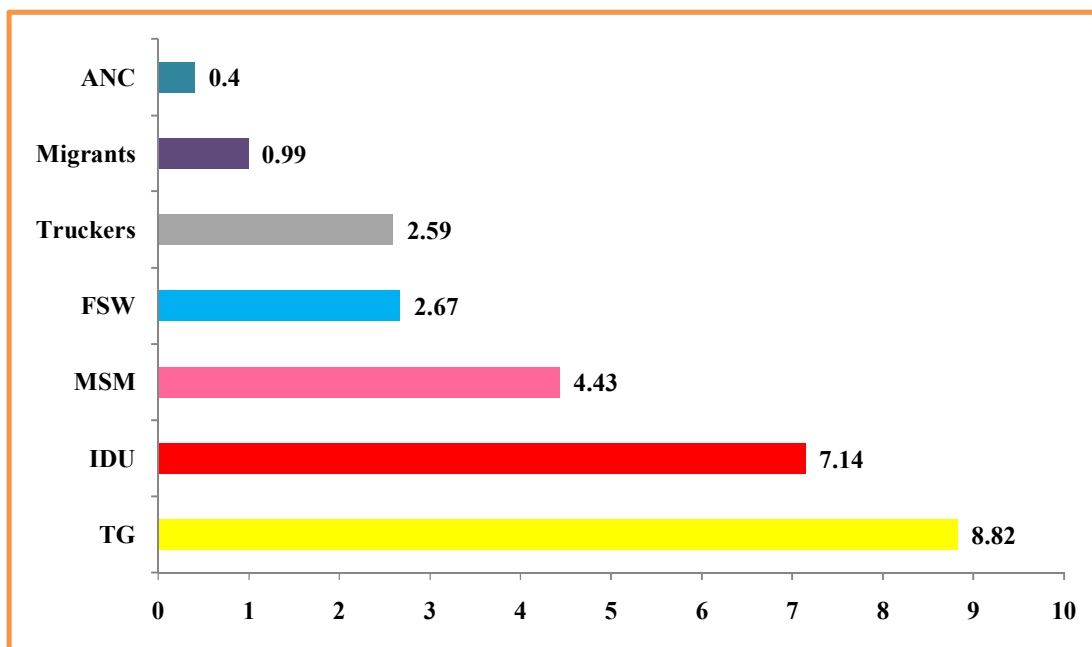
India continues to portray a concentrated epidemic. Considerable decline in HIV prevalence was recorded among Female Sex Workers at national level (5.06 per cent in 2007 to 2.67 per cent in 2011), men who have sex with men (7.41 per cent in 2007 to 4.43 per cent in 2011), general population (ANC attendees) and among different risk groups in 2010-11

Figure 1.3 Declining trend of new HIV infections, India, 2000-11



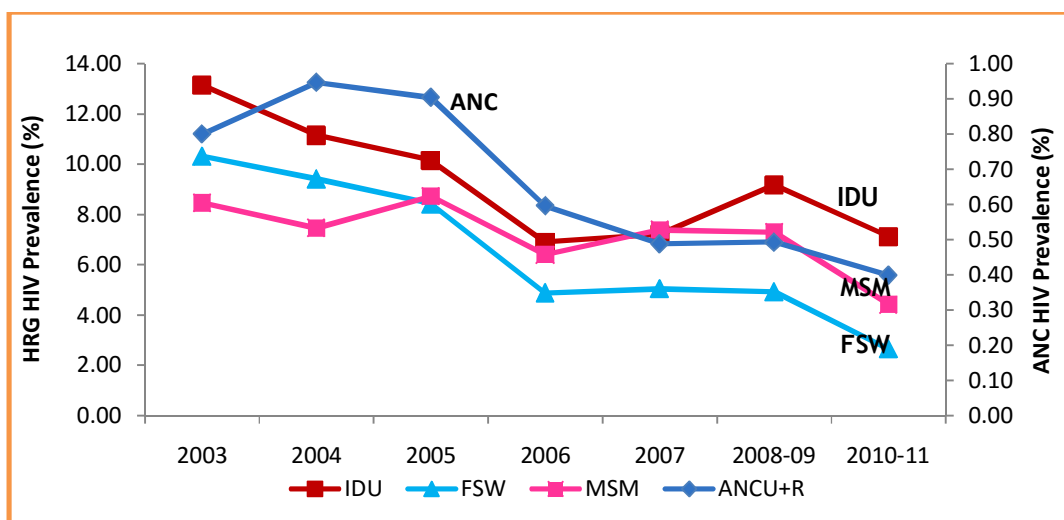
Source: Technical Report India, HIV Estimates-2012, NACO.

Figure 1.4 HIV prevalence among different risk groups, India, 2010-11



Source: Technical Report India, HIV Estimates-2012, NACO.

Figure 1.5 HIV prevalence across different population groups at national level, India, 2003-11



Source: Technical Report India, HIV Estimates-2012, NACO.

Though India has demonstrated an overall reduction of 57 per cent in estimated annual new HIV infections among adult population during the last decade from 2.74 lakhs in 2000 to 1.16 lakhs in 2011, it still remains a challenge to have a reduction of HIV and achieving Millennium Development Goals. Rising trends of new infections are very low in some low prevalence states. The programme has focused prevention strategies to address the emerging vulnerabilities.

1.3. Extent of HIV Infection in Children

Epidemiological evidence indicates that sexual contact continues to be the major mode of spread of HIV transmission in developing countries, leading to high prevalence of HIV infection in women of child-bearing age (Shmid et al, 2004). World-wide, one in seven of those who become newly infected with HIV are children under the age of 15 years (UNICEF, 2008; UNAIDS, 2008). It is estimated that 2.3 million of the 33 million (30.3 million —36.1) people currently living with HIV worldwide are children under the age of 15 years. As per the India 2012 HIV estimation, children less than 15 years account for 7 per cent (1.45 lakh) of all infections and 14,500 children are newly infected annually (NACO, 2012). The virus can be transmitted during pregnancy, especially in the last trimester, during child-birth and breast feeding. Without any intervention about two-thirds of transmissions occur during pregnancy or at delivery, and about one-third through unsafe breast feeding practices (DeCock et al. 2000).

The rate of PPTCT in the absence of preventive interventions is about 15-25 per cent among HIV-positive women who do not breast feed(Thorne and Newell 2004) and 25-45 per cent among HIV-positive women who practise customary breast feeding which involves breast feeding combined with other fluids or solids (WHO 2001). Data from different studies indicate that breast feeding for up to two years may be responsible for one-third to half of HIV infections in infants and young children in African countries (DeCock et al. 2000). The risks increase to 45 per cent among HIV positive women who practice customary breast feeding which involves breast feeding combined with other complimentary liquids or solids and prolonged breast feeding up to 2 years (MOH, 2003; UNAIDS, 2005). Table 1.2 summarises HIV transmission rates at different stages from pregnancy to post-natal period given below.

Table 1.2 Estimated risk and timing of mother-to-child transmission of HIV in the absence of intervention

Time	Transmission rates
During pregnancy	5 – 10 per cent
During labour and delivery	10 – 15 per cent
During breast feeding	5 – 20 per cent
Overall without breast feeding	15 – 25 per cent
Overall with breast feeding to six months	20 – 35 per cent
Overall with breast feeding to 18 to 24 months	30-45 per cent

Source: Adapted from DeCock et al. (2000), Prevention of mother-to-child HIV transmission in resource-poor countries – Translating research into policy and practice. JAMA; 283: 1175-82.

The overall risk of MTCT is associated with factors related to the virus, mother and infant (Newell 2001). Maternal RNA viral load in plasma has been strongly associated with the risk of MTCT (European Collaborative Study 1996; European Collaborative Study 1997; Mayaux et al. 1997; Simonds et al. 1998; Shaffer et al. 1999b; Leroy et al. 2001). However, although the risk of transmission increases substantially with increasing viral load, transmission of the virus to the foetus or infant can occur, albeit rarely, even with very low or undetectable viral load levels. Similarly, at very high levels of HIV RNA, transmission does not always occur. Nevertheless, women with a low CD4 cell count near the time of delivery (below 200 cells per mm³) and those who have been diagnosed with severe clinical diseases are approximately thrice as likely to transmit the virus as those who are less severely affected by HIV infection (European Collaborative Study 2001; Leroy et al. 2002). HIV has been recovered from vaginal and cervical secretions of pregnant women (Nielsen et al. 1996; John et al. 1997; Kovacs et al. 2001) and from gastric secretions of infants born to HIV-seropositive women (Mandelbrot et al. 1999). They constitute independent risk factors for MTCT.

Increasing use of HAART in pregnancy in developed countries has resulted in a growing proportion of women achieving undetectable levels of the virus by the time of delivery, which has had a substantial impact on vertical transmission. Several studies are currently under way in breast feeding populations in resource-poor settings to evaluate the use of HAART for mothers during pregnancy and post-natal time, and for uninfected infants during the breast feeding period. (Thorne & Newell 2007). Results from the DREAM study carried out in Mozambique suggest that a highly-active combination antiretroviral treatment regimen, given during and after pregnancy, is able to significantly

reduce HIV/RNA viral load in both plasma and breast milk. This suggests that there may be a role for HAART prophylaxis in mothers as a means to reduce breast feeding-associated transmission (Giuliano et al. 2007).

1.4. Review of Literature

HIV positive women have been the focus of research related to biomedical issues of mother to child transmission worldwide. However, there have been a number of studies on infant feeding practices among HIV positive mothers in developed and resource limited countries. The extant of literature can be organized into various sub-sections such as HIV testing during pregnancy, infant feeding practices of HIV positive women, risk factors involved in mother to child transmission through breast feeding, prevention of mother to child transmission (PMTCT) of HIV, international recommendation of infant feeding option for HIV positive women, new WHO guidelines for preventing mother to child transmission (MTCT) of HIV, Antiretroviral drugs and infant feeding, stigma and discrimination, and risk and disclosure of HIV in the context of parent to child transmission.

1.4.1. Review relating to HIV testing during pregnancy

Globally a number of studies have been conducted to determine the acceptability and review of HIV counselling and testing policies and procedures for pregnant women both in developed and developing countries (Bergstrom & Sherr, 2000, Kilew et al., 2001; Pool, Nyanzi & whitworth, 2001; Kowalczyk et al; 2002 Meda et al; 2002; Ononeze & Turner, 2003; Baiden et.al; 2005, Urassa, 2005).

The study by Bergstrom and Sherr (2000) reviewed HIV testing policies and procedures reported by obstetric staff in public health centres in Brazil for the successful implementation of antenatal testing procedures. It found that consent for a HIV test was acquired verbally and not written and in some cases the consent was not even asked for. Similarly, (Bruyn & Paxton, 2005) in their study of HIV testing of pregnant women mentioned that with increased availability of antiretroviral therapy, there is an escalating global trend to test all pregnant women for HIV in order to stop antenatal transmission. However, insufficient consideration is given to the impact this may have on the lives of these women and their families. In India, studies on HIV testing have done (Bharat, Tyrer & Aggleton, 2001, Brown et al; 2001, Shankar et. Al;2003; Bharucha et al; 2005; Kielmanna et al; 2005 Sheikh et al; 2005). The feasibility of voluntary counselling and

testing services for HIV among pregnant women is also specifically studied.(Shankar et al; 2003; Bharucha et al; 2005). These studies have highlighted that most of the HIV positive mothers learn that they are infected during routine antenatal testing. Studies in urban western India explored the violation of HIV testing guidelines by private medical providers (Kielmanna et al; 2005; Sheikh et al; 2005). A majority of the private practitioners prescribe/perform HIV tests or had conducted routine HIV screening tests without proper counselling. Prolific HIV testing in the private medical sector is accompanied by inappropriate practices and inadequate knowledge, reflecting deficiencies in the implementation of policy guidelines (Sheikh et al; 2005). Study relating to stigma and mother to child transmission in India by Bharat (2001) reveals that there were reports of people's HIV status being disclosed indiscriminately to family members and principals of pre-test counselling and informed consent prior to HIV testing flouted.

1.4.2. Knowledge, Risk and Disclosure

A study was carried out in Kenya by Oyieke (1999) to determine the knowledge, attitude and practices of PMTCT of HIV among MCH attendees before implementing an integrated PMTCT programme. It highlights significant improvement in women's knowledge of mother to child transmission after appropriate intervention strategies among MCH attendees.

Disclosure of HIV status to sexual partners among women who test for HIV as a part of the PMTCT programme is important to facilitate adherence to PMTCT recommendations and is critical for the success of each of the four pillars of the PMTCT programme including primary prevention among women who test HIV negative (WHO *Global health sector strategy on HIV/AIDS 2011-2015*). Moreover, if the woman was infected during pregnancy or breast feeding, there is a greater risk of (MTCT) due to the initial high viral load (Ministry of Health, Uganda, 2006). Studies in the African setting have documented fear of stigma, accusation of infidelity, violence and loss of support (Awiti Ujiji O et al; 2011, Medley A et al; 2004) as some barriers to women's disclosure of their HIV status to their partners, most of them have focused on people who test HIV positive (King R, et al; 2008, Brou H, Djohan G, et al; 2007). Thus, there is lack of views and experiences of HIV negative women who, in fact, are in a majority. Disclosure is important as it may unburden the women psychologically and decrease the feeling of isolation by increasing avenues for social support (Friedland, Renwick & McColl, 1996,

Hold et al;1998). However some negative consequences for women disclosing their HIV status have been reported in other studies (Pinch et al; 1993, Lester et al; 1995; Temmerman et al; 2003, Gielen et al; 1997). A study conducted in southern USA by Sowell (2003) to understand the phenomenon of disclosure among HIV positive women found that most of them had disclosed to sex partners, close family members, friends and health care professionals. However, for a group of women, disclosure of HIV infection is a difficult issue supporting the need for counselling (Sowell, et al; 2003). There are few studies which have highlighted women's barriers to disclosure (Maman et al; 2001), self-disclosure to sexual partners by (Marks, Richardson & Maldonado, 1991), stigma as a factor for non- disclosure (Ostrom et al;2006) and helping HIV positive persons to negotiate the disclosure process to partners, family members and friends (Servoich, 2000). In south India, a study (Chandra, Deepthivarma & Manjula, 2003) described that for more than one-third of the respondents, disclosure occurred without consent and in anticipation of negative social reactions as the main concern for disclosure.

1.4.3. Review relating to Infant Feeding Practices

HIV transmission during the breast feeding period is a significant source of infection that accounts for one-third of all transmissions that occurs in children from their mothers in developing countries (WHO, 2003). Despite recent advances in the use of antiretroviral, there is a critical need to make infant feeding safer as breast feeding is a major factor in HIV transmission (Nicoll, Newell & Pecham, 2000). About 15 per cent of babies born to HIV-positive mothers become infected through breast feeding and several factors are known to increase the risks of MTCT through breast milk (WHO, 2000; UNICEF, 2008). Based on the data available in Sub-Saharan Africa, mixed feeding is known to increase the risks of HIV transmission than exclusive breast feeding (Coutsoudis et al., 2001; Fowler, 2008; Iliff et al., 2005). Any food given before six months to an infant may cause inflammation reaction in the lining of the baby's mouth and intestines, making it easy for HIV to penetrate the baby's defence (Kumwenda et al., 2007; Dunn et al., 1992; WHO, 2001).

There is a increasing research on HIV in India, although the data on infant feeding and HIV transmission rates are still limited. Current rates of HIV in pregnant women in India based on sentinel surveillance are 2 per cent. In large urban areas such as Pune and Mumbai, HIV/AIDS rates are of the order of 4–6per cent (NACO, 2002). A study

assessing women's awareness of HIV in Pune found that nearly 70 per cent of them demonstrated knowledge of maternal to child transmission routes. However, 8 per cent women knew of treatment to prevent mother to infant transmission. Another study conducted in Pune showed that HIV positive mothers in the postpartum mixed fed their infants frequently which put the infants at greater risk of both non-HIV- related morbidity and HIV transmission as early introduction of foods other than breast milk may increase MTCT (Omari AA et.al, 2003; Suryavanshi et al, 2003).

1.4.4. Risk factors for MTCT through breast feeding

Transmission of HIV through breast feeding has been well documented since 1985. The first reports indicating the possibility of HIV transmission through breast milk were of breastfed infants of women who had acquired post-natal infection through blood transfusion or through heterosexual exposure (Ziegler et al. 1985; Hira et al. 1990; Van de Perre et al. 1991; Palasanthiran et al. 1993). HIV transmission during the breast feeding period is a significant source of infection that accounts for one-third of all transmissions that occur in children from their mothers in developing countries (WHO, 2003). About 15 per cent of babies born to HIV-positive mothers become infected through breast feeding and several factors are known to increase the risks of MTCT through breast milk (WHO, 2000; UNICEF, 2008). There were also reports of infants – with no other known exposure to HIV – who were infected through being wet-nursed and through pooled breast milk (Nduati et al. 1994). There is a theoretical risk of oral transmission from infant to wet-nurse, with cases having been reported (Visco-Comandini et al. 2005). Several factors have been found to be associated with an increased risk of MTCT through breast feeding. These include:

1.4.4 A. Maternal viral load and CD4-CD8 counts

High maternal viral load measured during pregnancy (John et al. 2001) or after delivery (Semba and Neville 1999) and a low CD4/CD8 ratio (Semba and Neville 1999) have been associated with an increased rate of MTCT through breast feeding. These conditions are mostly associated with detection of HIV in breast milk (UNAIDS, 2007b). A study conducted in Zambia by Kuhn and others (2007) demonstrated that 86 per cent of early transmission of HIV to infants occurred among women who had a low CD4 count. If a woman is recently infected with HIV during breast feeding period, the risks of MTCT through breast milk is twice as high as that of a woman whose infection is already

established (29 per cent vs. 15 per cent) (Mbori-Ngacha et al., 2001). This is due to high viral load occurring with recent infection (UNICEF, 2008).

1.4.4 B. Duration of breast feeding

The risk of HIV transmission through breast feeding is greatest in early infancy (before six months of age) and persists as long as breast feeding continues (Miotti et al. 1999; Nduati et al. 2000). Studies found that a longer duration of breast feeding is associated with increased risk of MTCT (Leroy et al. 1998; Embree et al. 2000; John et al. 2001). In a small cohort of Indian women who chose not to exclusively breast feed, overall MTCT transmission probability of 8 per cent during one year follow-up . Among the women, who exclusively formula fed their infants, the transmission was 3 per cent (Amita Gupta et al. 2007)

1.4.4 C. Breast milk infectivity

A randomised clinical trial in Nairobi (Kenya) suggests that the volume of milk ingested is an important factor in breast milk transmission of HIV (Richardson and Fairbank 2000). Another study found that infant oral thrush before six months of age is a risk factor for post-natal infection of children (Embree et al. 2000). Some studies found that inflammatory conditions such as mastitis, assessed clinically (Ekpini et al. 1997; John et al. 2001) or biologically by measuring the sodium level in breast milk (Semba and Neville 1999), fissures (Ekpini et al. 1997) and breast abscesses increase the risk of MTCT through breast feeding.

1.4.5. Infant feeding patterns and MTCT

Studies have suggested that mother to child transmission of HIV through breast-feeding depends on the pattern of breast-feeding (exclusive or mixed feeding) and not simply on all breast-feeding, (Miller, et al, 2002:1247). Coutsaudis, Pillay, Sponer, Kuhn and Couvadia (1999:471-476) have shown that the risk of post-natal mother to child transmission of HIV at three months of age for babies who were exclusively breast-fed was 45 per cent lower than those who were fed a combination of breast milk and formula, or breast milk and other foods or liquids (mixed feeding) (Coutsaudis et al. 1999). A carefully designed study conducted in KwaZulu Natal in South Africa recently provided crucial confirmatory evidence that when HIV positive mothers breast feed exclusively their babies have a significantly lower risk of infection from HIV. Mixed feeding before or after 14 weeks

nearly doubled the transmission risk, and the addition of solids increased the risk eleven-fold. It further reported that mortality by three months of age for replacement-fed babies was more than double (15 per cent) than that of those who were exclusively breastfed (6 per cent) (Coovadia et al. 2007). These findings add to the previous evidence about the additional risk of HIV transmission for non-exclusive breastfed babies (Coutsoudis et al. 1999; Coutsooudis 2001; Iliff et al. 2005).

1.4.6. Prevention of mother to child transmission (PMTCT) of HIV

The United Nations strategy to prevent the transmission of HIV to infants and young children involves: 1) prevention of HIV infection in general, especially in women and young people; 2) prevention of unwanted pregnancies among HIV-infected women; 3) prevention of HIV transmission from HIV-infected women to their infants during pregnancy, labour, delivery and breast feeding; and 4) provision of care, treatment and support to HIV-infected women, their infants and family.

1.4.6 A. Internationally recommended infant feeding options for HIV positive women

There have been various attempts at developing policies and guidelines in the search for the safest feeding options for infants of HIV-positive mothers. The World Health Organization (WHO), the United Nations International Children's Emergency Fund (UNICEF) and the joint United Nations Programme on HIV/AIDS (UNAIDS) issued a series of revised guidelines on infant feeding for HIV-positive women in resource-poor settings.

“When replacement feeding is acceptable, feasible, affordable, sustainable and safe (AFASS), avoidance of all breast feeding by HIV-positive mothers is recommended. Otherwise, exclusive breast feeding is recommended during the first months of life. To minimize HIV transmission risk, breast feeding should be discontinued as soon as feasible, taking into account local circumstances, the individual woman's situation and the risks of replacement feeding.” (WHO 2001).

According to the WHO (2001) guidelines, AFASS refers to five conditions that should be in place before any consideration is given to feeding the baby with breast milk substitutes (Box 1).

Exclusive breast feeding: Feeding only breast milk and prescribed medicine but no water, other liquids or foods to the infants for the first six months of life. **Exclusive commercial**

infant formula: Feeding only formulated powdered milk made specifically for infants' food.

Exclusive home-modified animal milk: Feeding only fresh or processed animal milk that is modified by adding water, sugar and micronutrients.

Mixed Feeding: Breast feeding a child while giving non-human milk or other foods and liquids (WHO, 2004).

Not Breastfed: Not fed on breast milk (WHO, 2004).

Colostrum: Thick yellowish secretion from the breast within few days of delivery (WHO, 1999).

Pre-lacteal food: Giving the infants feeds or fluids before initiating breast feeding after birth (WHO,1999).

Duration of Breast feeding: The length of time that infants who were initially breastfed continue to receive breast milk, even if also receiving other foods (WHO, 2009).

Wet-nursing by an HIV-negative woman: Having another woman breast feed the baby (the woman should be HIV-negative throughout the period of breast feeding).

Expressing and heat-treating breast milk (pasteurised breast milk): Removing the milk from the breasts manually or with a pump, then heating it to kill HIV.

Breast milk banks: Places where donor breast milk is pasteurised and made available for infants.

Based on the cumulative research evidence and programmatic experience that i) mixed feeding increases the risk of HIV transmission compared with exclusive breast feeding, ii) higher mortality occurs in infants who are formula fed compared with exclusive breastfed infants, and iii) exclusive breast feeding could be supported in HIV positive women, a need to balance the benefits and risks was recognised. This instigated a different focus in which child survival is regarded as a greater goal than merely the avoidance of HIV infection. The findings warranted recent updates (2006) for infant feeding guidelines (WHO 2001) which recommended replacement feeding to the infants of HIV positive women when the AFASS conditions are met.

Box-1.1. The AFASS conditions

Acceptable: Lack of barriers, pressure and discrimination attached to formula feeding.

Feasible: Adequate time, knowledge and skills to prepare and feed formula up to 12 times 24 hours despite other domestic or work disruptions.

Affordable: Parents can pay all the costs of formula feeding, including medical care for the increased number of infections suffered by a formula-fed baby.

Sustainable: A continuous and uninterrupted supply of all ingredients and products needed for safe replacement feeding for as long as the infant needs it.

Safe: Replacement foods and liquids are hygienically prepared, stored and fed in nutritionally adequate quantities, preferably by cup, and there is a reliable supply of safe water which can be boiled for at least ten minutes for preparing feeds and sterilising utensils.

1.4.6 B. Exclusive replacement feeding

Replacement feeding ideally involves feeding an infant with a diet that provides the child with all the needed nutrients without giving him any breast milk. WHO replacement feeding options recommended for HIV positive mothers include: commercial infant formula and modified cow's milk during the first six months of life. After six months, complementary feeding is appropriate. (UNAIDS, 2003: 39). The only way to achieve a zero-risk of post-natal HIV-transmission is by exclusive replacement feeding (WHO 2001). Nevertheless, parents need to consider their situation and AFASS conditions before a decision to use replacement feeding is made. Safety is the most critical criterion among the AFASS conditions for replacement feeding. Several studies have tried to identify which type of infant feeding would result in the highest rate of HIV-free survival or a decreased death rate. A randomised trial in Kenya infant feeding in the context of HIV conducted in 2001 concluded that infants assigned to be formula fed or breastfed had similar mortality rates during the first two years of life. However, HIV-free survival at the age of two was significantly higher in the formula arm (Mbori-Ngacha et al. 2001). A pooled analysis of African studies conducted in 2004 also found that mortality did not differ significantly between ever-breastfed and never-breastfed children born to HIV-positive mothers (Newell et al. 2004).

A mathematical simulation based on previously reported rates of HIV transmission and infant death indicated that in comparison with replacement feeding, breast feeding

during the first six months by HIV-positive mother increases HIV-free survival by 32 per 1000 live births. However, replacement feeding appears to be safer after six months (Ross and Labbok, 2004). The randomised Mashi study in Botswana suggested that breast feeding with zidovudine prophylaxis was not as effective as formula feeding in preventing post-natal HIV transmission but was associated with a lower mortality rate in seven months. Both methods had comparable HIV-free survival at 18 months (Thior et al. 2005). A non-randomised DITRAME Plus study in Cote d'Ivoire found no difference in two-year rates of adverse health outcomes between early weaned breastfed and formula-fed children, and the mortality rates did not differ significantly between these two groups (Becquet et al. 2005).

Another study has documented that stigma and secrecy surrounding HIV/AIDS make the choice of replacement feeding more difficult, particularly in the strong breast feeding cultures of Africa, and bottle-feeding may amount to an inadvertent disclosure of the mother's HIV infection (Didan, 2003). Preparing formula is difficult and time-consuming, especially without refrigeration, running water or a ready supply of fuel for boiling water. These factors may contribute to HIV-positive mothers choosing breast feed or to practise mixed feeding even if they have access to the formula (Didan, 2003). The communities providing free infant formula to HIV infected mothers, the combined risk of HIV transmission and death was similar whether infants were formula fed or breast fed from birth (Coutsoudis A. et al. 2008). These findings inspired the so called 'formula plus' programmes in Haiti and Botswana which provided HIV infected mothers with free formula, growth monitoring services, regular medical assessment, skills on safe preparation and appropriate treatment and care (Noel et al 2006). After six months of implementation, the 'formula plus' programme in Haiti reported reduced Mother To Child HIV transmission but very high infant mortality rates (217/1000) (Noel F et al. 2006).

A similar programme in Botswana reported 35,000 cases of diarrhoea, resulting in 532 deaths within the first six months (Creek T, 2006). Experiences in these two programmes underscored the dangers of formula feeding in impoverished communities despite the provision of free formula feeding. Further research has shown that infant milk in the form of powder may contain low levels of salmonella (Brouard C et al. 2007) or other contaminants causing diarrhoea outbreaks (Weir, 2002 and Threlfall E.J et al. 1998)

Cow's Milk: The major difference between cow's milk and human milk is the greater concentration of protein and minerals and lower concentration of lactose in cow's milk. Modified cow's milk implies fresh or processed animal milk that is modified by adding water, sugar and micronutrients supplements. (UNAIDS, 2003:10). Cow's milk has more protein and a greater concentration of sodium, phosphorus and other salts than breast milk (WHO, 1999). Modification of cow's milk, therefore, involves dilution with boiled water to reduce the concentration of salts. Dilution, however, reduces energy concentration and hence sugar must be added. The milk, water and sugar must be mixed in right proportions. (UNAIDS, 2003: 52)

1.4.6 C Exclusive breast feeding in the context of HIV

A field study on infant acquisition of HIV-1 through breast milk from infected mothers was first published in 1991. In 2000 it was estimated that without anti-retroviral intervention, mother-to-child transmission rates would be about 15-30 per cent without breast feeding, 25-35 per cent with breast feeding up to 6 months and 30-45 per cent with breast feeding up to 2 years. Later studies showed that different feeding modalities gave different risks of transmission. Pioneer work was done in South Africa by Coutsooudis et al. also as a part of vitamin A study. They described Exclusive Breast Feeding and Replacement Feeding as equally protective with regard to HIV transmission from mother-to-child, a finding that had immediate public health implications: EBF was thereafter recognised as a safe alternative to Exclusive Replacement Feeding when Replacement Feeding was not AFASS (acceptable, feasible, affordable, sustainable and safe).

Social, psychological, nutritional and health benefits of breast feeding are widely documented (Cesar et al. 1999; Latham and Preble 2000; WHO 2000). Exclusive breast feeding for the first months of life has been established as the best way to feed infants (Cohen et al. 2000; Dewey et al. 2001; Kramer et al. 2003), and could prevent 13–15 per cent of child deaths in low-income countries (Arifeen et al. 2001; Jones et al. 2003). However, HIV virus could be transmitted through breast milk created a major dilemma for the promotion of breast feeding, particularly in areas where a large proportion of the population is HIV-infected and where breast feeding is the cultural norm (UNAIDS/WHO 2004).

Given the risk of HIV transmission associated with breast feeding, it would appear that the simplest and most straightforward approach to prevention is to avoid breast feeding when mothers are infected (Nduati et al. 2000; Magoni and Giuliano 2005). However, in most parts of Africa replacement feeding is associated with an increased risk of morbidity and mortality (Bahl et al. 2005; Creek 2006; Wilfert and Fowler 2007). Although breast feeding is common in most African settings, exclusive breast feeding is rarely practised (DeCock et al. 2000). Whether a lower risk of MTCT through replacement feeding warrants the risk of damaging the life-saving cultural practice of breast feeding in resource-poor countries is a major question. Most operational challenges have been how to make breast feeding safer in communities with a high HIV prevalence and where breast feeding is the traditional acceptable way of feeding the babies. The finding that exclusive breast feeding carries a lower risk of transmission compared with mixed feeding (Coutsoudis et al. 1999; Iliff et al. 2005; Coovadia et al. 2007) gave new hope and set new challenges for promoting exclusive breast feeding. It has stimulated increasing attention to the social and cultural factors that affect HIV-positive mothers' decisions and practices of infant feeding (Bland et al. 2002; Thairu et al. 2005). Coutsooudis and colleagues suggest that exclusive breast feeding reduces the risk of HIV transmission to the baby because the infants become exposed to fewer bacterial contaminants and food antigens that can damage the gut lining and cause inflammation. Additional liquids and foods may compromise intestinal integrity, resulting in small lesions in the immature gut through which the HIV virus can pass to infect the infant (Coutsoudis et al. 1999).

1.4.6 D. Early breast feeding cessation to reduce post-natal transmission of HIV

Early cessation of breast feeding was identified as one of the infant feeding options for HIV positive mothers who find it difficult to avoid breast feeding completely, or who develop symptoms of AIDS during breast feeding, or who are able to provide adequate replacement feeds after a few months of breast feeding (WHO 1998). The risk of HIV transmission increases over time and shorter periods of breast feeding carry a smaller risk of HIV transmission. The transmission rate for babies over six months of age has been reported to carry a 5 per cent risk (Coutsoudis et al. 2001) which can be reduced further if exclusive breast feeding is practised. Indirect evidence from observational studies and mathematical modelling exercises suggests that exclusive breast feeding followed by a rapid transition to exclusive replacement feeding may be one of the safest feeding options for HIV-positive mothers (WHO 2000). Several studies from various settings in Africa

(Coutsoudis 2001; Fawzi et al. 2002; Leroy et al. 2003; Iliff et al. 2005) have provided strong justification for supporting early breast feeding cessation among HIV-positive women. They have revealed that more than two-thirds of all post-natal HIV transmission occurred after the baby reached the age of six months. To minimise the HIV transmission risk, breast feeding should, therefore, be discontinued as soon as feasible, taking into account the individual woman's situation as indicated in the guidelines (WHO 2003).

Most African women breast feed for more than one year but rarely practise exclusive breast feeding since they gradually introduce other liquids and foods while continuing breast feeding into the second year of life (Piwoz and Humphrey 2005). Abrupt weaning does infant feeding in the context of HIV occur, but it is most frequently practised in the second year of life once the child has had time to become accustomed to solid foods (Millard and Graham 1985). The major challenge associated with this 'modified breast feeding' option (early breast feeding cessation) is that it conflicts directly with traditional infant feeding patterns in Africa. How to wean safely and whether abrupt weaning is feasible was one of the significant and hotly-debated infant feeding topics at the international AIDS conference (2006) in Toronto, Canada. Some studies from South Africa and Eastern Africa (Almedom and de Waal 1990; Bland et al. 2007) have shown that most mothers who tried abrupt cessation of breast feeding re-introduced breast feeding again in order to comfort their crying babies. The major reason given was that the baby was crying in public beyond the mother's tolerance. Such re-introduction of mother's milk has been found to increase the risk of post-natal HIV transmission. However, there are a few studies, for example, in West Africa (Leroy et al. 2007) and in Zimbabwe (Iliff et al. 2005) that have reported the feasibility of early cessation of breast feeding, especially when women are socially supported to do so as safely as possible and when safe nutritionally adequate alternatives are available.

1.4.6 E. Expressing and heat-treating breast milk (pasteurised breast milk)

Manually expressed heat-treated breast milk is among the WHO's recommended breast feeding modifications to reduce the risk of post-natal HIV transmission while providing breast milk's immune properties to protect the infant against other common childhood infections (UNAIDS/WHO 2004). Some studies have shown that HIV in breast milk could be inactivated by Holder pasteurisation (heating to 62.5 degrees C for 30 minutes), while retaining most of the breast milk's protective elements (Eglin and Wilkinson 1987; Orloff

et al. 1993; Giles and Mijch 2005). However, the method requires temperature gauges and timing devices that are not available in most at-risk communities (Israel-Ballard et al. 2005). A recently published study (Israel-Ballard et al. 2007) has confirmed that flash-heat can inactivate HIV in naturally infected breast milk from HIV-positive mothers. The previous pilot data had suggested that the flash-heat method was capable of inactivating HIV in 'spiked' breast milk samples from healthy mothers while retaining most of the milk's nutritional and antimicrobial properties (Israel-Ballard et al. 2005; Israel-Ballard et al. 2006). It has been recommended as a simple pasteurisation method that a mother in a developing country could implement in her kitchen.

The responses from the UNICEF's exploratory studies conducted in Tanzania, Kenya, South Africa and Zambia suggest that the method is known but would be poorly accepted (UNICEF, 2000). In Uganda there is a strong cultural prohibition against expressing breast milk and feeding it to the baby (Steel and Serunjogi, 1993).

1.4.6 F. Wet-nursing / Surrogate breast feeding

Wet-nursing has been a long established practice in most African cultures (Riordan 1993) for a variety of reasons, including feeding the baby after the death of the mother or in the case of very sick mother. The babies were breastfed by close female relatives such as aunts or female friends who were nursing their own babies (Agnarsson 2001). The WHO's recommended guidelines (1998) state that the wet-nurse should be offered voluntary counselling and testing, she should have serial HIV-testing and regular counselling to remain negative, she should be able to practise safe sex in order to remain HIV-negative during the breast feeding period, she should breast feed the baby on demand and no payment should be involved in the arrangement. But this method has been met with uncertainty due to the increasing knowledge of the presence of the HIV virus in the mothers' milk. Studies have pointed out various concerns and beliefs related to wet-nursing in Africa. For Infant feeding in the context of HIV example in Zimbabwe's women were highly concerned about having someone else breast feeding a woman's baby due to the potential chance that the wet-nurse might also be HIV-positive or have another chronic disease (Gavin et al. 1999).

1.4.6 G. Mixed feeding

The reason why exclusive breast feeding is recommended is because evidence has shown that mixed feeding, which involves giving the infant breast milk and other drinks such as porridge, formula, glucose water, gripe water or traditional medicines increases the risk of HIV transmission from mother to child. (UNAIDS, 2003: 56). Mixed feeding is riskier than exclusive breast or formula feeding. The physiological explanation being that foods, traditional medicines or drinks damage the babies lining of the stomach and intestines, making it easier for HIV in the breast milk to infect the baby (Perinatal HIV Research Unit, 2006:21). In an early South African study of HIV-positive women and their babies, 36 per cent of babies who received mixed feeding were reported infected compared with about 25 per cent of those who were exclusively breast-fed and 19.5 per cent of formula-fed babies. (Coustaudis, 1999:127-33).

1.4.7. WHO's new recommendations (WHO guidelines, 2010): Preventing Mother to Child Transmission and Infant Feeding in the context of HIV

Infant feeding in the context of HIV is complex because of the major influence that feeding practices and nutrition have on child survival. Depending on the availability of interventions to reduce HIV transmission during pregnancy and delivery, HIV transmission through breast feeding is responsible for between 30 to 60 per cent of all HIV infections in children. However, in many resource-limited settings, infants who do not breast feed are up to six times more likely to die from malnutrition, pneumonia and diarrhoeal illnesses. The dilemma has been to balance the risk of infants being exposed to HIV through breast feeding with the risk of death from causes other than HIV if infants are not breastfed. In the past years, there was emphasis on preventing infants from becoming infected with HIV by counselling HIV-infected mothers to avoid all breast feeding. Replacement feeding with infant formula unquestionably prevents all transmission of HIV through breast feeding but in many settings can also increase the risk of death from other causes. Programme and research groups have reported the difficulties of implementing earlier United Nations recommendations on HIV and infant feeding within health-care systems constrained by limited human resources.

The WHO is revising its guidelines on the use of antiretroviral (ARV) drugs for PMTCT of HIV (PMTCT) and guidelines on infant feeding and HIV. The WHO revised the guidelines on antiretroviral therapy (ART) for adolescents and use of antiretroviral

drugs (ARV), and recommended infant feeding guidelines in the context of HIV for preventing MTCT. The key principles and recommendations for each guideline were released on 30th November, 2009. The recommendations are follows:

1.4.7 A. Recommendation on PMTCT

1. Earlier antiretroviral therapy (ART)¹ for a larger group of HIV-positive pregnant women to benefit both the health of the mother and prevent HIV transmission to her child during pregnancy.
2. Longer provision of antiretroviral (ARV) prophylaxis² for HIV-positive pregnant women with relatively strong immune systems who do not need ART for their own health. This would reduce the risk of HIV transmission from mother to child.
3. Provision of ARVs to the mother or child to reduce the risk of HIV transmission during the breast feeding period. For the first time, there is enough evidence for WHO to recommend ARVs while breast feeding.

1.4.7 B. Recommendation on infant feeding in the context of HIV

ARV interventions can drastically reduce the risk of HIV transmission through breast feeding. This new evidence transforms the landscape in which decisions on infant feeding practices should be made by individual HIV-infected mothers, national health authorities and international agencies and funders.

1. **Ensuring mothers receive the care they need:** Mothers known to be HIV-infected should be provided with life long antiretroviral therapy or antiretroviral prophylaxis interventions to reduce HIV transmission through breast feeding according to the WHO's recommendations.

The 2009 recommendations provide two alternative options for women who are not on ART and breast feeding resource-limited settings:

i) If a woman received AZT during pregnancy, daily Nevirapine is recommended for her child from birth until the end of the breast feeding period.

Or

ii) If a woman received a three-drug regimen during pregnancy, a continued regimen of triple therapy is recommended through the end of the breast feeding period.

2. **Which breast feeding practices and for how long:** Mothers known to be HIV-infected (and whose infants are HIV uninfected or of unknown HIV status) should exclusively breast feed their infants for the first six months of life, introducing appropriate complementary foods thereafter, and continue breast feeding for the first 12 months of life.
3. **When mothers decide to stop breast feeding:** Mothers known to be HIV-infected who decide to stop breast feeding at any time should stop it gradually within one month. Mothers or infants who have been receiving ARV prophylaxis should continue prophylaxis for one week after breast feeding is fully stopped. Stopping breast feeding abruptly is not advisable.

For all HIV-infected pregnant women who are not eligible for ART, ARV prophylaxis for preventing HIV transmission through breast milk (option A consists of daily Nevirapine to the infant; option B consists of triple ARV drugs provided to the pregnant women starting from as early as 14 weeks of gestation) should continue until one week after all exposure to breast milk has ended.
4. **What to feed infants when mothers stop breast feeding:** When mothers known to be HIV-infected decide to stop breast feeding at any time, infants should be provided with safe and adequate replacement feeds to enable normal growth and development.

For infants less than six months of age:

- Commercial infant formula milk as long as home conditions outlined in Recommendation #5 below are fulfilled,
- Expressed, heat-treated breast milk, and,
- Home-modified animal milk is not recommended as a replacement food in the first six months of life.

For children over six months of age:

- Commercial infant formula milk as long as home conditions outlined in Recommendation #5 below are fulfilled, and,
- Animal milk (boiled for infants under 12 months) as a part of diet providing adequate micronutrient intake. Meals, including milk-only feeds, other

foods and combination of milk feeds and other foods should be provided four or five times per day.

5. **Conditions needed to safely formula feed:** Mothers known to be HIV-infected should give only commercial infant formula milk as a replacement feed to their HIV uninfected infants or infants who are of unknown HIV status, when specific conditions are met as recommended in AFASS condition in the WHO's guidelines, 2006.

- safe water and sanitation are assured at the household level and in the community, and,
- the mother, or other caregiver, can reliably provide sufficient infant formula milk to support normal growth and development of the infant,
- the mother or caregiver can prepare it cleanly and frequently enough so that it is safe and carries a low risk of diarrhoea and malnutrition,
- the mother or caregiver can in the first six months exclusively give infant formula milk,
- the family is supportive of this practice, and,
- the mother or caregiver can access health care that offers comprehensive child health services.

6. **Heat-treated, expressed breast milk:** Mothers known to be HIV-infected may consider expressing and heat-treating breast milk as an interim feeding strategy:

- In special circumstances such as when the infant is born with low birth weight or is otherwise ill in the neo-natal period and unable to breastfeed;
- When the mother is unwell and temporarily unable to breast feed or has a temporary breast health problem such as mastitis;
- To assist mothers to stop breast feeding; and
- If antiretroviral drugs are temporarily not available. (*Weak recommendation, very low quality of evidence*).

7. **When an infant is HIV-infected:** If infants and young children are known to be HIV-infected, mothers are strongly encouraged to exclusively breast feed for the first six months of life and continue breast feeding as per the recommendations for the general population, that is, up to two years or beyond.

1.4.8. Adhering to infant feeding options

Research has shown that even when HIV positive mothers go through infant feeding counselling, real care and feeding of the infant is ultimately influenced by circumstances and interests beyond HIV infected mothers' direct control. These include socio-economic conditions, expectations of partners, mother-in-laws, extended families and the community. Studies in Botswana, where formula feeding among HIV positive women is strongly encouraged and offered free in PMTCT programmes, found that women accepted formula feed given from the clinic and went home only to practise both formula feeding and breast feeding (Shapiro RL et al. 2003: 220-30). A study in Zambia reported that HIV positive women changed to mixed feeding very early, whether they started out with replacement feeding or exclusive breast feeding (Omari AA et al. 2003: 156-62).

Another study in Tanzania showed that mothers who had started out with replacement feeding ended up breast feeding (Leshabari, 2006: 5). Women explained that they could not withstand the social pressure to breast feed and were concerned about their reputation as good mothers. These studies agree on the complexity and difficulty among HIV positive mothers to stick firmly to any of the WHO's recommended infant feeding methods. Despite such early evidence, however, very few studies have focused on the experiences of adherence among HIV positive mothers who have been counselled, have chosen infant feeding methods and are enrolled in a PMTCT programme.

1.4.9. Antiretroviral drugs and infant feeding in PPTCT

Pregnant women found HIV positive are administered ARV prophylaxis so as to prevent mother to child transmission of HIV. The most effective way to prevent MTCT of HIV is the use of a combination of several antiretroviral drugs (Carpenter et al. 1997) and the avoidance of breast feeding which reduces the risk to below 2 per cent (European Study 2001). Several studies are underway to explore the impact of antiretroviral therapy (ART) given to the mother who is breast feeding and/or to the infant during the breast feeding period. The aim is to reduce the transmission of the infection by reducing the viral load in

the breast milk and/or providing antiretroviral prophylaxis to infants to reduce sero-conversion (Gaillard et al. 2004).

1.4.10. Single-dose Nevirapine in reducing PPTCT

The HIVNET 0121 study conducted in Uganda in 2003 found that single-dose Nevirapine given to the mother and the new-born, combined with short duration breast feeding for six months could reduce HIV transmission to 16 per cent (Jackson et al., 2003). The SAINT2 study, which used single-dose Nevirapine to the mother and new-born combined with replacement feeding, reduced HIV transmission to 11 per cent (Moodley et al. 2003). “DITRAME plus”, which used AZT (Zidovudine and Retrovir) for a long duration from 28 weeks and single-dose Nevirapine to the mothers and infants combined with a short duration of breast feeding for six months, reduced transmission to 10 per cent (Leroy et al. 2002). The Thai PHPT3-2 study used AZT for a long duration from 28 weeks and single-dose Nevirapine to the mothers and infants combined with replacement feeding reduced HIV transmission to 2 per cent (Jourdain et al. 2004).

1.4.11. Continuing debates on infant feeding options in the face of HIV

As mentioned above, infant feeding options for HIV positive mothers have been governed by WHO guidelines. They offer women choices on infant feeding options according to their socio-economic conditions. According to them, formula feeding is recommended for HIV positive women who find the formula ‘acceptable, feasible, affordable, sustainable and safe’. This choice requires access to clean water, sanitation and clean home surrounding.

In contrast, where formula feeding is not ‘acceptable, feasible, affordable, sustainable and safe’, HIV infected women are encouraged to exclusively breast feed for the first six months of an infant’s life. The WHO’s statement on HIV and infant feeding underscores the initial dilemma and debate as to whether the HIV transmission resulting from breast feeding can be outweighed by the benefits of breast feeding and, therefore, morally justified.

1.5. Need for the Study

In view of the above literature, it is clear that breast milk remains the best and safest source of nutrition for a vast majority of infants worldwide (WHO 2006). However, there is continued concern that up to 20 per cent of infants born to HIV-positive mothers may acquire HIV through breast feeding, depending on the duration of breast feeding and exposure to other risk factors (DeCock et al. 2000; Gaillard et al. 2004). The study from Sub-Saharan Africa says that HIV prevalence is very high and where breast feeding is essential for child health and culturally normative, this fact represents one of the most serious public health dilemmas today and represents an obstacle for the promotion of breast feeding (Bland et al., 2002; de Paoli et al., 2002; Piwoz and Humphrey, 2005). WHO's guidelines recommend that HIV positive women should either breast feed exclusively their babies or use replacement feeding, and strongly discouraged mixed feeding (WHO, 2000). The latter has been found to increase the HIV transmission risk substantially more than exclusive breast feeding (Coovadia et al., 2007; Iliff et al., 2005; Coutoudious et al., 1999).

It is estimated that 27 million deliveries take place in India annually, and 97,200 of these occur in HIV positive pregnant women resulting in a yearly cohort of 21,000 HIV positive children (NACO, 2007). Breast feeding is culturally normative and it is one of the most serious public health dilemmas today. Until recently, there was no means of preventing Parent to Child Transmission for those HIV-positive women who wished to give birth. Though two interventions using antiretroviral (Nevirapine) are available to reduce the mother to child transmission, the successful implementation of the programme is highly dependent on the choice and effective implementation of an appropriate feeding regimen. To date there is no published data that examines knowledge, attitude of PPTCT and infant feeding choices of HIV positive mothers. Hence, it is important to understand the infant feeding choices of HIV positive mothers and their determinants.

This study is an attempt to understand the knowledge and attitude of HIV/AIDS and PPTCT and infant feeding methods and determinants among HIV positive women. It also explore the knowledge and attitude of infant feeding methods by health care providers and challenges involved in different infant feeding methods by HIV positive women. Its findings would be used to provide the appropriate choice of infant feeding practices to

prevent the parent to child transmission and improve the quality of PPTCT services and growth of the infants.

1.6. Research Questions:

1. What is the extent of knowledge of HIV/AIDS and PPTCT among HIV positive mothers in selected health facilities?
2. What is the knowledge about infant feeding methods among HIV positive mothers?
3. What is the attitude towards infant feeding among women with HIV infection?
4. What is the knowledge of feeding practices among health care providers in selected health facilities of Odisha?

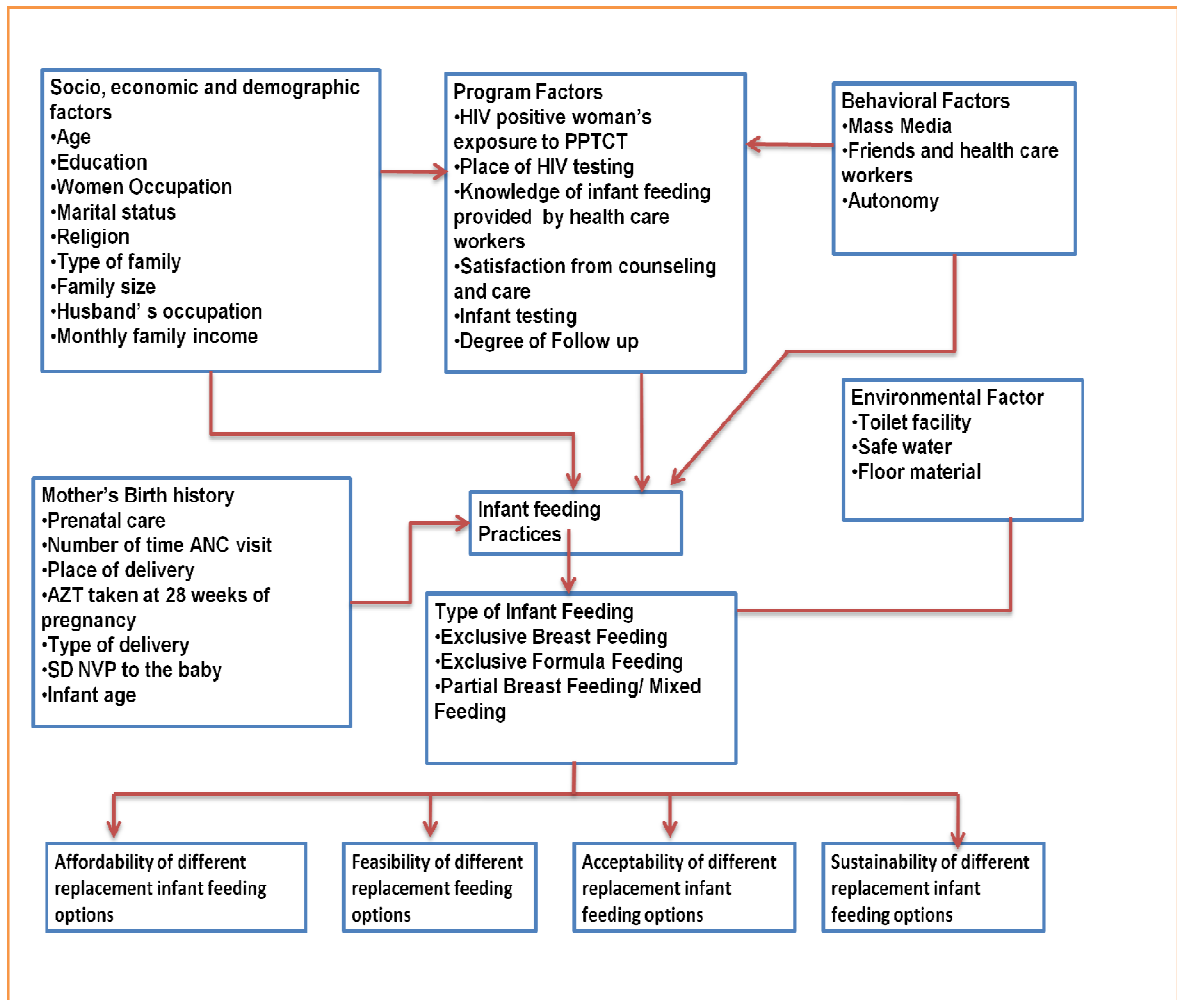
1.7. Objectives

- To examine the socio-economic, demographic and behavioural characteristics of HIV positive women.
- To assess the knowledge of HIV/AIDS and Prevention of Parent to Child Transmission among HIV positive pregnant women in selected health facilities.
- To measure the knowledge, attitude and perceptions of infant feeding and its relation to HIV transmission among HIV positive pregnant women and health care providers in selected health facilities.
- To assess the infant feeding practices and its associated factors determining the feeding practices among HIV positive women.

1.8. Conceptual Framework

Based on the information gathered from the study findings, we developed a conceptual framework (Figure 1.6) that demonstrated the interrelationships between the attributes that affect infant feeding practices among HIV positive women. These factors influence considerations of and the relative importance of affordability, feasibility, acceptability, and sustainability of feeding options recommended for HIV-Positive mothers and the decision by the mother to adopt a particular option or combination thereof.

Figure 1.6 Conceptual framework



1.9. Organisation of the Thesis

In addition to the present chapter **Introduction and review of literature**, the thesis has been organized into six chapters as presented below:

Chapter 2. Research Methodology: This chapter explains the methodological tools adopted in studying the infant feeding practices among HIV positive women in the selected health facilities of Odisha. The methodological details are discussed under some broad sections such as study design, selection of the districts and health facilities, selection samples, selection of HIV positive women, health care providers, data collection tools and techniques, research ethics, informed consent, duration of fieldwork, field experiences and challenges, measurement of scales and statistical methods applied for data analysis.

Chapter 3: Prevention of Parent to Child Transmission Programme (PPTCT) in India: This chapter presents counselling and testing programme, PPTCT programme, goals of National PPTCT programme, components of PPTCT programme, national guidelines for preventing parent to child transmission and infant feeding practices, PPTCT progress, etc. It explains the HIV/AIDS situation and discusses PPTCT services in Odisha, socio-economic, demographic and health profiles of selected districts.

Chapter 4: Demographic characteristics and knowledge about HIV/AIDS and PPTCT among HIV positive women: It presents the background characteristics of HIV positive women registered at the health facilities. It contains socio-economic, demographic and behavioural characteristics. Apart from profiles of HIV positive women, it examines the knowledge of HIV/AIDS and PPTCT among HIV positive women, prevention methods and disclosure of HIV positive status to spouses and in-laws.

Chapter 5: Knowledge, Attitude and Perception of Infant feeding methods among HIV Positive Mothers and Health Care Providers: It briefly examines the knowledge of infant feeding methods, attitude towards PPTCT and breast feeding and replacement feeding of HIV positive women with reference to prevention of parent to child transmission. We then discuss the health provider's knowledge on infant feeding methods and recommendation of feeding practices given by the health care providers.

Chapter 6: Infant Feeding Practices among HIV Positive Mothers: It deals with the intention of infant feeding practices, reasons for intended feeding practices and impact on intention of feeding practices intended by the HIV positive women. Further, it explores the challenges of different infant feeding practices opted by the HIV positive women.

Chapter 7: Summery, conclusion and policy implications: It presents the summary and conclusion of the study and attempts to provide relevant policy implications. It also concedes the limitations of the study as well as scope for future research on the similar issues.