

## Infant Feeding Choices Practiced among HIV Positive Mothers Attending a Prevention of Mother to Child Transmission (PMTCT) of HIV Program in Nnewi, Nigeria

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### Abstract

**Background:** The HIV epidemic has significantly altered the context within which women make decisions about how they will feed their infants. This study examined the antenatal infant feeding choices and actual infant feeding practices of HIV-positive mothers in order to assess adherence to the 2010 WHO national infant feeding guidelines in Nnewi, Nigeria.

**Methods:** The study was conducted between January 2012 and February 2013 at Nnamdi-Azikiwe University Teaching Hospital (NAUTH) in Nnewi-Anambra State, Nigeria. It was a prospective cohort study of HIV positive women attending the Prevention of Mother-To-Child Transmission (PMTCT) clinic in NAUTH. Women received HIV Counseling and Testing (HCT) from trained HIV positive women working in the hospital and from members of HIV support groups. The women made an informed decision on their infant feeding choice and received antiretroviral (ARV) treatment or prophylaxis (WHO option B) following WHO 2010 guidelines. Each mother-baby pair was followed up until the HIV sero-status of the baby was determined by DNA PCR (6-8weeks after cessation of breast-feeding).

**Results:** The overall HIV MTCT rate was 19 of 583 (3.3%; 95% confidence interval (CI): 2.0 - 5.0). Only 94 (16.1%; 95% CI: 13.2 - 19.4) mothers complied with the WHO 2010 recommendation of exclusive breastfeeding (EBF) and ARV treatment or prophylaxis. Overall, 431 (73.9%) mother-baby pairs received prophylactic ARV intervention; in 88 (15.1%) pairs, the baby or the mother received ARV; while in 64 (11.0%) pairs, neither mother nor baby received ARV. When the mother-baby pair received ARV, MTCT was 0.8%, 1.7% and 5.9% for Exclusive Formular Feeding (EFF), EBF and Mixed Feeding (MF), respectively. When either mother or baby received intervention, MTCT rates increased to 3.3%, 4.8% and 7.7% for EFF, EBF and MF, respectively. The rate of MTCT was further increased to 5.1%, 6.7% and 23.5% when neither mother nor baby received intervention for EFF, EBF and MF respectively.

**Conclusion:** EFF is still the infant feeding option preferred and practiced by majority of our HIV positive mothers despite the promotion of the safety of EBF with ARV interventions according to WHO 2010 guideline. It will take some time to change existing belief in EFF for us to achieve the required shift to EBF in our practice area. We also demonstrated that ARV treatment/chemoprophylaxis for both mother and baby is an important measure for achieving the reduction of MTCT of HIV in breastfeeding setting mixed feeding practice is associated with an increased rate of MTCT and should be strongly discouraged. Increasing the uptake of ARV treatment/chemoprophylaxis and ensuring appropriate counseling about infant feeding practices have the potential to markedly decrease the rate of MTCT of HIV in developing countries.

**Keywords:** Infant feeding; HIV+ mothers; Mother to child transmission; Antiretroviral treatment; Chemoprophylaxis; WHO guidelines 2010

### Background

The HIV epidemic has significantly altered the context within which women make decisions about how they will feed their infants.

This is especially true for sub-Saharan Africa where the HIV/AIDS epidemic is most severe. Safe infant feeding is one of the most complex aspects of mother to child transmission (MTCT) prevention in most developing countries affected by HIV/AIDS [1].

The promotion of breastfeeding is a key component of infant health polices worldwide because of its obvious health benefits [2]. It is widely practiced not only in Nigeria, but most of Africa, as it is socially and culturally acceptable [3]. However, in the present context of the

HIV epidemic, this has become a public health dilemma as the overwhelming cause of HIV infection in young children is through MTCT [4-7]. There is also the dilemma of infant feeding decisions faced by HIV sero-positive mothers, because most breast milk transmission of HIV occur in the first four months of life, a time when replacement feeding carries the greatest risk of increasing infectious disease morbidity while the benefits of breastfeeding are highest [8-10].

In developing countries, decisions regarding the best mode of infant feeding can be additionally complicated due to social, economic and financial constraints. The relative risks of morbidity and mortality associated with replacement feeding vary according to many factors including the environment, individual circumstances of the mother and her family and in particular her education and economic status [4,11,12]. The availability of short course anti-retroviral (ARV) drugs through the Prevention of Mother to Child Transmission (PMTCT) program has been shown to increase the potential for prevention of HIV transmission in pregnancy, during labor and delivery [13,14]. However, referring MTCT through low risk infant feeding choices and practices by HIV-positive mothers still remains a challenge, especially in settings where breastfeeding is the socially expected norm, and where universal coverage of Highly Active Antiretroviral Therapy (HAART) for pregnant women is still unavailable [15]. The present study examined the antenatal infant feeding choices and actual infant feeding practices of HIV-positive mothers attending PMTCT program in the NnamdiAzikiwe University Teaching Hospital, Nnewi-Anambra state, Nigeria. The study aimed to estimate the percentage of HIV-positive women who adhered to the 2010 WHO national infant feeding guidelines for developing countries as adopted by Nigeria which suggests exclusive breastfeeding with antiretroviral interventions [16]. Nigeria has adopted the WHO guideline and this study is coming at this transition period from mother receiving informed infant feeding choice to mothers being encouraged to breastfeed with antiretroviral intervention according to Nigeria National guideline 2010 [3]. The study also aimed to determine the rates of mother to child transmission of HIV infection when both mother and baby received any form of pharmacological ARV interventions within the infant feeding practice of the mother.

## Research Methodology

### Study design

This study used an analytical prospective cohort design to estimate the risk of HIV infection associated with the infant feeding choices practiced by HIV-positive mothers in Nnewi-Anambra, Nigeria.

### Setting

Nnamdi-Azikiwe University Teaching Hospital was among the first eleven tertiary institutions the Government of Nigeria (GON) approved for the PMTCT program in 2003. The hospital was declared baby friendly by the government of Nigeria in 2001. Nnewi-Anambra state has a relatively high HIV prevalence of 8.7% compared with the national prevalence of 4.6% [17].

### Ethics

The ethics committee of Nnamdi-Azikiwe University teaching hospital gave ethical approval for the study. The participants gave an informed consent to join the study.

### Study population

They include pregnant women living in Nnewi-Anambra who tested positive to HIV rapid screening test (performed by serial algorithm methods) after undergoing HIV Counseling. The women were counseled on infant feeding options at their first and subsequent antenatal clinic visits. Their informed choice of infant feeding, either exclusive formula feeding (EFF) or exclusive breastfeeding (EBF), after delivery was recorded. Participating HIV-positive mothers attended the infant follow-up clinic in the NnamdiAzikiwe University teaching hospital in Nnewi-Anambra state. Participating mothers were asked to bring their baby at 6 weeks to 18 months postpartum for DNA PCR testing. Pregnant HIV-negative women, women with stillbirth or miscarriage and premature babies as well as HIV-exposed babies who were less than 6 weeks or above two months of age for DNA PCR testing were excluded.

### Recruitment of participants

Recruitment, counseling and follow-up of participants was handled by the first and third authors and eight women trained in HIV Testing and Counseling and in the WHO 2010 infant feeding guidelines. The eight women were made up of four mentor mothers working in the HIV clinic of the hospital, three selected members of a HIV support group ("Help the Living" support group Nnewi) and one research assistant.

HCT was given to all pregnant women who attended the antenatal clinic for the first time during that pregnancy. After pre-test counseling, the women were tested for HIV using a serial algorithm by the opt out approach. Results were delivered immediately after a post-test counseling. Women who tested positive to the HIV-1 antibodies were invited to enroll into the study. Information about the prevention of mother to child transmission of HIV infection was provided to all women. Antenatal recruitment lasted from January 2012 to December 2012 and all recruited pregnant women had delivered by February 2013 completing the mother-baby pair.

### Treatment and prophylaxis

Highly Active Antiretroviral Therapy (HAART) was provided according to WHO 2010 revised PMTCT guidelines: (a) Lifelong ART for HIV-positive women if CD4 count is less than 350 cells/mm<sup>3</sup>. In this case women need ARV treatment for their own health, which is also considered safe and effective in reducing MTCT; (b) Short-term ARV prophylaxis (WHO option B) for HIV-positive women if CD4 count is above 350 cells/mm<sup>3</sup>. In this case ARV is mainly given to prevent MTCT during pregnancy, delivery and breastfeeding [18].

### Infant feeding practices

During the counseling session, women were educated on different infant feeding choices (exclusive breast feeding and exclusive formula feeding) and associated benefits and risks. Recommended feeding practices were: (a) Exclusive Breast Feeding (EBF) for 6 months with antiretroviral intervention or (b) Exclusive Formula Feeding (EFF) if Acceptable, Feasible, Affordable, Sustainable, and Safe [16]. During HCT, participants had to make their infant feeding choice, which was recorded as their antenatal feeding choice. Though Nigeria has adopted the WHO 2010 guideline, HIV positive women were actively encouraged but not forced to breast feed as in recommendation (a) above.

## Testing babies for HIV

Babies born to participating HIV-positive mothers were tested to determine their HIV sero-status according to the feeding practices: twice for those who were fed exclusive by breast feeding and once for formula feeding babies. The first test was scheduled between 6 weeks and two months of age, and the second test was scheduled 6 to 8 weeks after the cessation of breast-feeding for the babies whose first PCR test was negative. Blood samples were collected on Whatman's paper number 903 called Dried Blood Spots (DBS) and were tested using Deoxyribonucleic Acid (DNA) Polymerase Chain Reaction (PCR) technology. The exit PCR test was used to calculate the transmission rate i.e. the second test where a repeat test was done after weaning or the first where only one test was done.

## Follow-up procedures

Follow-up of mother baby pairs was handled by four women in the hospital –one woman each in the labor ward and lying-in ward and two women in the pediatric HIV clinic. Two trained women living with HIV/AIDS were responsible for home follow-up visits. Women, who wanted to be followed-up at home, provided their contact details and phone numbers for home visits.

For women who delivered in the hospital labor ward to a live baby, their follow-up started when they were transferred to the lying-in ward. Women were observed and asked about their actual infant feeding practice that was compared to their antenatal clinic feeding choice. Women who delivered in other hospitals and women who did not want to be visited at home were followed-up at the postnatal clinic six weeks after delivery.

The follow-up of mother-baby pairs continued at the pediatric HIV clinic of the hospital where blood samples were collected for Early Infant Diagnosis (EID). At these visits mothers were again asked about their actual infant feeding practice and this information was recorded in the National EID register. In addition, information about mothers and babies' ARV treatment and Cotrimoxazole prophylaxis was recorded.

At each postnatal visit either in the hospital or at home, adherence to HAART (pill count and questions) and the feeding practice including AFASS were assessed by the adherence counselors. Infants that were breast-fed and who also received any liquid or solids even for once only (with the exception of drugs), were considered as being mixed fed (MF), following the WHO definition [19]. Also infants on formula feeding who received breast milk were regarded as MF.

Follow-up of mother-baby pair was completed as soon as the HIV sero-status of the baby was determined by DNA PCR. Some mothers coming from far away villages were given about 2 US dollars to cover their transportation expenses as a gesture of appreciation for attending follow-up visits at the hospital.

## Data collection

The following information was entered into a Microsoft Excel spreadsheet designed for the study. (a) At the antenatal clinic PMTCT contact with the HIV-positive women: demographics, the hypothetical infant feeding choice, expected date of delivery and information on whether mother-baby pair received ARV intervention or not for treatment and prophylaxis depending on WHO clinical and immunological staging. (2) At the labor ward: HIV rapid test results, ARV drugs given to mother and baby within 72 hours and thereafter.

(c) In the lying-in ward: actual feeding practices and compliance with medication. The DNA PCR result for the infant, ARV treatment and prophylaxis of mother & baby pairs were recorded. Data was entered by the research assistant under the supervision of the first author (KSO.).

## Data analysis

Data were exported to SPSS 17.0 (IBM SPSS, Chicago, Illinois, USA) for data management and statistical analysis. The DNA PCR result for the baby was the main outcome variable. For data analysis, mother-baby pairs were initially classified according to the infant feeding choice provided at the antenatal clinic PMTCT program into EBF and EFF. However, mother-baby pairs were reclassified into three groups according to the information about infant feeding practice collected during follow-up: EBF, EFF and mixed feeding (MF).

HIV transmission rates were calculated as the number of HIV-infected infants divided by the number of mother-baby pairs in each feeding group and was presented together with 95%-confidence intervals (95%-CI). HIV transmission rates were compared between the infant feeding groups using Fisher's exact tests. All statistical tests were two sided and p-values less than 0.05 were considered statistically significant.

## Results

A total of 598 HIV-positive women were recruited during the study period. Overall, 15 (2.5%) women were lost to follow-up leaving 583 mother & baby pairs in the study; four women were transferred to another clinic, four women withdrew before delivery, and seven women withdrew during follow-up.

The overall MTCT rate of HIV was 19 of 583 (3.3%; 95% CI: 2.0-5.0). Of the 583 babies in the study, 289 (49.6%) were females. The MTCT rate was slightly but not significantly higher among female baby girls 11 of 289 (3.8%; 95% CI: 1.9- 6.7) compared with male baby boys 8 of 294 (2.7%; 95%, CI: 1.2 -5.3; p=0.493).

The majority of the women (459 of 583; 78.7%) chose to practice EFF (Table 1). Of these 459 who had chosen EFF antenatally, 33 practised mixed feeding while 30 mothers who chose to exclusively breastfeed their babies practised mixed feeding.

		Antenatal feeding choice		
Postnatal practice	feeding	Exclusive formula feeding	Exclusive breast feeding	Total
Exclusive formula feeding		426 (92.8%)	0	426 (73.1%)
Exclusive breastfeeding		0	94 (75.85)	94 (16.1%)
Mixed feeding		33 (7.2%)	30(24.25)	63 (10.8%)
Total		459 (78.7%)	124 (21.3%)	583

**Table 1:** Antenatal hypothetical feeding choices and postnatal actual feeding practices of 583 HIV-positive women in Nnewi, Nigeria

Overall, 431 of the 583 (73.9%) mother-baby pairs received pharmacological intervention, ARV treatment/chemoprophylaxis to decrease the rate of MTCT of HIV. Eighty-eight (15.1%) babies or

mothers received at least one ARV treatment/chemoprophylaxis and for 64 pairs (11.0%) neither mother nor baby received any form of ARV intervention. Only 94 of the 583 women (16.1%; 95% CI: 13.2-19.4) complied with the WHO 2010 safe infant feeding guidelines for developing countries (exclusive breastfeeding with ARV treatment/chemoprophylaxis).

A majority of the participants (357; 61.2%) had the HIV sero-status of their babies assessed between 6 weeks and 2 months of age of their baby (Table 2). HIV incidence in babies increased with their age at testing from 1.7% in 6 weeks to 2 months old babies to 6.1% in babies older than 6 months.

Age of baby	No screened	No positive	HIV incidence
6 weeks to 2 months	357	6	1.7%
>2 months to 6 months	94	5	5.3%
>6 months	132	8	6.1%
<b>Total</b>	<b>583</b>	<b>19</b>	<b>3.3%</b>

**Table 2:** Age of baby when assessing PCR test and MTC HIV transmission rate

There were strong and consistent dose-response relationships between ART intervention and HIV incidence in babies as well as between feeding practices and HIV incidence (Table 3). Mixed feeding showed the highest mother to child HIV transmission rate of 15.9% (95% CI=7.9-27.3) of the three different feeding practices, while the lack of ART intervention showed the highest transmission rate of 12.5% (95% CI: 6.4-21.3) compared to if at least one or both member of the mother – baby pair had received ART. The MTC HIV transmission rate was highest for the 34 mother-baby pairs with mixed feeding practices and no ART intervention with 23.5% (95% CI: 10.8-41.2) (Table 3).

Actual infant feeding choice	Absolute (relative) HIV incidence			
	Mother and baby both received ART	Only one member of the mother - baby pair received ART	No member of the mother-baby pair received ART	HIV incidence per feeding choice
<b>Exclusive formula feeding (n=426)</b>	3/357 (0.8%)	1/30 (3.3%)	2/39 (5.1%)	6/426 (1.4%)
<b>Exclusive breast feeding (n=94)</b>	1/58 (1.7%)	1/21 (4.8%)	1/15 (6.7%)	3/94 (3.2%)
<b>Mixed feeding (n=63)</b>	1/16 (6.3%)	1/13 (7.7%)	8/34 (23.5%)	10/63 (15.9%)
<b>HIV incidence per ART</b>	5/431 (1.2%)	3/64 (4.7%)	11/88 (12.5%)	19/583 (3.3%)

**Table 3:** HIV incidence in babies caused by mother to child transmission (MTCT) by infant feeding type, with and without anti-retroviral (ART) intervention as observed in Nnewi, Nigeria.

## Discussion

This is a pioneer study to determine the infant feeding choices practiced by HIV positive mothers in our setting after the adoption of the WHO 2010 infant feeding guideline. It is also unique in that mothers were counseled using HIV positive mothers (mentor mothers) as peer counselors on infant feeding.

Our results show that the commonest infant feeding practice among HIV positive mothers in Nnewi is exclusive formula feeding. The reason for this choice could be attributed to the previous success achieved in reduction of MTCT using HAART and exclusive formula feeding (2.8% vs. 12.5% for those on EBF) before the WHO 2010 feeding guideline was recommended to the mothers who attend PMTCT program in our setting [14]. Our findings in this study are in agreement with the report of Becquet et al. [19] and Coutsoudis et al. [20], in Cote d'Ivoire and KwaZulu-Natal respectively, that exclusive breastfeeding is rare but disagrees with their observation that mixed feeding was the common practice among HIV positive mothers. Our findings also differ from the findings of ChukwuemekaAnoje et al. [21] from southern Nigeria who reported 80% exclusive breast-feeding and Torpey et al. [22] in Zambia who reported 84% of babies receiving breast milk.

The reason for switching from one infant feeding choice to another was not investigated in this study. However, social (stigma and discrimination), environmental, and mainly unforeseen economic constraints on parents affording replacement feeding since it is no longer provided free by the Government of Nigeria may have contributed.

Of the 583 mother-baby pairs studied, 194 (21.3%) made the choice during antenatal care but only 94 (16.1%) complied in practice with the WHO guidelines on HIV and infant feeding recommendation [15].

Overall, 431 (73.9%) babies received pharmacological intervention - ARV treatment/chemoprophylaxis-to decrease the rate of MTCT of HIV. This percentage was quite encouraging. A majority of 61.2% of babies was tested at 6 to 8 weeks in accordance with the national PMTCT guidelines of Nigeria which stipulates that the first DNA PCR test should be In our study, of the 94 babies that were exclusively breastfed, 3 (3.2%) tested positive with the HIV-1 DNA PCR test. The transmission rate of about 2% for babies who were exclusively breastfed and mother-baby pair received ARV treatment / chemoprophylaxis is comparatively similar to the results seen in Mother to Child Transmission of HIV in developed countries [24-28]. The overall rate of MTCT of HIV among babies who were mixed fed was the highest in this study (15.9%) and in other studies [24]. The rate of MTCT decreased to 6.3% and 7.7%, respectively when both mother and baby, or when either mother or baby received ARV treatment/prophylaxis. Expectedly, the group of mixed fed children with neither mother nor baby receiving any pharmacological intervention had the highest HIV incidence in our study. Mixed feeding is not an infant feeding option and caregivers should counsel mothers effectively to avoid this practice considering its high MTCT rate The rate of MTCT of HIV in our study showed that exclusive formula feeding was associated with low transmission rate (1.4%) compared with exclusive breastfeeding (3.2%) while mixed feeding (15.9%) showed highest risk of MTCT of HIV, overall and within each treatment group.

On the other hand, the results of this study indicate as well that antiretroviral intervention (treatments/chemoprophylaxis) decreased



the risk of HIV transmission overall and within each infant feeding practice group.

### Limitations

HIV DNA PCR test was not performed for babies at birth (within 48 hours after delivery) to ascertain those who were infected in utero because the national testing algorithm did not state testing at birth. Also transmissions due to breastfeeding (BF) alone using the first and second (after cessation of BF) PCR test was not analyzed in this study.

ARV intervention for the mothers was HAART (ZDV/3TC/NVP or EFV or TDF/3TC/EFV or second line drugs), but we did not document the specific mothers' ARV regimen/level of adherence/CD4 counts in this study. We also consider as a limitation the grouping together of either mother or baby received ARV intervention. This should have been reported as separate groups.

Fifteen of the initial 598 (2.5%) mother-baby pairs were lost to follow-up. The study did not assess the factors that influenced mothers feeding intent because this was not a main research question. We relied on participating mothers telling us their feeding practices. However, participants may move from one feeding practice to another as a result of economic, social, or other constraints without admitting it to please the health workers. On the other hand, the use of women living with HIV/AIDS as peer-mentors counseling and interviewing participating women about their infant feeding choices and other information during ANC/PMTCT and postnatal clinics hopefully reduced stigma and may have helped limiting this information bias.

### Conclusion

EFF is still the infant feeding option preferred and practiced by majority of our HIV positive mothers despite the promotion of the safety of EBF with ARV interventions according to WHO 2010 guideline. It will take some time to change existing belief in the use of EFF to prevent MTCT of HIV for us to achieve the required shift to EBF in our practice area. We also demonstrated that ARV treatment/chemoprophylaxis for both mother and baby is an important measure for achieving the reduction of MTCT of HIV in breastfeeding setting. Mixed feeding practice is associated with an increased rate of MTCT and should be strongly discouraged.

Increasing the uptake of ARV treatment/chemoprophylaxis and ensuring appropriate counseling about infant feeding practices have the potential to markedly decrease the rate of MTCT of HIV in developing countries.

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