Review Article

Prevention of Mother to Child Transmission of Human Immunodeficiency Virus: The Nigerian Perspective

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Abstract

Despite the proven effectiveness of the prevention of mother to child transmission (PMTCT) of human immunodeficiency virus (HIV) program, Nigeria currently has the highest burden of vertical transmission of HIV in the world due to poor coverage of the PMTCT program partly as a result of poor knowledge of PMTCT interventions amongst healthcare providers in the country. This paper aims at making information on PMTCT interventions more readily available to healthcare providers in developing countries. The internet was searched using Google and Google scholar. In addition, relevant electronic journals from the Universities library including PubMed and Scirus, Medline, Cochrane library, and World Health Organization (WHO)'s Hinari were used. There was paucity of published work on PMCT from Nigeria. Most of the information concerning PMCT in Nigeria was obtained from technical reports from the Federal Ministry of Health and WHO. It is expected that this article will help in improving healthcare providers' knowledge of PMTCT interventions and thus help in the urgently needed rapid scale-up of PMTCT services in Nigeria.

Keywords: PMTCT, Healthcare providers, Rapid scale-up

Introduction

The discovery of human immunodeficiency virus (HIV) infection in 1981 and its subsequent emergence as a leading global epidemic are well documented.[1-3]

HIV is transmitted from an infected person to an uninfected person by two major modes, namely, horizontal transmission and vertical transmission (or mother to child transmission (MTCT)).[4-6]

Horizontal transmission refers to transmission between two individuals who exist separately. It covers the commonly known routes of transmission in the adult such as through unprotected sex with an infected person, transfusion with infected blood and blood products, sharing of contaminated needles and other contaminated instruments, among others. This mode accounts for 90% of all HIV infections and is the sole mode of infection in the adults.

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Vertical (or mother to child) transmission refers to the situation where an infant of an HIV-infected mother acquires the HIV infection from the mother at one or more of the following stages: Transplacentally in the uterus during pregnancy, perinatally during the process of labor and delivery, and postnatally during breastfeeding.[7-13]

Prevention of mother to child transmission (PMTCT) of HIV is a global interventional program initiated by the United Nations Organization to protect the children of the world from the scourge of the HIV pandemic.[14] A historical review of the PMTCT program was done. This was followed by a detailed update of the PMTCT interventions in Nigeria, including information on the management of pregnancy, labor and delivery, as well as the care of the mother–infant pair in the postpartum period, and appropriate infant feeding practices in the context of HIV infection. In this review, the magnitude of MTCT, and strategies, outcome, and challenges for prevention are discussed.

Review Methods

In this review, strategies used for locating materials include searching the internet using databases like Google and Google scholar. In addition, relevant electronic journals from the Universities library including PubMed and Scirus, Medline, Cochrane library, and WHO's Hinari were used. Relevant

key words included PMCT, HIV in pregnancy, vertical transmission of HIV, and mother to child transmission, among others.

Magnitude of MTCT of HIV

Mother to child transmission (MTCT) accounts for 90% of HIV infections in children under the age of 15 years.[15-18] By the end of 2006, an estimated 4 million children were living with HIV.[19-22] The sub-Saharan Africa is home to 90% of the children of the world living with HIV.[19-22] MTCT of HIV, therefore, seriously threatens to reverse the recent gains of child survival strategies in Africans unless the children are aggressively protected from HIV infection.[22] Nigeria, with a population of about 140 million people and national HIV seroprevalence rate of 4.1%,[23] is the country with the second highest HIV burden in the world after South Africa.[24] However, with an annual HIV-positive births of 56,681 in 2008,[25] Nigeria contributed 15.3% of the 370,000 global new pediatric HIV infections[24] and is thus the country with the largest number of unprevented childhood HIV infection in 2009.[24] Only about 11% of the HIV-infected pregnant women are currently reached with PMTCT interventions in Nigeria.[26] Enugu state has an HIV seroprevalence rate of 5.1%.[23] Only about 14% of deliveries take place under skilled health attendants (excluding deliveries at the University of Nigeria Teaching Hospital and ESUT Teaching Hospital) in Enugu state[27] and only two public health facilities in the state, namely, University of Nigeria Teaching Hospital and Enugu State University Teaching Hospital Park Lane, provide comprehensive PMTCT services. It is, therefore, evident that the unmet need for PMTCT services in Nigeria, particularly in Enugu state, is unacceptably high. To achieve HIV-free future generations, every healthcare provider should be knowledgeable about PMTCT interventions, hence this review was conducted.

Goal of PMTCT

The United Nations General Assembly Special Session (UNGASS) on HIV/AIDS held in June 2001,[14,15] among other decisions, identified PMTCT as a priority need and also set the specific goal of the program "to reduce the proportion of infants infected with HIV by 20% by 2005 and by 50% by 2010." The Federal Government of Nigeria has since adopted the UNGASS goal and also added another important goal, namely, "to increase universal access to quality voluntary counseling and testing (VCT) by 50% by 2010."[19-22] A scale-up plan to raise these goals to 80% by 2015 has been completed by the Federal Ministry of Health (in press).

Strategies for PMTCT

In addition to setting the goal of PMTCT, the UNGASS in 2001 also formulated four strategies for PMTCT, as follows:

- Prevention of primary infection in men and women of reproductive age.
- Prevention of unintended pregnancy in HIV-infected women.
- Prevention of MTCT of HIV from HIV-infected pregnant women to their infants during pregnancy, delivery, and breastfeeding.
- Care and support services to the HIV-infected women and members of the families.[14-16]

Prevention of primary infection in men and women of reproductive age

If all men and women of reproductive age were HIV negative, the rate of MTCT would be zero. Therefore, prevention of primary HIV infection among men and women of reproductive age is the most effective strategy to prevent MTCT of HIV. Primary prevention is achieved by creating public awareness and knowledge on HIV, including the personal, family, and community consequences of its acquisition, and its routes of transmission and methods of prevention. Safer sex practices, avoidance of needle sharing, safer blood transfusion practices, and avoidance of unsterile instruments are some of the expected behavioral changes needed to achieve primary prevention of HIV infection.[19-22] The ABC model of safer sex practices can be replicated for other risk behaviors for HIV infection:

A = abstinence, i.e. total avoidance of the risk behaviors (risk elimination);
B = be faithful, i.e. mutual, non-serial monogamous faithfulness to uninfected partner (risk reduction); and
C = correct and consistent use of condom with HIV-infected partners and persons of unknown HIV serostatus (risk reduction and harm reduction).[22,28]

Prevention of unintended pregnancy in HIV-infected women

To reduce the risk of MTCT of HIV, every pregnancy in an HIV-infected woman should be a planned pregnancy.

Vertical transmission of HIV is minimal at a viral load of less than 1000 copies/ml.[29] There is currently no viral load level at which HIV transmission is known to be completely absent.[29] It would be reasonable and desirable for HIV-infected women who desire to get pregnant to first reduce their HIV viral load to a level below 1000 copies/ml before embarking on pregnancy.[29,30] Where only the male partner is infected with HIV, various semen preparations and other assisted reproduction techniques are now available to achieve pregnancy without infecting the woman, and hence vertical transmission to the infant can be avoided.[30-32]

This is the usual practice in the advanced countries.[30-32] Unfortunately, most HIV-infected people in our environment do not know that they are infected, and so do not appreciate the risk of HIV infection to their infants if they become pregnant. Therefore, the first step in preventing unintended pregnancy in HIV-infected women is universal access to testing and

counseling, leading to individual HIV status identification. The second step is effective contraception. Condom offers double protection (against pregnancy and HIV) and is recommended for concordant and discordant HIV-positive couples.[19-22] Condom can be used concurrently with a more effective contraceptive method.[33,34] This is referred to as "dual method."

Prevention of MTCT in HIV-infected pregnant women

Without any intervention, the infant of an HIV-infected pregnant woman has 25–45% risk of HIV infection during pregnancy, delivery, and breastfeeding.[35-38] In the absence of breastfeeding, intrauterine (transplacental) infection and peripartum infection account for 25–40% and 60–75%, respectively, of vertical infection. Breastfeeding carries an 8–25% risk of vertical transmission in the developing countries.[38,39]

Specific PMTCT Interventions During Pregnancy

Antiretroviral drugs

Every antiretroviral drug (ARV) regimen for PMTCT, including the single-dose Nevirapine, offers significant protection against MTCT of HIV.[40-43] The drug combination regimens are more efficacious than the monotherapy regimens.[15,44] For treatment-naïve individuals, ARV prophylaxis for PMTCT (as against ART for the mother's health) is usually avoided in the first trimester of pregnancy.[29,45] Treatment interruption is discouraged in those who were on treatment prior to pregnancy, although some modifications in the drug components might become necessary.[15,29,46,47] At birth, the infant of an HIV-infected woman is given a single dose of Nevirapine within the first 72 hours of delivery. The revised National PMTCT Guidelines[26] recommend daily Nevirapine for the first 6 weeks of life starting as soon as possible after birth, preferably within 72 hours of birth. The use of Zidovudine for the HIV-exposed infants is no longer recommended.

ARVs and adverse drug reactions

The ARVs are potentially toxic substances. The greatest challenge in the development and use of the ARVs is to find the optimal balance between effectiveness and safety. Finding such a balance is especially challenging during pregnancy because of the fear of teratogenicity.

Zidovudine is currently the ARV with the longest history of effectiveness and safety during pregnancy.[29] But it is associated with anemia and should be avoided in women with a hemoglobin level of 8 mg/dl or less.[26]

Nevirapine is the ARV that has been most widely used in the developing countries for PMTCT as the "single-dose Nevirapine" regimen.[29] It is safe and effective but has been associated with lethal hepatotoxicity, rashes (including Steven–Johnson-like syndrome) and lactic acidosis, especially when administered to a person with high CD4 cell count.[29] It should be avoided when the CD4 cell count is greater than 350 cells/mm^3.[26] Efevernz is an alternative ARV to Nevirapine but has been associated with embryopathy in experimental animals.[29] Although the risk of embryopathy in man is less than 1%, it is avoided in the first trimester of pregnancy.[26]

Stavudine and Didonisine are associated with lactic acidosis.[26] They are not recommended during pregnancy.[26]

The Protease Inhibitors (PIs) are effective ARVs. They are associated with muscular dystrophies.[29]

Most ARVs are metabolized in the liver and excreted by the kidneys. Liver function test, renal function test, hemoglobin estimation, and lipid profile are some of the necessary investigations prior to the commencement of ARVs as well as periodically during the course of the treatment.[29] Together with periodic CD4 cell and viral load estimations as well as clinical evaluations, these investigations are used to monitor the safety and effectiveness of the ARVs.[26]

Antiretroviral treatment (ART) and prophylaxis regimens for PMTCT in different clinical settings

The use of ARV during pregnancy varies according to the peculiar clinical scenario of the client. The use of ARVs for the HIV-infected pregnant women and their HIV-exposed infants is reproduced here from the relevant sections of the revised PMTCT National Guidelines.[26]

Because all babies born to HIV-infected mothers are exposed to HIV infection, they are administered post-exposure ARV prophylaxis as follows:

- single-dose NVP – as soon as possible after birth, preferably within 72 hours plus
- daily Nevirapine for 6 weeks.

In November 2009, the World Health Organization (WHO), through the "Rapid advice on the use of ARV for treating pregnant women and preventing HIV infection in the infants"[48] and the "HIV and infant feeding: Revised principles and recommendations a rapid advice"[49] recommended changes in the regimens of ARV use during pregnancy and the breastfeeding period as well as in the feeding of HIV-exposed infants. These recommendations have been incorporated into the revised National PMTCT Guidelines. The following are the ARV prophylaxis and treatment regimens for HIV-infected women and their infants according to the revised National PMTCT Guidelines:[26]

Recommendations for the use of ARVs in different clinical settings

Clinical Setting I

Recommendations for pregnant HIV-seropositive women who meet the WHO criteria for ART are as follows:

Pregnant woman who is ART eligible, but not currently on ART.

Mother:
- Initiate ART as soon as the eligibility criteria are met irrespective of gestational age
- Include ZDV in the regimen whenever possible

The ART eligibility criteria are:
- CD4 count ≤350 cells/mm^3 regardless of WHO clinical stage
- WHO clinical stage III and IV regardless of CD4 count

Preferred regimen:
- AZT + 3TC + (NVP or EFV**)

Alternative regimen:

For hepatitis B co-infection
- TDF + (3TC or FTC) + (NVP++ or EFV**)
- Closely monitor for hepatotoxicity and systemic toxicity, especially in women on NVP-based regimen

Previous clinical or virologic failure on NNRTI-containing regimen
- PI* + 2 NRTIs
- ZDV + 3TC + Abacavir
- ZDV + 3TC + Tenofovir

*Avoid ZDV if hemoglobin is ≤8 g/dl or PCV is ≤24%

**EFV based regimen should not be used in the first trimester. Women on EFV based combination should be counseled and offered effective contraception after delivery to avoid conception while on EFV. EFV use in early pregnancy is associated with congenital malformations [potential risk (probably less than 1%) for neural tube defect with EFV use in the first month of pregnancy]

***Women commenced on ART – ZDV, 3TC, and NVP and found to react to NVP in the first trimester of pregnancy: Stop NVP and replace with PI

Previous single-dose Nevirapine:
- NVP stopped <6 months PI* + 2 NRTIs
- NVP stopped ≥6 months
- NVP + 2NRTIs (follow CD4 guidelines given above and monitor closely for virologic failure with alpha response+)

EFV + 2 NRTIs (second and third trimesters and monitor closely for virologic failure with alpha response+)
- ZDV + 3TC + Abacavir
- ZDV + 3TC + Tenofovir

Infant:
- All infants should receive daily NVP, preferably within 72 hours of birth to 6 weeks of age

Dose:
- Birth weight <2500 g: NVP 10 mg (1 ml) daily
- Birth weight ≥2500 g: NVP 15 mg (1.5 ml) daily

This is irrespective of infant feeding practice

++When NVP is used in women with CD4 count between 250 and ≤350, caution should be exercised

***Please include: Lopinavir/r, Saquinavir/r, Nelfinavir, Indinavir/r

+Alpha response – Check viral load about 1 month after starting treatment. A viral load drop that is ≥1.0 $\log_{10}$ suggests that the treatment is very likely to succeed

Clinical Setting II

Recommendations for pregnant HIV-seropositive women who do not meet the criteria for ART are as follows:

Pregnant woman not eligible for ART for her own disease

- For facilities with capacity (on-site or by linkage) to provide and monitor Triple ARV medication:
- Triple ARV prophylaxis is the preferred regimen

ARV prophylaxis should be started from 14 weeks gestation or as soon as possible when the woman presents later in pregnancy, in labor or at delivery. Any of the following Triple ARV combinations is recommended:
- AZT + 3TC + LPV/r
- AZT + 3TC + EFV
- AZT + 3TC (or FTC) + EFV
- AZT + 3TC + ABC
- TDF + 3TC (or FTC) + EFV

Note:
- Nevirapine is avoided in women with CD4 count >350

ARV prophylaxis and infant feeding practice:
- All infants should be given daily Nevirapine from birth to 6 weeks of age
- In mothers who decide to breastfeed, this prophylactic ARV combination for the mother is continued until 1 week after cessation of breastfeeding
- In mothers who decide not to breastfeed, ARV prophylaxis for the mother is stopped 1 week after delivery, but the infant should continue daily NVP for 6 weeks

Clinical Setting III

Recommendations for pregnant HIV-seropositive women on ART are as follows:

Mother on ART at the time of current pregnancy	Mother: • IHIV-infected women on ART who become pregnant should continue with the therapy *Zidovudine should be a component of the regimen whenever possible [avoid if hemoglobin is ≤8 g/dl or PCV is ≤24%; in this case, use TDF + (3TC or FTC) + NVP as applicable] *Efavirenz is contraindicated in the first trimester and should be replaced with NVP Infant: • All infants should receive daily NVP, preferably within 72 hours of birth to 6 weeks of age Dose: • Birth weight <2500 g: NVP 10 mg (1 ml) daily • Birth weight ≥2500 g: NVP 15 mg (1.5 ml) daily This is irrespective of infant feeding practice

Clinical Setting IV

Recommendations for HIV-seropositive women who are diagnosed or seen for the first time in labor are as follows:

HIV-infected mother who presents in labor	1. For facilities with capacity (on-site or by linkage) to provide and monitor Triple ARV medication: Mother: Triple ARV prophylaxis commencing during labor and continuing until 1 week after cessation of breastfeeding For details of regimen, see Clinical Setting II Clinical assessment for WHO staging of maternal disease (Table 3.2) and determination of maternal CD4 count should be done as soon as practicable after birth Infant: • Give daily NVP from birth to 6 weeks of age Dose: • Birth weight <2500 g: NVP 10 mg (1 ml) daily • Birth weight ≥2500 g: NVP 15 mg (1.5 ml) daily 2. For facilities with limited capacity (on-site or by linkage) to provide and monitor Triple ARV medication: Mother • Intrapartum • Sd NVP • ZDV + 3TC 12 hourly as soon as diagnosis is made in labor • Postpartum: ZDV + 3TC 12 hourly for 1 week after delivery • Determine if mother is eligible (within 5 days of delivery) for HAART for her own disease and follow appropriate guidelines including referral to ART/Care program Infant: *Mother breastfeeding not commenced on ART* Give daily NVP to infants from birth until 1 week after cessation of breastfeeding Mother breastfeeding (eventually commenced on ART) Give daily NVP to infants from birth and continue until 6 weeks after maternal commencement of ART: Mother not breastfeeding Give daily NVP to infants from birth until 6 weeks of age Dosage of daily NVP From birth to 6 weeks of age • Birth weight <2500 g: NVP 10 mg (1 ml) daily • Birth weight ≥2500 g: NVP 15 mg (1.5 ml) daily From 6 weeks to 6 months of age • NVP 20 mg (2 ml) daily From 6 to 9 months of age • NVP 30 mg (3 ml) daily From 9 to 12 months of age NVP 40 mg (4 ml) daily

Clinical Setting V

Recommendations for pregnant HIV-seropositive mothers who present after delivery are as follows:

HIV-infected mother who presents after delivery	Mother: • Determine if mother is eligible for ART for her own disease and follow appropriate guidelines including referral to ART/Care program

Mother:
- Determine if mother is eligible for ART for her own disease and follow appropriate guidelines including referral to ART/Care program

Infant:
Mother breastfeeding not commenced on ART
Give daily NVP to infants from birth until 1 week after all exposure to breast milk has ended
Mother breastfeeding (eventually commenced on ART)
Give daily NVP to infants from birth and continue until 6 weeks after maternal commencement of ART
Mother not breastfeeding
Give daily NVP to infants from birth until 6 weeks of age
Dosage of daily infant NVP
Refer to doses in Clinical Setting IV

Clinical Setting VI

Recommendations for pregnant HIV-seropositive patients who are co-infected with tuberculosis are as follows:

Pregnant mother with active tuberculosis Treat TB first if possible	Mother: Delay ARV treatment until second trimester, if possible The regimens are in decreasing order of preference If treatment is initiated in second trimester • EFV + 2NRTIs • ZDV + 3TC + Abacavir • Ritonavir-boosted PI* + 2 NRTIs (change rifampin to low-dose rifabutin) • ZDV + 3TC + Tenofovir (avoid ZDV if hemoglobin is ≤8 g/dl or PCV is ≤24%) combinations **Saquinavir/r or Lopinavir/r* Infant • Give daily NVP to infant from birth until 6 weeks of age • Prophylactic INH from birth (5 mg/kg once daily) until 6 months of age Dosage of NVP See Clinical Setting IV

Clinical Setting VII

Recommendations for pregnant HIV-seropositive patients with indication for ART, but required drugs are not available:

HIV-infected women with indication for ART, but required drugs are not available	All efforts should be made to ensure that all pregnant women who need ART have access to it either on-site or by referral

The highlights of the revised National PMTCT Guidelines[26] are as follows:
- The CD4 count eligibility criterion for initiation of ART in the HIV-infected pregnant women has been raised from the value of ≤250 to a value of ≤350.

For the HIV-infected pregnant women on ARV prophylaxis, the drug regimens are:
- Triple-drug combination where capacity for monitoring (clinical evaluation, liver function test, renal function test, and full blood count) is available at site or by referral
- Zidovudine monotherapy where capacity for monitoring is not available at site or by referral.

During labor

Those on Triple ARV regimens should take their drugs exactly the way they were taken during pregnancy. For those on Zidovudine monotherapy or Zidovudine plus Lamivudine during pregnancy and those diagnosed for the first time during labor, the following drugs are administered during labor:
- Single dose Nevirapine, 200 mg statin at the beginning of labor
- Zidovudine 300 mg plus Lamivudine 150 mg 12 hourly until delivery.

After delivery
- Women who are on therapy (lifelong treatment for their own disease) should continue with their triple-drug therapy.
- Those who received triple-drug prophylaxis during pregnancy and wish to breastfeed their babies could continue on the triple drugs until 1 week after cessation of breastfeeding, then stop the drugs OR stop the ARVs 1 week after delivery if they do not wish to breastfeed the babies or if they wish to breastfeed but prefer that the babies take ARV throughout the period of breastfeeding.
- Mothers who received Zidovudine monotherapy during pregnancy should be placed on Zidovudine plus Lamivudine 12 hourly for 1 week only while their breastfeeding babies should continue on Nevirapine until 1 week after cessation of breastfeeding.
- All HIV-exposed infants should in the first instance be placed on daily Nevirapine until the age of 6 weeks irrespective of maternal ARV use and feeding practice.
- After the age of 6 weeks, non-breastfeeding babies on the one hand and breastfeeding babies whose mothers have continued to receive ARV throughout the breastfeeding period on the other hand should discontinue Nevirapine.
- The recommended infant feeding practice is exclusive breastfeeding for 6 months with ARV cover, introduction of complementary feeds at the age of 6 months, and continued breastfeeding with ARV cover for up to 1 year.
- Those who opt out of the recommended feeding practice, namely breastfeeding, but choose to feed the infants with commercial infant formula, should be supported.
- The term "commercial infant formula" is preferred to "breast milk substitute" (BMS) to emphasize that only

the commercial infant formula and no other BMS is permissible as an alternative to breastfeeding.
- The concurrent feeding of the HIV-exposed infant with the maternal breast milk and any other feed in the first 6 months of life is termed "mixed feeding." After the age of 6 months, this practice is no longer termed mixed feeding. Mixed feeding is associated with unacceptably high rate of MTCT of HIV and so remains prohibited by the revised National PMTCT Guidelines.

Prophylaxis for Opportunistic Infections

Appropriate prophylaxis for opportunistic infections, especially in women with low CD4 cell count levels, improves the fetal and maternal outcomes of pregnancy and is recommended.[20,29,50] Cotrimoxazole prophylactic therapy should be offered when the CD4 cell count is ≤350/ml^3. HIV-infected pregnant women should receive three doses (instead of the generally recommended two doses) of Intermittent Preventive Therapy for malaria (IPTp).[26]

Avoidance of Invasive Procedures During Pregnancy

Invasive procedures such as chorionic villus sampling, external cephalic version, as well as other intrauterine operations are associated with increased risk of vertical transmission. They should be avoided.

Modification of Obstetric Procedures

Artificial rupture of the membranes (for 4 or more hours before delivery), fetal scalp electrode for intra-partum fetal monitoring, instrumental delivery, and episiotomy are associated with significant increases in MTCT and should be avoided. Some recommended practices include cleansing the birth canal with dilute antiseptic solutions, minimization of the number of vaginal examinations, dividing the umbilical cord under the cover of gauze pack, cleaning the baby immediately after delivery with dilute antiseptic solution, as well as strict observance of universal precaution in the labor ward.[9,10,11,19,20]

The Place of Cesarean Section for PMTCT

When the viral load is more than 1000 copies/ml, elective c/s significantly reduces MTCT. When the viral load is lower than 1000 copies/ml, cesarean section confers no additional advantage to the infant. Emergency cesarean section after the membranes have ruptured is associated with increased risk of MTCT.[9,11,12,29]

Infant Feeding Counseling

The revised National PMTCT Guidelines[26] and Guidelines on Nutritional Care and Support for People Living with HIV in Nigeria[51] recommend exclusive breastfeeding for 6 months with ARV cover, continued breastfeeding for up to 12 months with ARV cover, and introduction of complementary feeds from the age of 6 months. This is believed to be associated with the highest rate of HIV-free survival in the resource-restricted countries. Mothers who choose not to breastfeed should be supported to practice safe formula feeding.[26]

Breastfeeding by an HIV-infected woman increases the risk of MTCT by an additional 8–25% in various parts of the world.[29] Avoidance of breastfeeding completely eliminates this risk and is the recommended practice in the advanced countries.[9,29,36,37] In the developing countries, avoidance of breastfeeding neither may be possible nor is the safest option for the health and well-being of the infant as non-breastfeeding could sometimes constitute greater danger to the baby than the risk of HIV infection.[14,19,20,52,53] It is therefore recommended that the HIV-infected woman be offered quality infant feeding counseling to enable her to choose the infant feeding practice that is most appropriate for her particular circumstances.[15,19,20]

The two main infant feeding options are BMSs and breast milk options.

Breast milk substitute option

In the first 4–6 months of life, the infant needs to be fed with animal milk feeds. The optimal milk for the human infant is human milk, but other animals' milk could be modified and used as effective substitutes for human milk. These are called "breast milk substitutes" (BMSs). The BMSs are available as commercial infant formula or home-prepared infant formula. It is recommended that BMS be considered in the developing countries only when "AFASS" is in place, as follows:
- Acceptability: The practice should be socially acceptable.
- Feasibility: The practice should be feasible for the woman.
- Affordability: The chosen BMS should be affordable to the woman.
- Safety: The BMS should be safely and cleanly prepared and fed to the infant.
- Sustainability: The practice of BMS should be sustained for at least 4–6 months until the infant can be fully fed on non-milk feeds. Otherwise breast milk option may be more suitable.[19,20]

Breast milk options

- Exclusive breastfeeding for 6 months
- Exclusive breastfeeding for a short period (i.e. shorter period than 6 months) until AFASS is in place, then a changeover to BMS
- Expressing and heat-treating breast milk
- Breastfeeding by an HIV-negative wet nurse.

Although breastfeeding for less than 6 months is no longer recommended by the current relevant National Infant Feeding Guidelines,[26,51] any of the shorter durations of breastfeeding

may be indicated in certain special circumstances. Healthcare providers should therefore be familiar with all infant feeding options to enable them to guide the mothers through such difficult feeding situations.

Care and Support Services for the HIV-infected Woman and Members of Her Family

The woman living with HIV and the members of her family need a number of care and support services. These include medical care, family planning, screening and treatment of opportunistic infections, nutritional supplementation, psychosocial and spiritual support, and community-based care services, among others. These services are usually not all located at one site so that effective referral and linkages are necessary and should be in place.[15,19,20]

Care of the HIV-exposed infants

- At the time of delivery, observe universal precautions. Double-clamp the umbilical cord and cut it under the cover of light gauze. Cleanse the baby with warm dilute (2.5%) chlorhexidine solution or wipe dry with a towel. Keep the baby warm. Avoid suctioning the nostrils and mouth unless it is absolutely necessary. When suctioning is indicated, use low-pressure mechanical suctioning machine (suction pressure ≤100 mmHg). Avoid the use of mouth-operated mucus extractor. Determine mother's feeding choice and assist her to initiate infant feeding. Administer Vitamin K. Encourage body-to-body contact between the mother and the baby to enhance "bonding" irrespective of infant feeding practice.
- Immunization schedule of the HIV-exposed infant is the same as for the non-exposed infants except that live vaccines are avoided in the HIV-exposed infants who have HIV-related symptoms.[26]
- The infant is seen two weekly until the age of 6 months. At each visit, the infant undergoes the routine clinical assessment of all infants as well as specific assessment to look for signs and symptoms of HIV infection, such as persistent diarrhea, failure to thrive, etc.

At the age of 6 months, the infant receives the following interventions:

- HIV testing by DNA-PCR, otherwise known as early infant diagnosis (EID), if facilities are available
- Commencement of Cotrimoxazole prophylaxis against *Pneumocystis jirovecii* Pneumonia (PCP)
- Commencement of complementary feeding
- After 6 weeks of age, the HIV-exposed child is continued on Cotrimoxazole prophylaxis and followed up until the age of 18 months or until HIV infection is excluded (where the latter could be done earlier than the age of 18 months). HIV antibody test cannot be used to make the diagnosis of HIV infection in a child who is less than 18 months of age as the maternal antibody may still be in circulation in the child's blood
- At the age of 18 months, the HIV-exposed child undergoes a rapid (antibody) test for HIV. A negative result means that the child is not infected with HIV, provided exposure to breast milk had ceased at least 6 weeks prior to the test. Cotrimoxazole prophylaxis is discontinued, the child is discharged from the PMTCT program and referred to care and support services for people affected with HIV
- Whenever an HIV-exposed child is diagnosed HIV positive, he or she is referred to the pediatric ART team for further assessment and commencement of ARV therapy.

Outcome of PMTCT

Without intervention, the infant of an HIV-infected woman has as high as 45% risk of acquiring the infection from the mother. But with effective interventions, this risk can be reduced to as low as 0–2%.[13,15,29]

The outcome of PMTCT in Nigeria has been difficult to determine because of the following:

- Childhood HIV diagnosis cannot be made with the available antibody test before the age of 18 months
- The antigen-based tests (EID) that can make HIV diagnosis within the first 6 weeks of life are not readily available in Nigeria
- By the age of 18 months, most of the HIV-exposed children are lost to follow-up (and some may have even died).

By the end of 2009, only an estimated 11% of HIV-infected women in Nigeria had received any form of PMTCT intervention.[26] The poor follow-up of the infants and the challenges with early infant diagnosis of HIV in Nigeria have made it very difficult to determine the proportion of HIV-exposed infants who were prevented from acquiring HIV infection from their infected mothers.

Challenges of PMTCT Program in Nigeria

The PMTCT program in Nigeria is besieged with a number of challenges including the following:

- Poor political commitment and low resource allocation to the program at the state and local government levels
- Dependence on international donors for program resources. Program sustainability is therefore not guaranteed
- Implementing partners' preference to run the PMTCT program as a vertical program instead of integrating it into the existing Maternal and Child Health (MCH) structure
- Inaccurate knowledge of HIV-related issues by healthcare providers and the general public and the resultant pervasive stigma associated with the disease
- Low level of male partner involvement in PMTCT, among others.

These challenges have resulted in a very low program coverage.[26]

Conclusions

The strategies for PMTCT have proved very effective in preventing MTCT of HIV. Unfortunately, most women in Nigeria who need these interventions are still not accessing them. There is an urgent need for a rapid scale-up of the PMTCT services in Nigeria to reach the many women who need them. To achieve this, every healthcare provider involved in caring for pregnant and parturient women should be very familiar with the PMTCT interventions. Also, wider availability of facilities for HIV antigen tests and early diagnosis (or early exclusion) of HIV infection in the HIV-exposed infants are needed for early commencement of treatment of the infected infants as well as for an objective evaluation of the PMTCT program.

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