



Prevention of Mother-to-Child Transmission (PMTCT): Advancing Strategies to Reduce Infant Mortality

Funke Abolade Adumashi¹, Kennedy Oberhiri Obohjemu², Gabriel Olaoluwa Abayomi³, & Iyevhobu Oshiokhayamhe Kenneth⁴

1. Faculty of Health, Wellbeing & Social Care, Pearson, GBS Partnership, Manchester, United Kingdom; and PENKUP Research Institute, Birmingham, United Kingdom
2. Department of Interdisciplinary Research & Statistics, PENKUP Research Institute, Birmingham, United Kingdom. ORCID: <https://orcid.org/0000-0001-5175-1179>
3. Faculty of Health, Wellbeing & Social Care, Oxford Brookes University, GBS, Manchester Campus, United Kingdom; and PENKUP Research Institute, Birmingham, United Kingdom
4. Department of Medical Microbiology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria; Department of Medical Laboratory Science, Faculty of Applied Health Science, Edo State University Iyamho, Edo State, Nigeria

Abstract: Mother to child transmission of HIV remains one of the most persistent challenges in global public health, and Nigeria continues to carry a disproportionate share of the burden. This paper reviews the development of prevention of mother to child transmission programmes in Nigeria and examines their progress through a health systems perspective. The analysis draws together evidence on the scale of vertical transmission, the evolution of national policies, and the practical realities that shape service delivery. Although antiretroviral therapy has transformed the prospects of infants born to mothers living with HIV, the Nigerian experience shows that clinical effectiveness alone is not enough to secure population level gains. Weak health systems, uneven access to antenatal care, shortages of trained personnel, gaps in counselling and follow up, and persistent social stigma continue to limit the reach and impact of prevention efforts. The review highlights how these structural constraints interact with individual level factors to influence uptake of testing, adherence to treatment, and infant feeding decisions. It also considers the implications of global targets for elimination of paediatric HIV and the extent to which current strategies align with these ambitions. The paper argues that meaningful progress will require sustained political commitment, stronger integration of prevention services within routine maternal and child health care, and investment in community-based support systems that address the social and economic conditions shaping women's choices. The review concludes by outlining practical and contextually grounded recommendations that can support Nigeria's efforts to reduce new paediatric infections and improve HIV free survival.

Keywords: HIV, mother to child transmission, PMTCT, Nigeria, antiretroviral therapy, maternal health, infant feeding, health systems, vertical transmission, HIV exposed infants.

INTRODUCTION

Mother-to-child transmission of HIV (MTCT) is defined as the transmission of HIV from a mother to her child during pregnancy, labour, delivery or during breastfeeding (Bartlett & Gallant, 2019). In the absence of any interventions, transmission rates range from 15% to 45%. Without Highly Active Antiretroviral Therapy (HAART), half of the children born with HIV die by the age of two years, and 80 percent die by the age of five years. Globally, 2.6 million children younger than 15 years of age are living with HIV, yet only 32% are accessing

HAART. Despite significant efforts and achievements in prevention of mother-to-child transmission (PMTCT) over the past decade, approximately 240,000 children worldwide became newly infected with HIV in 2013 (World Health Organization, 2020).

Human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) is a spectrum of conditions caused by infection with human immunodeficiency virus (HIV) (Sepkowitz, 2021). Following initial infection, a person may experience a brief period of influenza-like illness. This is typically followed by a prolonged period without symptoms. As the infection progresses, it interferes more and more with the immune system, making the person much more susceptible to common infections like tuberculosis, as well as opportunistic infections and tumors that do not usually affect people who have working immune systems (Alexander *et al.*, 2020). The late symptoms of the infection are referred to as AIDS. This stage is often complicated by an infection of the lung known as pneumocystis pneumonia, severe weight loss, a type of cancer known as Kaposi's sarcoma, or other AIDS-defining conditions (Wilhelm, 2018).

HIV is transmitted primarily via unprotected sexual intercourse (including anal and oral sex), contaminated blood transfusions, hypodermic needles, and from mother to child during pregnancy, delivery, or breastfeeding (Markowitz, 2017). Some bodily fluids, such as saliva and tears, do not transmit HIV (Centers for Disease Control and Prevention, 2023). Prevention of HIV infection, primarily through safe sex and needle-exchange programs, is a key strategy to control the spread of the disease. There is no cure or vaccine; however, antiretroviral treatment can slow the course of the disease and may lead to a near-normal life expectancy. While antiretroviral treatment reduces the risk of death and complications from the disease, these medications are expensive and have side effects. Without treatment, the average survival time after infection with HIV is estimated to be 9 to 11 years, depending on the HIV subtype (UNAIDS/WHO, 2017).

In the absence of a vaccine for primary prevention, the availability of highly active antiretroviral therapy (HAART) has been pivotal in the global response to the HIV epidemic (Gaym, 2016). Over the years, the use of antiretroviral (ARV) drugs has advanced from simply treating HIV-infected persons to preventing transmission of the infection (Granich *et al.*, 2020). One of such important preventives uses of ARV is in averting perinatal transmission of HIV, which accounts for the majority of HIV infection in children aged < 14 years (World Health Organization, 2020). Multiple studies since the 1990s have shown that ARV drugs are efficacious in reducing the risk of mother-to-child transmission of HIV (Siegfried *et al.*, 2018; De Cock *et al.*, 2019).

Despite the proven effectiveness of ART, a number of children in sub-Saharan African countries like Nigeria still acquire HIV through vertical transmission. In 2017, according to the joint United Nations program on HIV/AIDS (UNAIDS) estimates, 159 000 of the 180 000 new infections among children globally occurred in sub-Saharan Africa, and Nigeria alone accounted for 23% of these new infections in the sub-region (Joint United Nations Programme on HIV/AIDS, 2019). Annually, Nigeria is estimated to have 160 000 HIV-infected pregnant women requiring ARV, making it the second largest globally after South Africa (UNAIDS, 2019). The national prevention of mother-to-child transmission of HIV (PMTCT) program in Nigeria started in 2002, (Agboghoroma *et al.*, 2018). Following the return of a democratic government in 1999, this launched an expanded HIV response (HIV/AIDS Emergency Action, 2019). However, limited coverage of PMTCT services has continued to affect the country's performance in reducing new infections among children. Among the 22

priority countries that were targeted by the UNAIDS global plan of eliminating new HIV infections among children by 2015, Nigeria's performance was the poorest, a 21% reduction in new infections among children from 2011-2019 (Joint United Nations Programme on HIV/AIDS, 2019). Over this period, ARV coverage for PMTCT increased from 14% in 2011 to 30% in 2019 (Joint United Nations Programme on HIV/AIDS, 2019). In 2017, only 32% of pregnant women living with HIV received ARV drugs to reduce the risk of perinatal transmission (Mark *et al.*, 2006).

A well-functioning health system that ensures quality service delivery, availability of HIV commodities, skilled healthcare providers and adequate funding, is critical to achieving the desired impact of PMTCT programs (Mutabazi *et al.*, 2017; Sprague *et al.*, 2019; Colvin *et al.*, 2020). The importance of robust health systems has been demonstrated in countries like Cuba and Thailand that have eliminated mother-to-child transmission of HIV and syphilis (Ishikawa *et al.*, 2022). With the current global aim of ending the HIV epidemic by 2030, (Joint United Nations Programme on HIV/AIDS, 2019) identifying and addressing health system-related challenges to PMTCT, particularly in high-burden countries, has become important (Modi *et al.*, 2017). The purpose of this review is to: (1) identify achievements and challenges in the elimination of mother-to-child transmission of HIV in Nigeria from a health system perspective, and (2) recommend feasible, culturally acceptable and sustainable interventions to address identified challenges.

HIV/AIDS has had a great impact on society, both as an illness and as a source of discrimination. The disease also has significant economic impacts. There are many misconceptions about HIV/AIDS such as the belief that it can be transmitted by casual non-sexual contact. The disease has also become subject to many controversies involving religion. It has attracted international medical and political attention as well as large-scale funding since it was identified in the 1980s (Harden, 2012).

Specific Prevention of mother to child transmission (PMTCT) interventions depends on whether a woman knows her HIV status (Kalish *et al.*, 2025). In the context of PMTCT, counseling and testing is a flexible intervention that is integrated into settings where pregnant women, and women of childbearing age receive services—RCH, antenatal, labour, and delivery, family planning and others (Marx *et al.*, 2021).

Counseling in PMTCT occurs during all stages of antenatal care (ANC), labour, delivery and postpartum care, and should involve not only the pregnant woman but also her partner and family (Zhu *et al.*, 2018). Counseling is critical to the ongoing treatment, care and support to the mother, her family and the newborn child and should observe all the basic concepts and communication skills in HIV/AIDS counseling (National Health Services, 2021).

Programs to prevent the vertical transmission of HIV (from mothers to children) can reduce rates of transmission by 92-99% (Coutsoudis *et al.*, 2020; Kurth *et al.*, 2021). This primarily involves the use of a combination of antiviral medications during pregnancy and after birth in the infant and potentially includes bottle feeding rather than breastfeeding (Coutsoudis *et al.*, 2020; Siegfried *et al.*, 2021). If replacement feeding is acceptable, feasible, affordable, sustainable, and safe, mothers should avoid breastfeeding their infants; however exclusive breastfeeding is recommended during the first months of life if this is not the case. If exclusive breastfeeding is carried out, the provision of extended

antiretroviral prophylaxis to the infant decreases the risk of transmission (Horvath *et al.*, 2019).

History of PMTCT Program in Nigeria

The initiative for the establishment of PMTCT program in Nigeria started with the inauguration of the PMTCT National Task Team (NTT) in December 2000. The PMTCT NTT was saddled with the responsibility of developing the proposal, framework, guidelines, monitoring and evaluating (M and E) the PMTCT program. Actual PMTCT services in Nigeria commenced as a pilot project in July 2002 (UNAIDS, 2015). The current overall goal as documented in the scale-up plan is to contribute to improved maternal health and child survival through accelerated provision of comprehensive and integrated PMTCT services (Gaym, 2016; Federal Ministry of Health, 2021).

Magnitude of MTCT in HIV

Globally in 2017, around 36.9 million people were living with Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) from which 1.8 million were children younger than 15 years and 18.2 million people were women age greater than 15 years (UNAIDS, 2017a). In addition, an estimated 1.3 million women living with HIV gave birth, 65% of women age greater than 15 had access to ART and more than 90% of HIV-positive pregnant women live in Sub Saharan Africa (SSA) (United Nation Joint HIV/AIDS Prevention Program (UNAIDS) DATA, 2017a; World Health Organization, 2019). Globally, more than 90% of children infected by HIV through mother to child transmission (MTCT). At the end of 2015, the number of children that acquired HIV from their mother through vertical transmission was 11,600 (Centers for Disease Control, 2018). Prevention from mother to child transmission Mother to Child Transmission (PMTCT) is a global provider of antiretroviral medicines to pregnant and lactating women living with HIV to reduce the risk of transmitting HIV to infants during pregnancy, delivery and the postpartum period which is a dynamic and rapidly changing program from time to time (UNAIDS 2018a).

World health organization (WHO) guidelines on antiretroviral therapy (ART) recommended three options to prevent mother to child transmission of HIV infection; Option A, Option B, and Option +. Options A and B WHO guidelines emphasize the importance of providing ART and prophylaxis to all HIV-infected women based on eligibility criteria (Mark *et al.*, 2006). The current approach, Option B+ approach PMTCT program, is the provision of universal lifelong ART for all HIV-infected women, without eligibility criteria (WHO, 2019). Option B+ PMTCT was first started in Malawi in 2021 and in 2014 over 20 countries had endorsed Option B+ for their national PMTCT program (UNAIDS 2018b). Currently, Ethiopia is also implementing Option B+ PMTCT program as its national policy for preventing new HIV infections among children and keeping their mothers alive starting from June 2013 (WHO, 2015). Since implementation of Option B+ PMTCT program globally, estimated 1.2 million new HIV infections among children have been prevented, and over two million pregnant and lactating women have started receiving lifelong ART and the percentage of pregnant women living with HIV, who received ART, has risen from 51% in 2020 to 80% in 2017 (UNAIDS, 2018b; WHO, 2019). In Ethiopia, around 16,700 pregnant women were

received lifelong ART under option B+ PMTCT program in 2016, and ART coverage for children age 0-14 years was 35% in 2016 (UNAIDS, 2017).

Goal of PMTCT

The United Nations General Assembly Special Session (UNGASS) on HIV/AIDS held in June 2021, (UNGASS 2020; UNGASS, 2021) 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 2025 and by 50% by 2020 (Mor *et al.*, 2017).” 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 2020” (FGN, 2018c). A scale-up plan to raise these goals to 80% by 2015 has been completed by the Federal Ministry of Health (FGN, 2016).

Strategies of PMTCT

In addition to setting the goal of PMTCT, the UNGASS in 2021 also formulated four strategies for PMTCT, as follows (Gaym, 2016):

- 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 (De Cock *et al.*, 2019).

The Benefits of Counseling and Testing for PMTCT

1. The primary advantage of HIV counseling and testing is that it helps people to learn their HIV status (CDC, 2020).
2. For women who test HIV-negative, HIV counseling and testing in PMTCT settings provides information and support to remain uninfected (Reid, 2019).
3. For pregnant women who are HIV-positive and know their status, counseling may help them (Reid, 2019):
 - Make informed decisions about their pregnancy.
 - Receive appropriate and timely interventions to reduce MTCT including:
 - Antiretroviral treatment or prophylaxis.
 - Infant-feeding counselling and support.
 - Information and counselling on family planning.
4. Education on the importance of delivering in a setting where Standard Precautions and safer obstetric practices are in effect (see Module 8: Safe and Supportive Care in the Work Setting for more information about Standard Precautions).

5. Receive information and counselling on the prevention of HIV transmission to others (National Health Services, 2021).
6. Obtain referrals for follow-up and ongoing healthcare (including antiretroviral treatment, care, and support) for themselves, their partners, their children, and their families (National Health Services, 2021).
7. Disclose their test results safely and appropriately to e.g. partners, family members, friends, and others (National Health Services, 2021).

Specific PMTCT Interventions during Pregnancy

1. **Antiretroviral drugs:** Every antiretroviral drug (ARV) regimen for PMTCT, including the single-dose Nevirapine, offers significant protection against MTCT of HIV (Dabis, 2019; Nightingale & Dabis, 2019; Lockman *et al.*, 2022). The drug combination regimens are more efficacious than the monotherapy regimens (De Cock, 2020). 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 (Bartlett & Gallant, 2019; Mefenson & Munderi, 2020). Treatment interruption is discouraged in those who were on treatment prior to pregnancy, although some modifications in the drug components might become necessary (United Nations, 2016; Lawrence *et al.*, 2018; Gallant, 2019; El-Sadr & Neaton, 2021). 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 (FGN, 2021) 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 (WHO 2021).
2. **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 (Bartlett & Gallant, 2019) But it is associated with anemia and should be avoided in women with a hemoglobin level of 8 mg/dl or less (FGN, 2018). Nevirapine is the ARV that has been most widely used in the developing countries for PMTCT as the "single-dose Nevirapine" regimen (Bartlett & Gallant, 2019). 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 (Bartlett & Gallant, 2019). It should be avoided when the CD4 cell count is greater than 350 cells/mm³ (FGN, 2021). Efevernz is an alternative ARV to Nevirapine but has been associated with embryopathy in experimental animals count (Bartlett & Gallant, 2019). Although the risk of embryopathy in man is less than 1%, it is avoided in the first trimester of pregnancy (FGN, 2018b). Stavudine and Didonisine are associated with lactic acidosis (Bartlett & Gallant, 2019). They are not recommended during pregnancy (FGN, 2021). The Protease Inhibitors (PIs) are effective ARVs. They are associated with muscular dystrophies (Bartlett & Gallant, 2019). 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 (Bartlett & Gallant, 2019). 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 (FGN, 2018).

3. **Antiretroviral drugs 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 (FGN, 2015; Bartlett & Gallant, 2019; Walter *et al.*, 2021). Cotrimoxazole prophylactic therapy should be offered when the CD4 cell count is $\leq 350/\text{ml}^3$. HIV-infected pregnant women should receive three doses (instead of the generally recommended two doses) of Intermittent Preventive Therapy for malaria (IPTp) (FGN, 2021).

Specific PMTCT Interventions during Labour and Delivery

Women who test HIV-negative should receive post-test counseling and counseling on risk reduction interventions including involvement of partners or spouses, focusing mainly on how to maintain their HIV-negative status. They should continue to receive routine antenatal care, and should be encouraged to use condoms. They should be offered a repeat HIV test at or around 32 weeks gestation, to detect those who may have sero-converted during pregnancy. Women who choose not to be tested should receive individual 'post-refusal' counseling and be offered HIV testing at every subsequent visit in a non-coercive manner during the antenatal period. They should also be offered an HIV test at the onset of labour; if this is not possible, they should be offered testing shortly after childbirth (Bartlett & Gallant, 2019; WHO 2021).

Women who initially test negative and subsequently test positive during pregnancy should be given a CD4 cell count test, clinically staged, and initiated onto AZT whilst awaiting the CD4 cell count result. If the result is CD4 is 350 or less the woman must commence lifelong ART within 2 weeks. If the CD4 is more than 350, then she continues on AZT (Bartlett & Gallant, 2019).

Unbooked women reporting in labour should be counseled and tested for HIV during the first stage of labour and offered a PMTCT intervention as per guidelines. If this is not possible, counseling and testing should be offered after delivery. If the mother tests positive, the infant should be initiated onto NVP, the mother should be counseled on feeding options and counselled about infant testing. The mother must be staged and a CD4 cell count taken prior to discharge with a follow up visit scheduled within one week. If eligible for ART (CD4 of 350 or less or WHO stage 3 or 4) she should commence lifelong ART within 2 weeks (FGN, 2016; WHO, 2019).

1. **Avoidance or Invasive Procedures:** 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 (FGN, 2016; WHO, 2019)
2. **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 (FGN, 2016; Perinatal HIV Guideline Working Group, 2019; WHO, 2019)

Infant Feeding Counselling

The revised National PMTCT Guidelines (FGN, 2015) and Guidelines on Nutritional Care and Support for People Living with HIV in Nigeria (FGN, 2018) 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 Nigeria (FGN, 2018). Breastfeeding by an HIV-infected woman increases the risk of MTCT by an additional 8-25% in various parts of the world. Nigeria (FGN, 2018). Avoidance of breastfeeding completely eliminates this risk and is the recommended practice in the advanced countries (WHO, 2019) 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 countries (WHO, 2019). 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 (FGN, 2015; UN, 2015; FGN, 2016)

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 (FGN, 2015; UN, 2016; FGN, 2016).

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% (Coutsouddis *et al.*, 2018; Enugu State Government, 2018; UN, 2019). 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 2019, only an estimated 11% of HIV-infected women in Nigeria had received any form of PMTCT intervention. 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 (Mor *et al.*, 2017)

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 (United Nations General Assembly, 2016).
- 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 very low program coverage (FGN, 2021)

RECOMMENDATIONS

It is hereby recommended that: The prevention of mother-to-child transmission (PMTCT) of HIV has played an important role when implemented, these recommendations are as follows;

1. Scaling up of the programme is recommended so that the PMTCT services are available at the door steps of HIV-positive mothers
2. Specific PMTCT interventions during labour and delivery should be embraced by all health workers.
3. HIV-positive mothers are advised to observe all the PMTCT protocols in order for their newborn babies not to be infected.
4. The current international support programs focus on Nigeria and the readiness to assist the county in scaling up PMTCT services is an opportunity that Nigeria must leverage on in order to meet its target of eliminating MTCT by 2025.
5. After delivery, you can prevent transmitting HIV to your baby by avoiding breastfeeding, since breast milk contains HIV in infected mothers.
6. If your partner has HIV, encourage your partner to get and stay on treatment. This will prevent your partner from transmitting HIV to you.

7. In the light of the global effort, it is critically important to provide the best evidence-based interventions to reduce the risk of transmission from an HIV-infected mother to her newborn child, while at the same time promoting the health of both the mother and the child.
8. Since WHO issued revised guidelines in 2006, important new evidence has emerged on the use of antiretroviral (ARV) prophylaxis to prevent MTCT, including during breastfeeding, on the optimal time to initiate antiretroviral therapy (ART) in individuals who need treatment, and on safe feeding practices for HIV-exposed infants.
9. Providing a HIV positive mother access effective antiretroviral therapy (ART) and support services during pregnancy, delivery and breastfeeding
10. Primary prevention of HIV infection among women of reproductive age.

CONCLUSION

The persisting high burden of HIV infected pregnant women and MTCT in the country is an indication of the need to urgently scale-up the PMTCT program and make the services accessible to all women especially those in the rural areas. Pre-service training curricula for all relevant cadres of health-care workers should be revised to include the knowledge and competences required for the provision of PMTCT services. Strategies that improve utilization of health services by rural dwellers should be promoted.

Author Contribution: All authors contributed meaningfully to the design, analysis, interpretation, and writing of the study. The manuscript reflects the collective input and review of all authors. All authors read and approved the final version of the manuscript and agreed to be accountable for its content.

Conflict of Interest: The authors declare no conflict of interest.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgement: The authors would like to express their sincere gratitude to the management and technical staff of PENKUP Research Institute, Birmingham, UK, for their excellent assistance and for providing medical writing and editorial support in accordance with Good Publication Practice (GPP3) guidelines.

REFERENCES

- Agboghroma, C.O., Sagay, S.A. & Ikechebelu, J.I. (2018). Nigerian prevention of mother to child transmission of human immunodeficiency virus program: the journey so far. *Journal of HIV and Human Reproduction*, 1(1), 1-7.
- Alexander, K., Mirjam, K., & Klaus, K. (2020). Modern infectious disease epidemiology concepts, methods, mathematical models, and public health (Online-Ausg. ed.). New York: Springer. p. 88.
- Bartlett, J.G. & Gallant, J.E. (2019). Medical Management of HIV infection. John Hopkins University School of Medicine, Baltimore, Maryland, USA. Pp. 67 - 74.

- Centers for Disease Control and Prevention, (CDC) (2020). "HIV transmission through transfusion --- Missouri and Colorado, 2018.". *Morbidity and Mortality Weekly Report*, 59(41), 1335-1339.
- Colvin, C.J., Konopka, C., & Chalker, J.C. (2020). A systematic review of health system barriers and enablers for antiretroviral therapy (ART) for HIV-infected pregnant and postpartum women. *PLoS One*, 9(10), e108150.
- Coutsoudis, A., Pillay, K., Kunhn, L., Spooner, E., Tsai, W.Y., & Coovadia, H.M. (2018). Methods of feeding and transmission of HIV 1 from mother to child by 15 months of age: A prospective cohort study. *Durban South Africa*, 15, 379-387.
- Coutsoudis, A., Kwaan, L. & Thomson, M (2020). "Prevention of vertical transmission of HIV-1 in resource-limited settings". *Expert review of anti-infective Therapy*, 8 (10), 1163-1175.
- Dabis, F. (2019). Field efficacy of zidovudine, lamivudine and single-dose nevirapine to prevent peripartum HIV transmission. *AIDS*, 19, 309-318.
- De Cock, K.M, Fowler, M.G. & Mercier, E. (2019). Prevention of mother-to-child HIV transmission in resource-poor countries. *Journal of American Medical Association*, 283 (9), 175-181.
- De Cock, K.M. (2020). Prevention of mother-to-child HIV transmission in resource-poor countries: Translating research into policy and practice. *Journal of American Medical Association*, 283, 1175-1182.
- El-Sadr, W. & Neaton, J. (2021). Episodic CD4-guided use of ART is inferior to continuous therapy: Results of the SMART Study. conference of retrovirus and opportunistic infections. Denver Co. USA, Pp. 5-8.
- Enugu State Government (2018). Health Services Directory, Enugu State Ministry of Health. Pp. 67 - 75.
- Federal Government of Nigeria (FGN), (2016). Prevention of mother to child transmission of HIV (PMTCT), Nigerian curriculum. Trainers' manual. Federal Ministry of Health. Pp. 89 - 94.
- Federal Government of Nigeria (FGN), (2017). Guidelines on nutritional care and support for people living with HIV in Nigeria. Federal Ministry of Health. Pp. 45 - 52.
- Federal Government of Nigeria (FGN), (2018a). ANC Report: HIV estimates and projection. Federal Ministry of Health. Pp. 56 - 78.
- Federal Government of Nigeria (FGN), (2018b). Scale-up plan on Prevention of Mother to Child Transmission (PMTCT) of HIV in Nigeria. Federal Ministry of Health. Pp. 45-61.
- Federal Government of Nigeria (FGN), (2018c). Training manual on HIV/AIDS Voluntary Counseling and Testing (VCT) services in Nigeria. Federal Ministry of Health. Pp. 90 - 98.
- Federal Ministry of Health (FMOH), (2021). A Directory of Health Facilities in Nigeria. Abuja, Nigeria: Federal Ministry of Health. Pp. 67 - 78.
- Gaym, A. (2016). Microbicides emerging essential pillars of comprehensive HIV/AIDS prevention. *Ethiopian Medical Journal*, 14, 1017-1026.
- Granich, R., Crowley, S. & Vitoria, M. (2020). Highly active antiretroviral treatment as prevention of HIV transmission: review of scientific evidence and update. *Current Opinion of HIV AIDS*, 5(4), 298-304.
- Harden, V.A. (2012). *AIDS at 30: A History*. Potomac Books Inc. p. 324.
- Horvath, T., Madi, B.C., Iuppa, I.M., Kennedy, G.E., Rutherford, G. & Read, J.S. (2019). Horvath, Tara, ed. "Interventions for preventing late postnatal mother-to-child transmission of HIV". *Cochrane Database of Systematic Reviews (Online)*, (1), CD006734.

- Ishikawa, N., Newman, L. & Taylor, M. (2022). Elimination of mother-to-child transmission of HIV and syphilis in Cuba and Thailand. *Bulletin of World Health Organisation*, 94, 787-797.
- Joint United Nations Programme on HIV/AIDS (2019). Preventing mother-to-child transmission of HIV-1 in Africa in the year. Info. [http:// aidsinfo.unaids.org/](http://aidsinfo.unaids.org/). accessed 15 January, 2025.
- Kalish, M.L., Wolfe, N.D., Ndongmo, C.D., McNicholl, J. & Robbins, K.E. (2025). "Central African hunters exposed to simian immunodeficiency virus". *Emerging Infectious Diseases*, 11 (12), 1928-1930.
- Kurth, A.E., Celum, C., Baeten, J.M., Vermund, S.H., & Wasserheit, J.N. (2021). "Combination HIV prevention: significance, challenges, and opportunities". *Current HIV/AIDS Reports*, 8 (1), 62-72.
- Lawrence, J., Mayers, D.L., Hullsiek, K.H., Collins, G., Abrams, D.I. & Reisler, R.B. (2018). Structured treatment interruptions in patients with multi-drug resistant human immunodeficiency virus. *New English Journal Medicine*, 349, 2268-2269.
- Lockman, S., Shapiro, R.L., Smeaton, L.M., WEster, C. & Thior. I. (2022) Response to antiretroviral therapy. *AIDS*, 14, 1017-1026.
- Mark, G., Crepaz, N. & Jansen, R.S. (2006). Estimating sexual transmission of HIV from persons aware and unaware that they are infected with the HIV virus in USA. *AIDS*, 20, 1447-1452.
- Markowitz, J. (2017). edited by William N. Rom; associate editor, Steven B. (2017). *Environmental and occupational medicine* (4th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins. p. 745.
- Marx, P.A., Alcabes, P.G. & Drucker, E. (2021). "Serial human passage of simian immunodeficiency virus by unsterile injections and the emergence of epidemic human immunodeficiency virus in Africa". *Philosophical Transactions of the Royal Society B*, 356 (1410), 911-920.
- Mefenson, L.M. & Munderi, P. (2020). Safety of antiretroviral prophylaxis of perinatal transmission for HIV infected pregnant women and their infants. *Journal of Acquired Immune Deficiency Syndrome*, 30, 200-215.
- Modi, S., Callahan, T. & Rodrigues, S. (2017). Overcoming health system challenges for women and children living with HIV through the global plan. *Journal of Acquired Immune Deficiency Syndrome*, 75(supply 1), S76-85.
- Mor, Z., Chemtob, D., Pessach, N. & Nitzan-Kaluski, D. (2017). Human immunodeficiency virus in new born of infected mothers: Pregnancy, breastfeeding and prevention. *AIDS*, 9, 9-18.
- Mutabazi, J.C., Zarowsky, C. & Trottier, H. (2017) The impact of programs for prevention of mother-to-child transmission of HIV on health care services and systems in sub-Saharan Africa—A review. *Public Health Review*, 38, 28.
- National Health Services (NHS) (2021). "Will I need a blood transfusion?". *NHS patient information*.
- Nightingale, S. & Dabis, F. (2019). Evidence behind the WHO guidelines: Hospital care for: What antiretroviral agents and regimens are effective in the prevention of mother to child transmission of HIV? *Journal Tropical Paediatrics*, 52, 235-238.
- Perinatal HIV Guideline Working Group (2019). Public Health Services Task force Recommendations for Use of Antiretroviral Drugs in pregnant HIV infected women for maternal health and interventions to reduce perinatal HIV transmission in the United States. Pp. 20-39.
- Reid, S.R. (2019). "Injection drug use, unsafe medical injections, and HIV in Africa: a systematic review". *Harm Reduction Journal*, 6, 24.
- Sepkowitz, K.A. (2021). "AIDS—the first 20 years". *New England Journal of Medicine*, 344 (23), 1764-1772.

- Siegfried, N., van der Merwe, L. & Brocklehurst, K. (2018). Antiretrovirals for reducing the risk of mother-to-child transmission of HIV infection. *Cochrane Database Systemic Review*, 1(7), CD003510.
- Siegfried, N., van der Merwe, L., Brocklehurst, P. & Sint, T.T. (2021). Siegfried, Nandi, ed. "Antiretrovirals for reducing the risk of mother-to-child transmission of HIV infection". *Cochrane Database of Systematic Reviews (Online)*, (7), CD003510.
- Sprague, C., Chersich, M.F. & Black, V. (2019). Health system weaknesses constrain access to PMTCT and maternal HIV services in South Africa: a qualitative enquiry. *AIDS Research Therapy*, 8, 10.
- UNAIDS (2017). United Nation Joint HIV/AIDS Prevention Program (UNAIDS) DATA, Joint United Nations programme on HIV/AIDS 2017. Geneva Switzerland. Retrieved 23-01-2025.
- UNAIDS (2018a). United Nation Joint HIV/AIDS Prevention Program (UNAIDS), Global AIDS Monitoring 2019: Indicators for monitoring the 2016 Political Declaration on Ending AIDS 2018. Retrieved 23-01-2025.
- UNAIDS (2018b). United Nation Joint HIV/AIDS Prevention Program (UNAIDS), Closing Gaps Breaking Barriers Righting Injustices. Global AIDS UPDATE, 2018. Retrieved 23-01-2025.
- UNAIDS (Joint United Nations programme on HIV/AIDS) (2019). Global plan towards the elimination of new HIV infections among children by 2015 and keeping their mothers alive. Report on the Global HIV/AIDS Epidemic. Geneva; UNAIDS. Available from: <http://www.unaids.org>. Retrieved 23-01-2025.
- UNAIDS (Joint United Nations programme on HIV/AIDS) (2021). Report on the Global HIV/AIDS Epidemic. Geneva: UNAIDS. Available from: <http://www.unaids.org>. Retrieved 23-01-2025.
- UNAIDS/WHO (2017). "2017 AIDS epidemic update" (PDF). "The impact of AIDS on people and societies". *2006 Report on the global AIDS epidemic* (PDF).
- United Nations General Assembly (UNGASS), (2016). Declaration of commitment on HIV/AIDS: Five years later. Follow-up to the outcome of the twenty-sixth special session: Implementation of the declaration of commitment on HIV/AIDS. Report of the Secretary General. Agenda 45. Pp. 78 - 90.
- Walter, J., Mwiya, M., Scott, N., Kasonde, P., Sinkasa, M., & Kankasa, C. (2021). Reduction in preterm delivery and neonatal mortality after introduction of antenatal cotrimaxazole prophylaxis. Elsevier Publishers, Pp. 34 - 42.
- Wilhelm, K. (2018). *Encyclopedia of public health*. New York: Springer. pp. 676-677.
- World Health Organization (WHO) (2019). New data on Prevention of Mother to Child transmission of HIV and their policy implications, conclusions and recommendations. Pp. 78 - 86.
- World Health Organization (WHO) (2020) technical consultation on behalf of the UNFPA/UNICEF/WHO/UNAIDS inter-agency Task Team on mother to child transmission of HIV, Geneva. 11-13. Geneva. World Health Organization; WHO/RHR/01-28.
- Zhu, T., Korber, B. T., Nahmias, A. J., Hooper, E., Sharp, P. M. & Ho, D. D. (2018). "An African HIV-1 Sequence from 1959 and Implications for the Origin of the epidemic". *Nature*, 391 (6667), 594-597.