

## Effectiveness of Prevention of Mother-to-Child Transmission of HIV Program in Benue, Nigeria

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### Abstract

**Introduction:** Over 90% of HIV infections in children are acquired through the mother-to-child transmission route. Mother to child transmission can be prevented through use of efficacious antiretroviral drug regimens and complete avoidance of breastfeeding. This study evaluated the effectiveness of PMTCT program in Benue State, Nigeria.

**Methods:** This was a retrospective study of infants and children perinatally exposed to HIV aged 6 weeks -18 months from Benue State, Nigeria. 5734 consecutive sample of infants and children identified from the EID laboratory register from January 2017-December 2017 were enrolled for this study. The details of ARV therapy commencement for mother and baby, infant feeding choices, and HIV PCR DNA test results were analyzed using SPSS version 20.

**Result:** 225 out of 5734 exposed babies tested positive to HIV giving an overall prevalence of 3.9% (95% CI: 3.4 -4.4). When neither mother nor baby received ARVs the prevalence was 33%; when only baby received ARVs the prevalence was 10.8%; when only mother received ARVs the prevalence was 9.1% and when both mother and baby received ARV for PMTCT the prevalence reduced to 1.5%.

**Conclusions:** This study has shown the usefulness of ARVs as the single most important intervention in PMTCT. There was a high prevalence of HIV among exposed children in our setting, especially if the mother and child pairs did not receive any form of antiretroviral prophylaxis. Therefore, there is need to expand antiretroviral coverage, ensure access of the PMTCT program, and provide effective services to support infected children.

**Keywords:** prevention of mother-to-child HIV transmission, PMTCT, HIV, antiretroviral prophylaxis.

### Introduction

HIV infection is an important cause of morbidity and mortality in children in Africa (Tindyebwa et al, 2006). Over 90% of HIV infections in children are acquired through the mother-to-child transmission (MTCT) route. About 25–40% of HIV-positive women will transmit the virus to their children during the period of pregnancy, labor/delivery, and breastfeeding if there is no intervention. With appropriate interventions which include use of antiretroviral (ARV) drugs, obstetric interventions and modification of infant feeding, MTCT rates have been reduced to <2% in some countries (Townsend et al, 2008; ECS,2005; Agboghoroma,2014). This has significantly reduced the incidence of pediatric HIV/AIDS and associated morbidity and mortality in those countries.

Nigeria contributes significantly to the global gap in elimination of MTCT thus accounting for the largest proportion of new HIV infections globally in children (UNAIDS,2014). The high prevalence of HIV among pregnant women, prolonged breast feeding, nonuse of health facilities for antenatal and deliveries have contributed to a high MTCT (FMoH,2015). The trends of HIV infections among pregnant women attending antenatal care have been periodically monitored through the National HIV sero-prevalence Sentinel Survey (NHSSS). The NHSSS survey of 2014 gave the national HIV sero-prevalence among pregnant as 3.0%. This shows a decline from 4.1% in 2010 to 3.0% in 2014. The HIV prevalence among young people (age 15-24years) which is a marker of trends in the incidence of new infections, progressively and consistently declined from 6.0% in 2001 to 2.9% in 2014. The prevalence rate in the states of Nigeria ranged from 0.9% in Zamfara State (North West, Nigeria) to 15.4% in Benue State (North Central, Nigeria) with 17 of the states having a sero-prevalence rate above the national mean of 3.0%. Heterosexual transmission is responsible for 80% of new HIV infections

while MTCT and transfusion of infected blood and blood products accounted for other modes of transmission (FMoH, 2015; NACA,2017; Fowler et al, 2007).

Tremendous gains have been made to prevent mother-to-child HIV transmission (PMTCT) worldwide. There has been a steady decline in new HIV infections among children since 2010 by 35% i.e. 270,000 in 2010 to 180,000 in 2017. This cut in the number of new HIV infections by 50% among children in the 21 Global Plan priority countries in sub-Saharan Africa has been significant. Nigeria is among the seven priority countries that have recorded a reduction in new HIV infection among children by only 30% or less since 2009. The MTCT rate across the 21 Global Plan priority countries has been cut in half, following access to antiretroviral drugs. Despite these substantial gains, however, the absolute numbers of HIV-infected children remain staggering. In 2017 alone, more than 1.8million children were newly infected and in need of lifelong HIV treatment (UNAIDS, 2015; UNAIDS,2018).

The cornerstone of PMTCT programs have been the use of efficacious antiretroviral drug regimens. The use of several combinations of antiretroviral (ARV) and complete avoidance of breastfeeding is the most effective means of preventing MTCT. ARVs used during pregnancy and delivery have been shown to be very effective in reducing HIV transmission from mothers to infants. These drugs reduce the risk of MTCT by reducing the replication of HIV in the mother and through infant prophylaxis when exposed to the virus (Maria et al, 2014; WHO, 2016). Globally the percentage of pregnant women living with HIV on ARV to prevent MTCT has risen from 51% in 2010 to 80% in 2017. However only 30% (19-44%) of HIV pregnant positive women in Nigeria were on antiretroviral drugs to prevent MTCT. These gains have given hope towards the day when no child acquires HIV (UNAIDS, 2018).

MTCT interventions in Benue were implemented in accordance with current national PMTCT practice and standard operating procedures. The Nigerian 2016 PMTCT guideline recommends that. ART should be initiated in all HIV pregnant and breastfeeding women, regardless of gestational age, WHO clinical stage, CD4+ cell count and continued for life. The preferred first line for HIV positive pregnant or breastfeeding women is a combination of Tenofovir (TDF) + 3TC + Efavirenz (EFV). All HIV exposed infants should receive Nevirapine (NVP) ARV prophylaxis for six weeks. Dual prophylaxis with zidovudine (ZDV-twice daily) and NVP once daily) for the first 6 weeks of life should be given to infants who are at high risk of acquiring HIV irrespective of feeding option. These infants should receive daily NVP within 72 hours of birth continued to 6weeks. Extended ARV prophylaxis is given to high risk infants which is a dual combination of ZDV+NVP for 12 weeks. EID is conducted at 6 weeks using DNA polymerase chain reaction (PCR) technology (FMoH, 2015).

## Methods

### Study design

This was a retrospective cohort study using routine early infant diagnosis (EID) program data of infants and children perinatally exposed to HIV aged 6 weeks -18 months from Benue State, Nigeria. 5734 consecutive sample of infants and children identified from the EID laboratory register from January 2017-December 2017 were enrolled for this study.

### Study setting

Benue State is one of the six states that make up the north central zone of Nigeria. It lies between latitudes 6°25'N and 8°8'N and longitudes 7°47'E and 10°E'. Makurdi is the State capital and also a local Government headquarters. The facilities providing PMTCT services in Benue State are supported by Presidents Emergency Plan for Aids Relief (PEPFAR) through Centres for Disease Control (CDC) and Global Fund (GF). The State has one centralized EID laboratory located at Federal Medical Centre Makurdi where all DBS samples across the state from over 300 facilities are sent and analyzed. The laboratory was set up as a partnership between Government of Nigeria (GoN) and APIN Public Health Initiatives, Nigeria with support from CDC Nigeria. Partners that sent samples during the period under review included Aids Health Care Foundation (AHF), Centre for Integrated Health Programs (CIHP), Caritas Catholic Foundation, Nigeria (CCFN) and GF. The laboratory was set up to strengthen HIV care in children as a continuum of the PMTCT program. EID is a centralized facility and laboratory-based program that uses DBS specimens to determine the HIV status of exposed infants

at young age (6 weeks to less than 18 months). Through EID outcome treatment for identified HIV infected infants will be facilitated and mortality reduced

### Data collection and management

Dried blood spots (DBS) samples are usually collected at the facility level by trained staff designated as EID focal persons. These infants and children were systemically identified in the postnatal clinic through information on their mother's card on her HIV status and during follow up in the clinic where exposure status of children is determined. The DBS samples were collected using special filter paper and the EID PCR laboratory request and result form filled which accompanied the sample to the laboratory. The information collected from the exposed baby included age, sex of the child, breastfeeding status of child and ARV intervention status of mother and baby. The samples are transported directly to the laboratory by the hospital staff. The same process is used to send back the results. This study was based on a review of data routinely collected at 278 partner supported EID sites in Benue. The routine service data was extracted from structured national data collection tools and entered into a Microsoft excel sheet designed for data entry. The national tools used to get data for analysis were the PCR request and result form; and the EID register.

### Data analysis

Statistical analysis was done with Statistical Package for the Social Sciences (SPSS) version 20

Descriptive statistics were used to summarize the baseline characteristics. Continuous variables were categorized to facilitate analysis. Transmission rates were estimated for specific PMTCT intervention received by mothers and children. The Chi-square test was used to test for association between categorical variables and the p value < 0.05 was considered statistically significant.

### Results

Results of data obtained from 5734 infants and children aged 6 weeks-18 months who were enrolled in the PMTCT program in Benue were analyzed. The age distribution at PCR shows 58.2% (n= 3132) of the infants were < 6 weeks, 33% (n=1773) were >6 weeks -6 months and 8.8% (n=473) were >24 weeks-18 months of age as at the time of DBS collection. The highest DBS samples representing 58.2% (n=3132) were collected at six weeks of age This is normally the recommended age of DBS collection though it can be collected after that in a program setting. The mean age was 11.34 weeks (95% CI: 11.05-11.64). There were 356 missing values for age out of 5734 clients. Total of 3873 (71.9%) mothers were on ARVs prior to pregnancy, while 1183 (22.1%) commenced ARVs during pregnancy. Total of 5023(93.7%) of the exposed babies received single dose nevirapine (sdNVP) at birth till 6 weeks and 339 (6.3%) received nothing 5497 (98.4) of the babies had been breastfed, while 87 (1.6%) were never breastfed. (Table 1)

**Table 1.** Characteristics of study participants (N=5734)

Characteristics	Number (%)
<b>Age</b>	
< 6 weeks	3132 (58.2)
>6 weeks -6 months	1773 (33.0)
>24 weeks-18 months	473 (8.8)
<b>Gender</b>	
Male 2688 (49.4)	Male 2688 (49.4)
Female	2755 (50.6)
<b>Child Breastfeeding status</b>	
Yes 5497 (98.4)	Yes 5497 (98.4)
No 87 (1.6)	No 87 (1.6)
<b>Maternal ARV start</b>	
HAART started before pregnancy	3873 (71.9)
HAART started during pregnancy	1183 (22.1)
No ARV	330 (6.1)

Maternal ARV	
Yes	5056 (93.9)
No	330 (6.1)
Infant ARV	
Yes	5023(93.7)
No	339 (6.3)
PMTCT ARV Intervention status	
Both	4750 (85.9)
Mother only	317(5.7)
Child only	250 (4.5)
None	215 (3.9)
HIV DNA PCR result	
Positive	225(3.9)
Negative	5509(96.1)

Two hundred and twenty-five (225) out of 5734 exposed babies tested positive to HIV giving an overall prevalence of 3.9% (95% CI: 3.4 -4.4). Prevalence of 1.5%, 4.6 % and 17.1% was found in babies tested at  $\leq 6$  weeks,  $>6$  weeks -6 months and  $>6$  months-18 months, respectively [Table 2]. The prevalence of HIV in children who had been breastfed was 3.7% while it was 3.4% in babies who had not been breastfed [Table 3].

**Table 2.** Age of distribution and HIV transmission

Age Category of Babies	HIV DNA PCR Result n (%)		Total (%)	$\chi^2$	p-value
	Positive	Negative			
$\leq 6$ weeks	48(1.5)	3084(98.5)	3132(58.2)		
$>6$ weeks to 6 months	81(4.6)	1692(95.4)	1773(33)	269.356	$<0.001$
$>6$ months to 18 months	81(17.1)	392(82.9)	473(8.8)		
Total	210(3.9)	5168(96.1)	5378(100)		

\*356 babies had no data on age

**Table 3.** Breastfeeding and HIV transmission

Breastfeeding status	HIV DNA PCR Result n (%)		Total (%)	$\chi^2$	p-value
	Positive	Negative			
Yes	204(3.7)	5290(96.3)	5494(98.4)	0.024	0.877
No	3(3.4)	84(96.6)	87(1.6)		
Total	210(3.8)	5374(96.2)	5584(100)		

\*150 babies had no data on breastfeeding

When neither mother nor baby received ARVs the prevalence was 33%; when only baby received ARVs the prevalence was 10.8%; when only mother received ARVs the prevalence was 9.1% and when both mother and baby received ARV for PMTCT the prevalence reduced to 1.5%

**Table 4.** Intervention status and transmission rates

Intervention status	Number	Positive result	Transmission rate (%)	p-value
Both	4750	72	1.5	
Mother only	317	29	9.1	$<0.0001$
Baby only	250	27	10.8	
None	215	71	33	

## Discussion

The overall prevalence in this study is 3.9% which is lower than 8.6% reported from a previous study in another tertiary facility in Benue State (13). Similarly, the transmission at 6 weeks age of 1.5% was

also lower than in the Cameroonian study with a transmission rate of 2.6 % (14). The current HIV prevalence in the state is 15.4% which is above the national mean of 3.0% (FMOH,2015). In Nigeria MTCT and transfusion of infected blood and blood products accounted for 20% of other modes of new HIV infection and the high HIV prevalence in women for the brunt of MTCT. MTCT is responsible for more than 90% of HIV infections in infants and young children (FMOH, 2015; NACA, 2017). This improvement is attributed to aggressive efforts of partners in scaling up PMTCT and EID thus resulting in enhanced coverage of ARV therapy among positive women and recent implementation of new PMTCT guidelines to commence all pregnant women on ARVs despite the CD4 count in the state. The WHO in 2014 defined the validation criteria of eMTCT. The impact indicators are achievement of < 50 new HIV infections in children per 1000 live births. MTCT rate of <5% in breastfeeding or <2% non-breastfeeding populations (15). In this our study MTCT rate is less than 5% in a predominantly breastfed population. This means Benue State is on course towards eMTCT.

Although 98.4% of infants and children in this study are breastfed over 80% of them were under ARV cover in line with the new PMTCT guideline (option B+) of lifelong ART to all pregnant and breastfeeding women. The relationship between age at PCR and transmission of HIV may be attributed to the prolonged exposure to breast milk which increases the risk of transmission in older infants and children. The findings in this study is an indication of improvement in PMTCT outcomes within the Benue health system. This also points to the fact that public health policies of government such as roll out of new 2016 guidelines following WHO guidance are yielding positive results. This study supports the current policy framework of WHO Option B+, which stipulates that HAART should be made available to all HIV-positive pregnant women irrespective of CD4 count (WHO, 2016).

The rate of MTCT increased to 33% when neither mother nor baby received any intervention. This is consistent with the MTCT risk of 25-45% in developing countries in the absence of intervention (De Cock et al,2000), thus emphasizing the importance of a comprehensive PMTCT programme and its primary role in reducing HIV transmission (Agboghoroma, Audu, Iregbu,2015).

With the development of effective ARV interventions, evidence-based successes have been attained over the years to prevent MTCT. It is unfortunate that in Africa this prevention is challenging, mostly due to low global coverage of HIV counselling and testing, the low number of women that are offered effective interventions to prevent MTCT and prevention of breastfeeding transmission, which has remained largely elusive due to socio-cultural challenges. This study further revealed that maternal ARV therapy has a more significant role in reducing transmission rates than when only the baby was given ARV after birth (9.1% versus 10.8%). This is because the rate of transmission to the baby is lowered by the lower maternal viral load achieved with maternal ARV (Chukwuemeka,2014; Pharr et al,2016).

This study could not determine the CD4 count and viral loads of the mothers to correlate the influence of viral load as a contributor to infection in babies. It has been established that the risk of HIV transmission through breastfeeding is 3 to 10 times higher among women with CD4 count < 200 cells/ml (Fowler et al,2007). Another limitation in this study is that the proportion of women who mixed fed was unknown in the study population.

## Conclusion

The single most important intervention in PMTCT programmes is the use of ARVs. When both mother and child receive adequate therapy there is a much more reduction of MTCT than when given to either alone. Low MTCT rates are therefore achievable in Nigeria through rapid scale up of the PMTCT programme. Other non-chemo prophylactic factors especially breastfeeding and its duration remains a significant risk factor and its continued advocacy remains controversial especially in settings where the mothers cannot be adequately monitored for treatment adherence and adequate viral suppression. Determination of the effect of these specific interventions is achievable, and requires further prospective cohort studies

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