

The impact of a HIV prevention of mother to child transmission program in a Nigerian early infant diagnosis centre

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ABSTRACT

Background: Mothers infected with human immunodeficiency virus (HIV) can transmit the virus to their babies in utero, intrapartum or postpartum through breastfeeding. Maternal to child transmission can be prevented through administration of antiretroviral drugs to mother and child, and through restriction of breastfeeding. This study evaluated the effectiveness of prevention of mother-to-child transmission (PMTCT) activities in reducing the incidence of HIV infection among exposed babies at the National Hospital Abuja, Nigeria. **Materials and Methods:** Early infant diagnosis laboratory records of 515 exposed babies aged below 18 months who had polymerase chain reaction (PCR) test between January 1st 2011 and December 31st 2012 were reviewed. The details of antiretroviral (ARV) therapy commencement for mother and baby, infant feeding choices, mode of delivery and HIV test results were analysed. **Results:** Of the 515 samples tested, 36 (7.0%) were found to be positive. The mean age of exposed children tested was 4 months. Highest prevalence was among children in the age group 6-18 months (16.1%). There was statistically significant association between HIV positive results and age. ($P = 0.0000$). If the mother and child pairs received ARVs, the prevalence was 1.3%, whereas if the mother only received ARV, then the prevalence was 4.6%, and when only the child received ARV the prevalence was 20.0%. When neither the mother nor the child received ARVs, the prevalence was 66.7%. **Conclusion:** 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. This further emphasises the usefulness of ARVs as the single most important intervention in PMTCT. Therefore, there is need to expand antiretroviral coverage, ensure access of the PMTCT program, and provide effective services to support infected children.

Key words: Abuja, early infant diagnosis, HIV, prevention of mother-to-child transmission

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INTRODUCTION

Globally, at the end of 2011, 34.0 million [31.4 million-35.9 million] people were living with HIV, including 3.4 million (3,000,000-3,800,000) children less than 15 years of age.¹ In that same year, 330,000 [280,000-390,000] children acquired human immunodeficiency virus (HIV) infection.² This represents a 43% decline since 2003 and a 24% drop since 2009.² In 2010, about 250,000 (220,000-290,000) children, aged less than 15 years, died from acquired immunodeficiency disease syndrome (AIDS) related causes.¹

Sub-Saharan Africa continues to bear the burden of the HIV pandemic, with Nigeria as one of the countries with the highest burdens of paediatric AIDS.² In 2011, Nigeria had an estimated 440,000 children, under 15 years, living with HIV.³

Mother-to-child transmission (MTCT) accounts for 90% of HIV infections in children under the age of 15 years.¹ Prevention of mother-to-child transmission (PMTCT) has become a key public health priority in Nigeria, a country faced with 56,681 annual HIV-positive births and more than 210,000 women living with HIV.⁴ The national PMTCT programme in Nigeria commenced in 2002 with supports from the World Health Organisation (WHO) and The United Nations Children's Fund (UNICEF).⁵ In 2008, MTCT of HIV was reported as the most common route of transmission among the paediatric age group in the National Hospital Abuja.⁶ The importance of PMTCT in reducing paediatric morbidity and mortality cannot therefore, be overemphasised.

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There are about 1,216 PMTCT service points across the Nigeria presently.³ In 2009, 18.7% of pregnant women living with HIV received antiretroviral (ARV) agents to reduce the risk of MTCT, showing a significant increase in PMTCT coverage from 5.3% in 2007, although the coverage for ARV prophylaxis during the breastfeeding period has still remained low.⁷ Providing ARV prophylaxis to pregnant women living with HIV has prevented more than 350,000 children from acquiring HIV infection since 1995 and resulted in a 24% decline in newly infected children since 2004.¹

Mother-to-child transmission of HIV can occur in uterine (*in-utero*), during delivery (intrapartum), or after birth (postnatally) through breastfeeding. Strategies to reduce MTCT focus on these periods of exposure and include the use of ARVs, caesarean section before onset of labour or rupture of membranes, and complete avoidance of breastfeeding.⁷ These combined interventions when followed effectively, reduce the risk of MTCT to as low as 1-2%.⁸ Without intervention 30-45% of all infants born to HIV positive mothers will be infected and 10-20% will be infected through breastfeeding.⁹ Early infant diagnosis (EID) programs can be used to evaluate the impact of PMTCT, as well as substantially improve the survival rates.⁸ This study evaluated the various PMTCT methods used by mother and child pairs and the effect this had on the outcome of the infants' HIV status.

MATERIALS AND METHODS

This was a retrospective study at the National Hospital Abuja, a 200-bed referral tertiary hospital located in the Federal Capital Territory of Nigeria. The early infant diagnosis laboratory register of all blood samples submitted over a 2 year period from January 2011 to December 2012 were reviewed. Included in this study were all exposed patients whose samples were sent for HIV DNA PCR within the specified time period. Patients whose ages were unspecified and whose results were not entered into the register were excluded from this study. Relevant data such as age, sex, ARV therapy for mother and baby, infant feeding choices, mode of delivery and HIV DNA results were analysed.

All samples were received as dried blood spots (DBS)¹⁰ at the Medical Microbiology and Parasitology laboratory and processed by HIV DNA PCR using Amplicor HIV-1 DNA assay version 1.5 (Roche Molecular Systems, Branchburg, NJ, USA) according to manufacturer's instructions.¹¹ The protocol used in the tests were in accordance with the Nigerian National PMTCT guideline.⁵

Results were analysed using STATA version 12 software (StataCorp, College Station, Texas, USA) and presented as simple averages and percentages. Statistical analysis was done using the Pearson's Chi-square test and Fisher's exact test.

RESULTS

Five hundred and fifteen children were included in the analysis while 7 were excluded from the study due to data incompleteness.

The mean age group at the time of DBS sample collection was 4 months, with a range of 17.5 months (0.5-18 months). Total of 179 (34.8%) samples were taken from babies aged 6 weeks or less, 243 (47.2%) samples were taken from babies greater than 6 weeks to and up to 6 months old and 93 (18%) were from babies greater than 6 months to and up to 18 months of age. Total of 323 (62.9%) mothers were on ARVs prior to pregnancy, while 122 (23.5%) commenced ARVs during pregnancy. Total of 349 (67.8%) of the exposed babies received single dose nevirapine (sdNVP) at birth, 62(12%) received zidovudine (AZT) for 6 weeks and 50 (9.7%) received nothing. 252(48.9%) of the babies had been breastfed, while 252 (48.9%) were never breastfed. [Table 1]

Thirty-six out of 515 exposed babies tested positive to HIV giving an overall prevalence of 7%. Prevalence of 0.6%, 8.2% and 16.1% was found in babies tested at ≤ 6 weeks, >6 weeks -6 months and >6 months-18 months, respectively (Pearson's $\chi^2(2) = 23.9097$, $P_v = 0.0000$) [Table 2]. The prevalence of HIV in children who had been breastfed was 9.1% while it was 3.6% in babies who had not been breastfed (Fisher's exact = 0.016) [Table 3].

Table 1: Baseline characteristics of babies enrolled in the study (n = 515)

Characteristics	Number (%)
Gender	
Male	253 (49.1)
Female	244 (47.4)
Unspecified	18 (3.5)
Age	
≤ 6 weeks	179 (34.8)
>6 weeks-6 months	243 (47.2)
>6 months-18 months	93 (18.0)
Maternal ARVs	
HAART prior to pregnancy	323(62.9)
HAART started during pregnancy	122 (23.5)
No HAART	44 (8.5)
Unspecified	26 (5.0)
Infant ARVs	
Single dose NVP	349 (67.8)
AZT for 6 weeks after birth	62 (12)
No ARV at all	50 (9.7)
Unspecified	54 (10.5)
Infant ever breastfed	
Yes	252 (48.9)
No	252 (48.9)
Unspecified	11 (2.2)
Mode of delivery	
SVD	181 (35)
CS	153 (29.7)
Unspecified	181 (35.3)

The prevalence of 3.3% was found among babies whose mothers had caesarean (CS), whereas it was 6.1% in those who were delivered vaginally.

When neither mother nor baby received ARVs the prevalence was 66.7%; when only baby received ARVs the prevalence was 20.0%; when only mother received ARVs the prevalence was 4.6% and when both mother and baby received a form of chemoprophylaxis for PMTCT the prevalence reduced to 1.3% [Table 4].

DISCUSSION

The overall prevalence in this study is lower than 9.1% reported in 2010 from a previous study conducted at the same centre.¹² This improvement might be due to enhanced coverage of ARV therapy among positive mothers and the recent change in guidelines to commence all pregnant women on ARVs despite the CD4 count. A comparable rate had been reported in South Africa (6.2%) whereas rates reported from the University of Abuja teaching hospital (33.7%), Zambia (12.2%) and Maiduguri (9.9%) are seemingly higher.¹³⁻¹⁶ Due to improving trends in the Nigerian PMTCT protocol over the years, this study is more recent than the one done at the University of Abuja study and may account for the wide variation in the prevalence rates despite the close geographic proximity between the two centres.

Table 2: Age distribution and HIV transmission (n = 515)

Age	HIV +ve %	HIV -ve %	Total %
≤6 wks	1 (0.6)	178 (99.4)	179
>6 wks-6 months	20 (8.2)	223 (91.8)	243
>6 months-18 months	15 (16.1)	78 (83.9)	93
Total	36 (7.0)	479 (93.0)	515 (100)

Pearson's $\chi^2(2) = 23.9097$, $Pv = 0.0000$

Table 3: Breastfeeding and HIV transmission (n = 504)

Breastfed	HIV +ve %	HIV -ve %	Total %
Yes	23 (9.1)	229 (90.9)	252
No	9 (3.6)	243 (96.4)	252
Total	32 (6.3)	472 (93.7)	504 (100)

11 babies had no data on breastfeeding, Fisher's exact = 0.016

Table 4: Overall rate of positivity with pharmacological intervention (n = 453)

Antiretroviral drugs Received	Total No	No Positive	Percentage positivity %
Both mother and baby	397	5	1.3
Only mother	22	1	4.6
Only baby	10	2	20.0
Neither mother nor baby	24	16	66.7

56 mothers and babies had no data on ARV usage

Studies conducted in Anambra and Abuja reported prevalence rates of 3.6% and 2.7%, respectively in mothers who had strictly adhered to the PMTCT protocol, but these rates are higher than that found in this study.^{14,17} In this study the prevalence of HIV in the exposed babies among only mother-baby pairs who received ARVs was as low as 1.3%, highly comparable to the figures in high income countries such as North America and United Kingdom of less than 2%.¹⁸

The rate increased significantly to 66.7% when neither mother nor baby received any form of therapy, thus emphasising the importance of a comprehensive PMTCT programme and its primary role in reducing HIV transmission. The prevalence of HIV infection in babies whose mothers had been on highly active antiretroviral therapy (HAART) (1.2%) prior to pregnancy was similar to the prevalence in babies whose mothers were commenced on HAART during the pregnancy (1.6%), suggesting that time of commencement of maternal ARV, prior or during pregnancy, may have little or no impact on MTCT programme outcome.

Evidence-based successes have been attained over the years to prevent MTCT with the development of effective ARV interventions.¹⁹⁻²¹ Unfortunately, this prevention remains challenging in Africa, 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.¹⁹ 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 (4.6% versus 20.0%). This is because the lower the maternal viral load achieved with maternal ARV, lowers the rate of transmission to the baby.¹⁸

In 2010, the World Health Organisation (WHO) revised the PMTCT guidelines and advocated that all infants born to HIV-positive mothers should receive a course of ARV drugs, be exclusively breastfed for 6 months and complementary fed for up to a year.²² In this study, the highest prevalence was seen among those greater than 6 months of age, and this group has majority of those that had been breastfed at some point in time. The study further revealed an increasing trend in prevalence from birth to 18 months. Prevalence in babies less than 6 weeks was 0.6% compared to 8.2% at greater than 6 weeks to 6 months and then 16.1% at greater than 6 months to 18 months. The most common factor that could transmit HIV infection to children at these ages is breast feeding and the association was statistically significant (Pearson's $\chi^2(2) = 23.9097$ and $Pv = 0.0000$). Also breastfed babies had a higher overall prevalence (9.1%) when compared to those that had not been breastfed (3.6%) with a statistically significant association between breastfeeding and HIV transmission

(Fisher's exact = 0.016). A statistically significant association was also found between HIV transmission and ARVs among breastfed mothers with a Pearson's $\chi^2(3) = 108.98$, and $P_v = 0.0000$. Three (1.6%) of the babies that were breastfed were found positive despite the use of ARVs in both mother and baby, whereas 18 (73.3%) were found positive when neither mother nor baby received any form of HAART [Table 5]. All these implicated breastfeeding as a major means of transmission postpartum.

Results from a pooled analysis from Côte d'Ivoire and South Africa showed that the overall risk of MTCT was twice as high among children breastfed for greater than 6 months than among children breastfed for less than 6 months.²³ Breastfeeding beyond six months should therefore be avoided when replacement feeding can be achieved safely and sustainably after breastfeeding cessation. Ideally HIV positive mothers should not breastfeed. Only 12 babies, out of the 252 that had been breastfed were retested at an average time interval between 1st testing and repeat testing of 4.4 months after breastfeeding had been stopped. All 12 babies who had been negative at the 1st testing remained negative and all their mothers were on HAART throughout breastfeeding.

This being a retrospective study, was not readily feasible to determine the CD4 count and viral loads of the mothers to be able to ascertain whether infection in those babies that were breastfed was due to poor or absent viral suppression. 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.¹⁸ Another limitation in this study is that the proportion of women who mixed fed was unknown in the study population. This demonstrates that advocating exclusive breastfeeding for 6 months in women on HAART in low-to middle-income countries without proper counselling, closely following up the mothers and performing virological testing for suspected cases of failure may pose a threat to achieving successful reduction in overall MTCT rates.

CONCLUSION

The use of ARVs remains the single most important intervention in PMTCT programmes and 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-chemoprophylactic 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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Table 5: Association of HIV transmission and pharmacological intervention among breastfed babies (n = 252)

ARV use	HIV +ve %	HIV -ve %
Both Mother and baby	3 (1.6)	191 (98.4)
Only mother	1 (7.7)	12 (92.3)
Only baby	1 (33)	2 (66.7)
Neither mother and baby	11 (73.3)	4 (26.7)

Pearson's $\chi^2(3) = 111.81$ $P_v = 0.000$

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