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The Prevalence and Predictors of HIV Infection among Children of Mothers who Missed Prevention of Mother to Child Transmission of HIV Interventions in Makurdi, Nigeria

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Abstract

Introduction: In Nigeria, gaps between uptakes of Prevention of Mother To Child Transmission of HIV (PMTCT) interventions by HIV-infected women continue to exist with its consequent increase in perinatal HIV epidemic. This study aims to determine the predictors and HIV infection rates among infants and children of mothers of PMTCT Gaps in a major Nigerian city.

Methods: It is a retrospective study that involved infants and children seen at the Federal Medical Centre, Makurdi, between June 2009 and June 2011. The bivariate and multivariable logistic regression models were used to identify risk factors that may predict MTCT of HIV.

Results; A total of 224 subjects comprising 121 males (M) and 103 females (F) with a M: F ratio of 1:0.9 was seen. The median age was 150 days with a range from 4 days to 690 days. MTCT of HIV was 34.4% (77/224). In multivariate analyses and after adjusting for other factors: absence of episiotomy at delivery (Adjusted Odd Ratio –AOR 0.063, 95%CI 0.005-0.773, p=0.031), *partial* PMTCT interventions involving antiretroviral given to mothers and their babies-after 72 hours of life, (AOR 0.050, 95%CI 0.005-0.512, p=0.031), mixed feeding (AOR 4.017, 95%CI 1.030-15.665, p=0.045), maternal HIV viral loads of 1001-10,000 copies/ml (AOR 3.207, 95%CI 1.158-8.882, p=0.025) and children presenting at older than 12 months of age (AOR 26.331, 95%CI1.244-557.230, p=0.036) remain independently associated with HIV transmission.

Conclusion: The high prevalence of MTCT of HIV in the present study can be prevented if access, uptake and PMTCT interventions are improved.

Keywords: Prevalence; Predictors; HIV; MTCT; PMTCT-Gaps; Makurdi

Introduction

In 2008, an estimated 1.4 million HIV infected pregnant women living in low- and middle-income countries gave birth and 91% of these women reside in sub-Saharan Africa [1]. Without intervention, 25-40% of infants born to HIV-positive mothers will become infected [2] and mother to child transmission of HIV (MTCT) is responsible for over 85% of paediatric HIV/AIDS [3,4]. With current interventions of Prevention of Mother to Child Transmission of HIV (PMTCT), this risk can be reduced to between 1-2% [2]. The PMTCT program started in Nigeria in 2001 in 6 tertiary health facilities but has steadily increased to involve 1,320 sites spread across the 36 States of the country and its Capital, Abuja [5]. However, uptake of PMTCT interventions at these sites has been meagre, increasing from 11% in 2010 to 20.7% in 2012 [5] and Nigeria remains one of the 22 focus countries of the Global Plan to Eliminate MTCT [6]. The Nigeria National AIDS Control Agency (NACA) has rightly identified the challenges facing PMTCT to include poor uptake despite the availability of PMTCT services and commodities amongst others [5]. For example in Benue State where the study was done, there are currently 200 PMTCT sites spread across all the 23 local Government Areas, [7] with the Federal Medical Centre, (FMC) offering a tertiary level of PMTCT interventions in Makurdi, the state capital. Despite the availability of these facilities, the FMC continues to record HIV infected infants, whose mothers did not access, initiate and sustain PMTCT interventions. Although, the knowledge and documentation of the Preventers and Barriers of PMTCT services are important and are also being studied by the Authors, the present study focuses on the prevalence and risk factors of MTCT of HIV among infants and children whose mothers have missed or had a partial PMTCT intervention.

Material and Methods

Study area and setting

The study was carried out at the Paediatric ART (Antiretroviral therapy) Clinic of the Riverside Specialist Clinics of the FMC, Makurdi. The Centre is the only tertiary health hospital providing care and treatment for children exposed to or infected with HIV in Benue State. It provides paediatric HIV care and treatment in accordance with the Nigeria National Guidelines on Paediatric HIV/AIDS Treatment and Care. It is also a referral centre for primary and secondary health facilities in Benue State and the surrounding states of Taraba, Nasarawa, and Kogi. The facility is supported by the AIDS Prevention Initiative

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in Nigeria (APIN) /Harvard PEPFAR (The USA President's Emergency Plan for AIDS Relief) program.

Ethical consideration

Ethical approval for the study was obtained from the Hospital Research and Ethics Committee. HIV-exposed and infected infants were recruited into care and treatment upon consent of their parents or caregivers.

Study population

It is a retrospective study that involved infants and children seen at FMC, Makurdi between June 2009 and June 2011. Study proforma was developed to retrieve relevant data that were routinely recorded in infants' Initial Visit Forms at recruitment and the last pre-delivery Follow-up Clinical Forms for mothers that attended antenatal care at the centre. Inclusion criteria included HIV-exposed babies older than 72 hours who were delivered to HIV-infected mothers. HIV infection may have been confirmed in these mothers before and during pregnancy, in labour and after delivery. Exclusion criteria included the receipt of blood transfusion and or those with a proven history of sexual abuse that may suggest horizontal mode of HIV transmission.

Follow-up of HIV positive pregnant mothers and their infants and operational definitions

Scheduled follow-up clinic attendances for HIV-exposed infants were as follows: every 2-week for the first 6 weeks, every month for the first 3 months and thereafter, every 3-month till the age of 18 months. Early infant diagnoses with the DNA/PCR were offered at the 6th week and 3rd month of life or at any time before the age of 18 months. Antibody diagnostic tests were applied for the infant presenting at and beyond 18 months of life. Universal co-trimoxazole prophylaxis was commenced for all infants from 6 weeks of life. Unscheduled visit took place at any time when diagnostic assessments of presenting problems were done. Infants with a confirmed HIV-infection were recruited into care and anti-retroviral therapy.

PMTCT Interventional guidelines for the mothers followed the 2004, 2006 and 2010 WHO [8] recommendations depending on the year of pregnancy and whether ANC and or delivery took place at FMC Makurdi (tertiary interventions) or at the referring primary and secondary PMTCT centers.

During the first ANC visit, all pregnant women received HIV testing and counseling and those found HIV-infected were screened for clinical and immunological eligibility for the commencement of ART. Mothers who were eligible received highly active antiretroviral therapy (HAART) regimen including Zidovudine (AZT) plus Lamivudine (3TC) plus Nevirapine (NVP) from 14 weeks of gestation. Mothers that were not qualified for HAART also receive ARV chemoprophylaxis including zidovudine (AZT) from 14 weeks and administration of single dose nevirapine (sdNVP) during labour and with Zidovudine plus Lamivudine also given for one week to cover the Nevirapine tail. Pregnant women starting prophylaxis at 33 weeks of gestation were given zidovudine (AZT) plus Lamivudine (3TC) and sdNVP taken during labour. Women newly diagnosed for HIV during labour received sdNVP alone which was followed with a week course of Zidovudine and Lamivudine combination. Zidovudine from gestational age of 14 weeks till delivery and single dose nevirapine during labour were the only option given at the primary and secondary health facilities referring to FMC Makurdi. Infantile prophylaxes for the HIV-exposed babies included daily doses of Nevirapine (NVP), commenced within the first 72 hours of life and given for the first 6 weeks of life or a single dose NVP at birth and zidovudine, commenced within the first 72 hours of life and given for the first 6 weeks of life. CD4+ lymphocyte count and HIV-1 ribonucleic acid (RNA) level were measured at scheduled visits during ANC for FMC Makurdi attendees.

Subjects are consecutive infants who met the inclusion criteria and did not access full PMTCT interventions. Access to full PMTCT interventions is ***strictly defined*** as a combination of the following: first, receipt of ARV medicine by HIV-infected pregnant women for their own HIV disease or for the purpose of PMTCT during antenatal care or in labor; second, HIV-exposed babies' receipt of ARV prophylaxes as described above. As previously categorized elsewhere [9], HIV-exposed or infected babies who did not access full PMTCT interventions would then include; (1) babies whose mothers received ARV prophylaxis/ treatment but had no ARV prophylaxes, (2) babies who received ARV prophylaxes while their mothers had no ARV prophylaxis/ treatment (3) babies whose mothers had ARV prophylaxis/treatment but receive ARV prophylaxes after 72 hours of age and (4) mother-baby pairs that did not receive ARV prophylaxis/treatment. For mothers who attended ANC at FMC Makurdi, pre-trained nurses provided education and training on mothers' informed choices of either breastfeeding or replacement feeding. A 6-month supply of commercial infant formula was offered free by the programme but dispensed to the mothers on a monthly prescription.

Exclusive breastfeeding (EBF) was defined as the infant receiving only breastmilk from birth to 6 months of age from his/her mother and no other liquids or solids, with the exception of drops or syrups consisting of vitamins, mineral supplements, or drugs [10]. Exclusive breastmilk substitute feeding (EBMS) was defined as provision of infant formula and the exclusion of all breastfeeding during the first 6 months of age [8]. Mixed breastfeeding (BF+BMS) was defined as giving breast milk with non-human milk or solids at any time during the first 6 months of age [10].

Data collection and management

The following relevant information from the subjects' Initial Visit Forms were obtained: age at presentation, gender, mothers' receipt of ARV prophylaxes/treatment or not, mode and place of delivery, presence of prolonged rupture of membrane of more than 4 hours, vaginal tear, episiotomy, gestational age at birth, birth weight, types of ARV prophylaxes in the infants, mothers' breast conditions, babies oral thrush/sore, history of breastfeeding/mixed feeding/exclusive breast milk substitute feeding and the anthropometric measures of weight and height . Anthropometric computations and comparisons were conducted using the WHO anthro software which is based on WHO child growth standards 2006 [11]. Underweight was defined as a weight for age z-score (WAZ-score) less than -2 standard deviations (SD) from the WHO reference median values [11]. Stunting was defined as height for age z-score (HAZ-score) less than -2SD from the reference values and weight for height z-score (WHZ-score) less than -2SD from the WHO reference median defined wasting [11]. For mothers who attended ANC at FMC Makurdi, the last Follow-up Visit Forms before delivery were analysed for information such as the viral load, CD4 count, haemoglobin count, Hepatitis B surface antigen and Hepatitis C virus antibodies.

Outcomes

Outcomes of HIV-screening included HIV-infected infants defined as babies whose mothers are HIV-infected and had two positive

consecutive DNA/PCR results at the 6th week and the 3rd month of life for babies who presented before the 6th week of life and two positive DNA/PCR results for babies presenting to the health facility after the 6th week of life and before the age of 18 months. Two negative consecutive DNA/PCR results defined HIV-exposed un-infected babies delivered to HIV-infected mothers. When the first two DNA/PCR results are discordant, a 3rd DNA/PCR confirms negativity or positivity. For subjects that are ≥18 months, they had an initial double rapid HIV antibody tests using Determine HIV1/2 first and then HIV 1/2STATPAK in serial algorithm. HIV infection was then confirmed in subjects who had reactive rapid test by using a Western Blot test. Because the exposed infant's and children's HIV status was first assessed and documented between the ages of 4 days and 23 months at presentation, it was difficult to know precisely when HIV infection occurred.

Statistical analysis

Statistical analysis was done using SPSS version 16. Descriptive analysis was employed to describe the proportion of HIV-infected babies by age groups, gender and categories of babies that did not access or had a partial PMTCT. Baseline demographic characteristics were presented as proportions, medians with interquartile ranges (IQR), and means with standard deviations (SD). The bivariate and multivariable logistic regression models were used to identify *a priori* variables [12] that may predict MTCT of HIV (and other variables that may predict MTCT of HIV). These other variables include HIV-Hepatitis B and HIV-Hepatitis C virus co-infections in the mother, maternal anaemia, maternal marital and socioeconomic status. Others include number of children in the household as well as history of prior hospitalization in the children at presentation. Only variables with p value of 0.1 at the bivariate analysis were considered for multivariate logistic regression. For all analyses, confidence intervals (CI) were set at the 95% level and p-values less than 0.05 were considered statistically significant.

Results

Some clinical and demographic characteristics of the subjects at presentation

Table 1 shows that a total of 224 infants and children was seen during the period of study. Four infants were excluded having received blood transfusions at a primary health facility. Other 26 subjects did not have the complete records of data of interests. Out of the 224 subjects' studied, only 71 (31.7%) attended ANC at FMC Makurdi. The remaining 153 mothers (68.3%) were referred from both primary and secondary health centres from Benue and its surrounding states. The 224 subjects comprised 121 males (M) and 103 females (F) with an M: F ratio of 1:0.9. There were 5 twin-pairs. The median age was 150 days with a range from 4 days to 690 days. The mean Gestational Age (GA) was 39.22 weeks with a Standard Deviation of ± 1.92 weeks. A total of 113 subjects (50.4%) were stunted with a median HAZ-score of -2.030 and Interquartile Range (IQR) of -3.645 to -0.553. A little below half, 110 (49.1%) subjects were underweight with a mean WAZ-score of -1.915 and a SD of ± 2.14. Wasting was only found among 68 subjects (30.4%), with a median WHZ-score of -0.750 and IQR of -2.308 to 0.7150.

A majority-216 (96.4%) of the subjects was born via the vagina. Prolonged rupture of the membrane occurred among 93 subjects (41.5%). Only one-third of the children had ARV prophylaxes including 42 (18.8%) that had NVP for 6 weeks and 26 (11.6%) that were given sdNVP at birth and ZDV for 6 weeks. MTCT of HIV was 34.4% (77/224) accruing from the 77 subjects that were HIV-infected.

Characteristics	Number (%)
Gender	
Male	121 (54.0)
Female	103 (46.0)
Age at presentation	
Median age in days (IQR)	150 (30-330)
≤6 weeks	65 (29.0)
>6 weeks – 6 months	58 (25.9)
>6 months – 12 months	63 (28.1)
>12 months	38 (17.0)
GA	
Mean (±SD)	39.22 (1.92)
≥37 weeks	210 (93.8)
37 weeks	14 (6.2)
WAZ	
Mean (±SD)	-1.915 (2.14)
Underweight	110 (49.1)
Not underweight	114 (50.9)
HAZ	
Median (IQR)	-2.03 (-3.65 to 0.55)
Stunted	113 (50.4)
Not stunted	111 (49.6)
WHZ	
Median (IQR)	0.75 (-2.31 to 0.72)
Wasted	68 (30.4)
Not wasted	156 (69.6)
No. of children in the household	
≤4	86(38.4)
>4	138(61.6)
Delivery type	
Elective C/S	2 (0.9)
Emergent C/S	6 (2.7)
Vaginal	216 (96.4)
ROM	
<4 hours	129 (57.6)
≥4 hours	93 (41.5)
Nil	2 (0.9)
ARV prophylaxis in Infants	
NVP (6 weeks)	42 (18.8)
sdNVP + ZDV (6 weeks)	26 (11.6)
None	156 (69.6)
HIV Screening outcome	
Negative	147 (65.6)
Positive	77 (34.4)
Mode of HIV screening	
DNA/PCR	215 (95.9)
RVST	9 (4.1)
Sources of referral	
FMC	71 (31.7)
Private 1^0	133 (59.4)
Government 1^0 +2^0	20 (8.9)

C/S- Caesarean section, ROM= Rupture of membrane, RVST= HIV antibody test, 1^0=Primary health facility, 2^0= Secondary health facility

Table 1: Some clinical and demographic characteristics of subjects at presentation.

Some characteristics of the 71 mothers that had ANC at FMC Makurdi

Table 2 reveals that among the 71 mothers that attended ANC at FMC Makurdi, the mean CD4 count was 356.12 ± 199.66 with 16 (22.5%) women having CD4 count of ≤ 200 cells /mm^3. The median viral load was 65,026 copies/ml and IQR of 2848 to 386,846 copies/ml and only 6 (8.5%) mothers had undetectable viral load. The mean haemoglobin was 10.31g/dl ± 1.65 and 27 (38%) were anemic. Hepatitis B surface antigen was positive in 9 (12.7%) and Hepatitis C antibodies in 3 (4.2%) women. Most mothers-211 (94.2%) were having a form of partner (husbands or co-habitants) at the time of the study and a similar number, 212 (94.6%) was earning a monthly income below the Nigeria minimum wage of 8,000 Naira (an equivalent of 50 USD). At the time of presentation, 193 women (86.2%) were alive and healthy, with 28 others being sick and 3 mothers had died. Breast abscess was reported in only one mother (0.4%). ARV interventions among the 71 mothers included 44 (62%) that had HAART and 27 (38%) with ARV prophylaxis.

Characteristics	Number (%)
HCV antibody	
Positive	3 (4.2)
Negative	68 (95.8)
HBsAg	
Positive	9 (12.7)
Negative	62 (87.3)
Anaemia	
Mean Hgb (±SD)	10.31 (1.65)
10g/dl	27 (38.0)
≥10g/dl	44(62.0)
Marital status	
With partner	211 (94.2)
Without partner	13 (508)
Social- economic status	
≥minimum wage	12 (5.4)
< Minimum wage	212 (94.6)
Breast abscess	
Yes	1 (0.4)
No	223 (99.6)
Health status	
Alive and healthy	193 (86.2)
Alive and sick	28 (12.5)
Dead	3 (1.3)
Viral load	
Median (IQR)	65,026 (2848 -386,846)
Detectable	65 (91.5)
Undetectable	6 (8.5)
CD4Count	
>200	55(77.5)
≤200	16(22.5)
ARV Interventions	
HAART	44 (62)
ARV	27 (38)

HCV=Hepatitis C virus, HBsAg= Hepatitis B surface antigen, Hgb=haemoglobin

Table 2: Some characteristics of the 71 mothers that had ANC at FMC Makurdi.

Characteristics	HIV Status		OR	95%CI	P value*
	Positive %	Negative %			
CD4 Count					
>200	18 (32.7)	37 (67.3)	Ref		
≤200	11(68.8)	5(31.2)	0.24	0.065-0.855	0.028
Viral load categories					
≤1000	0 () 0.0	6 (100.0)	Ref		
1001-10,000	4(22.2)	14(77.8)	36.06	1.028-1265.00	0.048
10,001-100,000	8(53.3)	7(46.7)	0.79	0.071-8.787	0.847
>100,000	17 (53.1)	15 (46.9)	NA	NA	NA
Viral load					
Undetectable	0 (0.0)	6 (100.0)	NA	NA	0.90
Detectable	29 (44.6)	36 (55.4)			
Hepatitis B					
Negative	24 (38.7)	38 (61.3)	Ref		
Positive	5 (55.6)	4 (44.4)	0.58	0.132-2.548	0.470*

No association was found for Hepatitis C, Maternal anaemia, Marital status and Socioeconomic status . *= Yates's continuity correction done, NA= Not available.

Table 3: Risk factors for HIV transmission during pregnancy.

Characteristics	HIV Status		OR	95%CI	P value*
	Positive %	Negative %			
Vaginal tear					
No	46 (27.7)	120 (72.3)	Ref		
Yes	31 (53.4)	27 (46.6)	0.38	0.198-0.723	0.003
Episiotomy					
No	51(27.6)	134(72.4)	Ref		
Yes	26(66.7)	13(33.3)	0.21	0.099-0.450	<0.001

No association was found for Prolonged Rupture of Membrane and Delivery types.

Table 4: Risk factors for HIV transmission during labour and delivery.

Risk factors for HIV transmission during pregnancy

Table 3 shows that HIV infection was associated with significantly increased odds of high viral load (1001-10,000), [OR=36.06; 95%CI: 1.028, 1265.00; p=0.048]. Maternal CD4 count of >200 is significantly protective against MTCT of HIV [OR=0.24; 95%CI: 0.065, 0.855; p=0.028). Hepatitis B co-infection in the mothers was not associated with MTCT of HIV [OR=0.58; 95%CI: 0.132, 2.548; p=0.470].

Risk factors for HIV transmission during labour and delivery

In Table 4, absence of vaginal tear was significantly protective against MTCT of HIV [OR=0.38; 95%CI: 0.198, 0.723; p=0.003] and so did absence of episiotomy with [OR=0.21; 95%CI: 0.099, 0.450, p=0.001.

Some risk factors in babies, mode of feeding and partial PMTCT interventions

In Table 5, among the HIV infected subjects, underweight was found in 68.8% (53/77), stunting was found in 61.0% (47/77) and wasting in 42.9% (33/77) of subjects. The absence of both oral thrush and underweight in subjects was found to significantly protect against HIV infection, with [OR=0.28; 95%CI: 0.112, 0.718; p=0.008] and [OR=0.40; 95%CI: 0.182, 0.854; p=0.018], respectively. Conversely, HIV infection was associated with significantly increased odds of EBMS [OR=27. 83; 95%CI: 9.770, 79.290; p=0.001], Mixed Feeding [OR=59.64; 95%CI:

Characteristics	HIV Status		OR	95%CI	P value*
	Positive %	Negative %			
Age Group					
≤6 weeks	11 (16.9)	54 (83.1)	Ref		
>6 weeks – 6 months	22 (37.9)	36 (62.1)	------	------	-----
>6 months – 12 months	25(39.7)	38(60.3)	2.20	0.750-6.440	0.151
>12 months	19(50.0)	19(50.0)	3.50	1.120-10.900	0.031
WAZ Score					
Not underweight	24 (21.1)	90 (78.9)	Ref		
Underweight	53(48.2)	57(51.8)	0.40	0.182-0.854	0.018
HAZ Score					
Not stunted	30 (27.0)	81 (73.0)	Ref		
Stunted	47(41.6)	66(58.4)	0.77	0.360-1.631	0.490
WHZ Scores					
Not wasted	44 (28.2)	112 (71.8)	Ref		
Wasted	33(48.5)	35(51.5)	0.53	0.265-1.058	0.072
No. of hospitalization					
Nil hospitalization	40 (27.6)	112 (72.4)	Ref		
1-2	32(46.4)	37(53.6)	2.63	0.721-9.555	0.143
>2	5(50.0)	5(50.0)	1.16	0.307-4.358	0.830
GA at birth					
≥ 37weeks	76 (36.2)	134 (63.8)	Ref		
<37 weeks	1(7.1)	13(92.9)	7.37	0.946-57.465	0.057
Oral thrush					
No	64 (31.5)	139 (68.5)	Ref		
Yes	13(61.9)	8(38.1)	0.28	0.112-0.718	0.008
Mode of Feeding					
EBF	12 (12.0)	88 (88.0)	Ref		
Mixed BMS+BF	14(21.2)	52(78.8)	59.64	20.810-170.900	<0.001
EBMS	51(87.9)	7(12.1)	27.83	9.770-79.290	<0.001
Partial PMTCT					
Mother had & baby After 72 hours	1 (5.0)	19 (95.0)	Ref		
Only mother had ART	28(54.9)	23(45.1)	0.298	0.137-0.650	0.002
Only baby had ART	17(35.4)	31(64.6)	0.604	0.267-1.366	0.226
Mother & baby did not had ART	31(29.5)	74(70.5)	6.660	0.804-55.147	0.079

No association was found for Breast abscess, Breast engorgement and No of children in the household. *= Yates's continuity correction done, GA=gestational age. No. of hospitalization= Prior number of hospitalizations at presentation.

Table 5: Some risk factors in babies, mode of feeding and partial PMTCT interventions.

20.810, 170.900; p=0.001] and those subjects that presented at age of >12 months [OR=3.50; 95%CI: 1.120, 10.900; p=0.031]. Subjects who had EBMS were more infected, 87.9% (51/58), followed by those with Mixed BMS +BF, 21.2% (14/66) and EBF 12% (12/100). The HIV infection rate was also found to increase progressively with age of subjects at presentation: ≤ 6 weeks (16.9%), > 6 weeks- 6 months (37.9%), >6 months-12 months (39.7%) and > 12 months (50.0%)

Multivariate analysis of the risk factors for HIV transmission

In Table 6, in multivariate analyses and adjusting for WAZ, mother's CD4 count, vaginal tears, episiotomy, *partial* PMTCT Intervention, Oral thrush, Mode of feeding, Mother's Viral Load, Age groups, WHZ and GA, only episiotomy, *partial* PMTCT interventions, mode of feeding, mothers' viral load and age at presentation of the subjects remained independently associated with HIV infection. The odds ratio of transmission for women that did not have an episiotomy compared to those that had it was 0.063 (95% CI, p=0.031). The odds ratio was 0.050 (95% CI, p=0.012) when both mothers and their babies had ARV -after 72 hours -compared to when only mothers had ARV for PMTCT intervention. Conversely, the odds ratio of transmission for HIV increased 4.017-fold for children that were fed on EBMS and those that had mixed BMS+BF compared to those with EBF. The odds ratio of transmission of HIV increased 3.207-fold when pre-delivery maternal HIV RNA levels is within 1001-10,000 compared to viral load ≤ 1000. Lastly, the odd ratio increased 26.331-fold when children presented at > 12 months compared to when they presented at ≤ 6 weeks of life.

Discussion

Among the 20 Global Plan Priority Countries, Nigeria had shown a slow decline of 8% of new HIV infection among children between 2009

Characteristics	AOR	Multivariate P-value	95% CI
WAZ	0.425	0.415	0.054-3.330
Mother's CD4 count	0.394	0.389	0.047-3.277
Vaginal tear	0.931	0.953	0.089-9.764
Episiotomy	**0.063**	0.031	0.005-0.773
PMTCT Intervention	0.050	0.012	0.005-0.512
Oral thrush	0.093	0.179	0.003-2.969
Mode of feeding	4.017	0.045	1.030-15.665
Viral Load categories	3.207	0.025	1.158-8.882
Age groups	26.331	0.036	1.244-557.230
WHZ	0.453	0.514	0.042-4.888
GA	NA	NA	NA

NA=Not available

Table 6: Multivariate analysis of the risk factors for HIV transmission.

and 2012 [6]. Also, Nigeria has the largest number of children acquiring HIV infection – nearly 60 000 in 2012, a number that has remained largely unchanged since 2009 [6]. Furthermore, 80% of HIV infected pregnant women did not receive antiretroviral medicines for PMTCT and the same 80% of women or infants did not receive ARV medicines during breastfeeding to prevent MTCT of HIV [6]. Without urgent action in Nigeria, the global target of a decline of 50% of new paediatric HIV infection sets for between 2009 and 2015 is unlikely to be reached.

The high prevalence of MTCT of HIV of 34.4% occurring among mothers-infants pairs with no or sub-optimal access and uptake of PMTCT interventions is instructive as the study was carried out in Benue State, one of the 12+1 states, which had consistently contributed immensely to the high burden of HIV in Nigeria [6]. Benue state, located in the North Central region of Nigeria had the highest survey of HIV prevalence of 12.7% in 2010 [13].

However, the MTCT rate of 34.4% in this study was lower than; 73.7% of HIV infection in Eastern India [14], 67.7% in Abakiliki [15], 69.6% in Jos [16], but higher than 30.0% reported from Enugu [17]. In Africa, geographical differences in the prevalence and rate of MTCT of HIV have been linked to the circulating viral genotypes in different areas with subtype B found predominantly in countries reporting lower MTCT rates of HIV and non-B subtypes and recombinant forms (CRFs) having a higher efficiency of MTCT [18-21].

It has been well established that MTCT of HIV can occur during pregnancy, labour and delivery and during breastfeeding and that in the absence of any intervention; the rate of MTCT is about 15%-25% among non-breastfeeding populations in North America and Europe and 25%-40% among breastfeeding populations in resource-limited countries [2]. However, with intervention, the MTCT rate can be reduced to as low as 2% [2]. It becomes obvious that the burden of new paediatric HIV infection that will continue to see in Nigeria and other Sub-Saharan countries are due to failure in accessing the PMTCT interventions.

The median age of presentation of subjects in the present study was 150 days with a range from 4 days to 690 days. Whereas, it is expected that babies are born in facilities where they can be given ARV prophylaxis for PMTCT within the first 72 hours of life. This delay in presentation contributes to the inaccessibility of PMTCT intervention in our cohort.

The odds ratio of transmission for women that did not have an episiotomy compared to those that had it was 0.063 (95% CI, p=0.031). Sebitoloane et al. [22] had also reported that episiotomy was associated with a two-fold increased risk of postpartum infections among the HIV-positive women. Although, avoidance of episiotomy is a standard care during delivery for PMTCT [12], unfortunately, most deliveries in this study took place at private primary health centres (more than half, 59.4%) where the application of this knowledge may be sub-optimal. Similarly, poor application of standard care during deliveries for the prevention of HIV transmission was also noticed in Indian private health facilities [23,24].

We also found that some sub-optimal PMTCT interventions protects against HIV transmission as the odds ratio was 0.050 (95% CI, p=0.012) when both mothers had ARV and their babies also had ARV, albeit after 72 hours compared to when only the mother had ARV. Providing ARV prophylaxis for the newborn infant is intended to "mop up" circulating virus that may have been transmitted in spite of maternal ARV prophylaxis or treatment; and it is expected to be given within the first 72 hours of life. We proposed that ARV prophylaxes given to infants who presented shortly after 72 hours of life may still offer some protection against MTCT of HIV.

We also found that the odds ratio of transmission for HIV increased 4-fold for children that were fed on EBMS and those that had mixed BMS+BF compared to those with EBF. Also only 12% of babies that had EBF were HIV infected against 21.2% among those on mixed feeding and 87.9% of those on "EBMS". Our findings tend to support the WHO 2010 guideline which recommends that provided the mother and/or baby is receiving ARVs for their health or as prophylaxis, exclusive breastfeeding should be practiced by HIV-infected mothers for the first six months of life [25]. Although, a continuous infant feeding counselling at scheduled visits was in place and BMS were provided free of charge by our program at FMC, Makurdi, we cannot be too sure if mixed feeding has not taken place among these cohorts on "EBMS". Oladokun et al. in Ibadan also reported that although the choice of BMS was 93.5% among the women interviewed, 3.7% actually practiced mixed feeding [26]. In the community of study, stigmatization and social pressure from relatives are contending factors that may pressurize a woman to mix feed even when BMS are provided free. Buskens et al. in South Africa had also reported that both relatives and breadwinner have influence and even authority over options and modes of infant feeding [27]. Nevertheless, the increased risk that mixed feeding posed on HIV transmission has been reported by several studies [29,30].

The odds ratio of transmission of HIV increased 3.207-fold when pre-delivery maternal HIV RNA levels is within 1001-10,000 compared to viral load ≤ 1000. The proportion of subjects with HIV infection was also found to increase with pre-delivery maternal viral load; 0% for those with viral load ≤ 1000, 22.2% (1001-10,000), 53.3% (10,001-100,000) and 53.1% for those greater than 100,000. Similar proportions of HIV infection were reported by Garcia et al. [31] including 0% for viral load 1000, 16.6 % (1000 – 10,000), 52.2 % (10,001-100,000) and 40.6 % of viral load greater than 100,000. John and Kreiss [32], as well as Mofenson et al. [33] in the 1990s have linked high levels of maternal viral HIV RNA to a higher risk of MTCT of HIV. In fact, the earlier realization of this link was part of the basis for the use of ARV drugs to lower maternal HIV viral load during pregnancy, labour and delivery [12].

Lastly, the odd ratio increased 26.331-fold when children presented at > 12 months compared to when they presented at ≤ 6 weeks of life. The HIV infection rate was also found to increase progressively at an older age of subjects. This finding tends to support the fact that the earlier HIV-exposed babies are brought to the health facility, the more feasible it is for ARV prophylaxis to be given and the better results we

get in PMTCT. We have already seen that even when ARV prophylaxis was given to infants who were older than 72 hours, some protection against HIV transmission was possible. Some of the reasons which made the presentation of infants within 72 hours of life impossible have already been discussed earlier.

We did not find any significant association between HIV-HBV co-infection and risk of MTCT of HIV even though systemic co-infections like HBV have been shown to increase the risk for mother-to-child transmission of HIV (MTCT) via stimulation and the release of cytokines and inflammatory agents that enhance HIV replication systemically which then weaken the natural defenses to MTCT [34].

In conclusion, our study would add up to indicate that the practice of episiotomy, *partial* PMTCT interventions, mode of feeding of infants , mothers' viral load and age at presentation of the subjects remained independently associated with HIV infection, when adjusted for other risk factors of MTCT of HIV.

The findings of the study have been passed forward to Benue State AIDS Control Agency (BENSACA) and firm positive actions are being taken to increase the access, the up-take and the sustenance of PMTCT activities in the state

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