

# Evaluation of Some Factors Associated with Mother to Child HIV Transmission in Some States in the North Central Part of Nigeria

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**Abstract:** In developing countries, despite the availability of proven interventions for the Prevention of Mother-to-Child Transmission, HIV in children is still a largely uncontrolled epidemic. Data of infants were collected from infant's medical record and mother's history charts from four states in North central part of Nigeria. Socio-demographic data such as age, occupation, place of delivery and mode of delivery and the rate prevalence in different states were also collected. The data were analyzed using chi-squared test with 95% confidence intervals and p-value (0.05). Out of one thousand four hundred and sixteen data collected on mode of child birth, the percentage mother to child transmission on children delivered through vaginal and cesarean surgery were 17.3% and 16.7%, respectively. Children delivered at home had the highest percentage HIV infection at 19.7%; while children delivered at private hospital had the lowest 16.5%. Younger mothers between the ages of 17-25 had the highest rate of mother to child transmission. Benue and Plateau states had the highest rate of mother to child transmission 21.7% and 20.4%, respectively compared to Nassarawa and Bauchi with infection rate 13.2 and 12.7%, respectively. The data collected in this study demonstrate the factors associated with mother to child transmission of HIV in some states in north central Nigeria.

**Keywords:** HIV, Mother to Child Transmission, Prevalence

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## 1. Introduction

HIV remains a major global public health issue, 32 million lives so far has been lost since the beginning of the epidemic [8]. Globally, approximately 37.9 million people and 1.3 million pregnant women are living with HIV while 1.7 million people became newly infected at the end of 2018 [39, 45]. Every week, roughly 6000 young women become infected with HIV [39]. The Joint United Nations programme on HIV/AIDS fast-track strategy has set diagnosis and treatment goals for 2020 and 2030; target that will significantly reduce both new infections and deaths by 2030 [35]. Regardless of the goals, the annual number of decline from 2010 to 2018 is 16%, a reduction that is far from the goals hence, a need for more viable approach to end the HIV epidemic [10, 40].

HIV/AIDS is also a leading cause of morbidity and premature death in sub-Saharan Africa [22]; coupled with the different patterns of changing HIV prevalence where many areas experience increases and others decrease over the same period [15]. Scientific breakthrough since the scourge of HIV almost four decades ago has successfully managed once a fatal disease with antiretroviral drug (ART) and specific HIV screening tests [14, 40]. In spite of the rapid increase in the use of ART and programs to prevent HIV transmission, 61% of new infection at the end of 2018 is from sub-Saharan Africa [39]. More than 70% of all new HIV infections among young people are in sub-Saharan Africa, which also has the fastest growing youth population in the world [38]. The burden of the global HIV infection is unduly concentrated in Africa where in 2018, 25.7 million people are living with HIV and 1.1 million recorded new infection [46]. Nigeria has

the second highest burden of HIV diseases in the world and the greatest number of new HIV infections among children [36, 29]. Nigeria recorded 130, 000 new HIV infection in 2018; where 55,000 are from women above 15 years of age, 47,000 are from men and 24,000 from children below the age of 15 [40]. In addition, about 1.9 million Nigerians are living with HIV infection, with women having the highest number of infection [40]. More so, the high prevalence rate of HIV and inability to reduce the risk of infection, is of particular concern for Africa [38].

Mother-to-child transmission (MTCT), which is also known as vertical or perinatal transmission, accounts for the vast majority of infections in children. MTCT is the spread of HIV from a woman living with HIV to her child during pregnancy, childbirth or breastfeeding [38]. Prevention of Mother to Child Transmission (PMTCT) is primarily intended to reduce HIV transmission through vertical means. The use of antiretroviral drugs and other strategies have helped to lower the rate of mother-to-child transmission of HIV to 1% or less in the United States and Europe [8]. A scheduled cesarean delivery can reduce the risk of mother-to-child transmission of HIV in women with unconfirmed viral load at the time of delivery [8]. Despite the use of medical interventions and early diagnosis to reduce the chance of HIV transmission [44], some social economic and demographic factors often contributes to infection. These factors are associated with having adequate knowledge of HIV, higher education levels, household income, living in an urban area, HIV testing and knowledge of where to go for the test as well as enrolment in PMTC [8]. This study evaluates the effect of some of the factors that might contribute to vertical or perinatal transmission of HIV in four states in North central Nigeria.

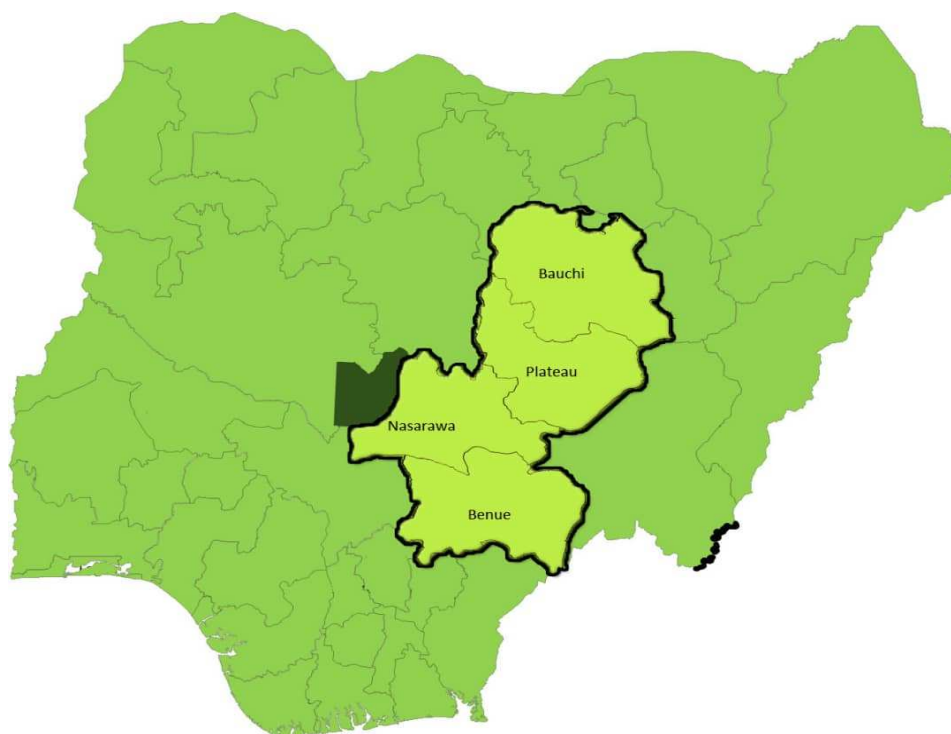
## 2. Materials and Methods

### 2.1. Study Location

The study was carried out in Plateau State Human Virology Research Centre (PLASVIREC) Jos, Plateau state, Nigeria; it is one of the regional centers established to address HIV challenges. PLASVIREC was established in 2004. It is located within the premises of the Plateau state specialist hospital, a state government owned facility situated in Jos. PLASVIREC is a research and diagnostic center with an ISO 15189 accredited laboratory. PLASVIREC offers HIV serological testing to mothers and their infants. PLASVIREC was initiated for the implementation of HIV surveillance, research, testing, and prevention activities in Nigeria, as well as early infant diagnosis, molecular techniques, clinical trials, cohort studies and provision of technical support/training. PLASVIREC offers the community quality and affordable trainings (Research, Advance PCR, QMS etc), Biorepository and Lab test (HIV, HBV and HCV VL, GeneXpert). Viral testing (e.g. PCR) are conducted at 4-6 weeks of age for infants known to be HIV-exposed, or at the earliest possible opportunity for those seen after 4-6 weeks of age.

### 2.2. Study Area

The data were collected from PLASVIREC data base. Data were collected between December 2018 to August 2019 from the data bank of four different states (Bauchi, Plateau, Nasarawa and Benue Sate) that enrolled in the health care facility (PLASVIREC) (see Figure 1).



**Figure 1.** Map of Nigeria showing the sample states.

### 2.3. Infants Sample Collection

Samples required for this assay were in Dried Blood Spot (DBS) Cards, with the help of a punch. A 6 mm disc of the Dried Blood Spot was cut into the required tube for assay. DBS samples gotten from infants born of HIV infected mothers from 6 weeks to 18 months of life were taken to PLASVIREC from different health facilities in North Central Nigeria for analysis. Early Infant diagnosis (EID) is done in this research center which is one of the regional centre for PCR analysis. The samples were analyzed using real-time PCR (cobas tagman and cobas ampliprep machine). The DNA-PCR results were categorized into positive and negative containing some factors in the documentation process.

### 2.4. Data Collection

Clinical data from mother and infant treatment history were collected from infant medical record and mother's history recording charts using a checklist. Socio-demographic data such as age, sex, occupation and other risk factors of the study participants were collected from mothers using a structured questionnaire.

### 2.5. Ethical Considerations

Data were meticulously collected with the health professional working in the health facility that were also aware of the status of the participants to further protect their privacy. Verbal information was obtained using questionnaire with consent to respect the right of a study participant to

accept or decline were also obtained.

### 2.6. Data Analysis

The data were analyzed using chi-squared test and result was presented using tables. A p-value less than 0.05 was considered as statistically significant.

## 3. Results

One thousand four hundred and sixteen DBS collected from infants born to HIV infected mothers from different health facility in four different sates in Nigeria were taken to PLASVIREC for HIV-1 DNA testing using the Real Time PCR. As at the time of testing the maximum age was below 20 months while the minimum was 4 weeks of age. Data were collected from the data bank of PLASVIREC; from enrolled HIV infected mother and their infants seeking for HIV health services which are available at the health facility (PLASVIREC) Jos.

Table 1 shows the effect of the type of delivery on HIV transmissions. Among the 1416 data examined, 1075 delivered their infants through vaginal delivery (VA) which account for 17.3% transmission rate. Mothers that deliver their infant through cesarean surgery contribute 16.7%; although the percentage rate of infection in VA mode of delivery is higher than CS, the transmission rate were found to be statistically insignificant ( $p=0.802$ ). Also, the odd ratio being greater than one means that there is association between the infection rate and the child HIV status.

**Table 1.** Effect of Mode of the Child Birth on the HIV Status of Children Born to HIV Infected Mothers.

Mode of Delivery	Number Examined	Status (%)		$\chi^2$	df	p Value	Odd Ratio (95% CI)
		Positive	Negative				
VA	1075	186 (17.3)	889 (82.7)	0.063	1	0.802ns	1.042 (0.753-1.443)
CA	341	57 (16.7)	284 (83.3)				
Total	1416	243 (17.2)	1173 (82.8)				

VA (vaginal delivery); CS (cesarean surgery)

Among the data collected on the places of delivery or child birth, out of 963 collected from HIV infected mothers that delivered their infants in General hospital (GH), 17.2% of the infants are HIV positive. Data collected from mothers that

gave birth in Private Hospital (PH) presented the lowest percentage of infection; data from mothers that gave birth in their homes had the highest percentage (19.7%) irrespective of non-significant statistics.

**Table 2.** Association between the Places of Child Birth to Infant HIV Transmission Rates.

Place of Delivery	Number Examined	Status (%)		$\chi^2$	df	p Value
		Positive	Negative			
GH	963	166 (17.2)	797 (82.8)	0.494	2	0.781ns
HM	76	15 (19.7)	61 (80.3)			
PH	377	62 (16.4)	315 (83.6)			
Total	1416	243 (17.2)	1173 (82.8)			

GH (Government Hospital), HM (Home Delivery), PH (Private Hospital)

Assessment of the data collected on the age of HIV infected mothers suggests that children born to younger women face higher level of contracting HIV infection. The data in Table 3 shows that young women between the ages of

17-25 had the highest percentage (19.7%) of MTCT. Mothers between the ages of 36-40 and 41-45 had the lowest MTCT rate, 7.7% and 14.3%, respectively compared to the younger counterparts (Table 3).

**Table 3.** Association between Age of HIV Infected Mothers on their infants HIV Status.

Mother's Age (Years)	Number Examined	Status (%)		$\chi^2$	df	p Value
		Positive	Negative			
17 - 20	61	12 (19.7)	49 (80.3)	6.18	5	0.289ns
21 - 25	417	82 (19.7)	335 (80.3)			
26 - 30	616	98 (15.9)	518 (84.1)			
31 - 35	256	45 (17.6)	211 (82.4)			
36 - 40	52	4 (7.7)	48 (92.3)			
41 - 45	14	2 (14.3)	12 (85.7)			
Total	1416	243 (17.2)	1173 (82.8)			

Among the data collected on HIV infected mother's livelihood, mothers that were Student (ST) presented the highest risk of MTCT at 21.7% while mothers that were Unemployed (UN) shows the lowest transmission rates at

13.2% (Table 4). Data collected on mothers that were House Wives (HW) and Government Worker (GW) showed the transmission rates of 17.1% and 16.9%, respectively.

**Table 4.** Relationship between Occupation of HIV Infected Mothers on Infants HIV Status.

Mother's Occupation	Number Examined	Status (%)		$\chi^2$	df	p Value
		Positive	Negative			
HW	790	135 (17.1)	655 (82.9)	5.135	3	0.162ns
ST	203	44 (21.7)	159 (78.3)			
UN	204	27 (13.2)	177 (86.8)			
GW	219	37 (16.9)	182 (83.1)			
Total	1416	243 (17.2)	1173 (82.8)			

HW (House Wife); ST (Student); UN (Unemployed); GW (Government worker)

Data obtained from PLASVIREC data bank on Benue and Plateau states, on the rate of MTCT from individuals that enrolled in the health facility for HIV test; showed the transmission rate of 21.7% and 20.4%, respectively.

Nassarawa and Bauchi states revealed lower transmission rate at 13.2% and 12.7%, respectively when compared with the other two states (Table 5) which were also statistically significant ( $P=0.001$ ).

**Table 5.** Rate of Mother to Child Transmission on Different Locations.

Locations (States)	Number Examined	Status (%)		$\chi^2$	df	p Value
		Positive	Negative			
Nassarawa	355	47 (13.2)	308 (86.8)	16.473	3	0.001*
Benue	359	78 (21.7)	281 (78.3)			
Bauchi	324	41 (12.7)	283 (87.3)			
Plateau	378	77 (20.4)	301 (79.6)			
Total	1416	243 (17.2)	1173 (82.8)			

## 4. Discussion

From the results above, HIV could be transmitted through the mode of child bearing vaginal delivery/cesarean surgery (VA/CS), the handling in the place of birth and other factors like maturity and understanding of the mother (age); the mother level of literacy/awareness and state of income as well as occupation. The use of data to collect various information from national banks and studies, could result in stakeholders reaching a consensus on the need for greater focus on high burden states and key population, for greater effectiveness and favorable outcome which could also be used to prevent new HIV infections. For example, in Africa, new HIV infections among children in 2018 were as a result of women not being retained on treatment throughout pregnancy and breastfeeding and access to Antiretroviral drug (ART) [39].

MTCT ranked second after heterosexual as the most common mode of HIV transmission in Nigeria [29]; and the

key population that contributes significantly to this national HIV epidemic are women; through child related birth. Mode of child birth plays a greater role in MTCT of HIV during child birth, if the delivery is not properly handled; it can result to infant infection. In this study the rate of infection through VA mode of child delivery presented a higher percentage than CS mode of child delivery, although not statistically significant as also documented by [31]. According to documented information, a scheduled cesarean delivery can reduce the risk of MTCT of HIV in women especially women with high viral load and also low CD4 counts even in low income countries [1, 4, 16]. Furthermore, with confirmation from European Collaborative Study, they found elective CS an effective way of PMTCT intervention with a high viral load; with 80% and 93% decreased risk in women with undetectable viral load [18, 19]. From the data obtained in this study, it was discovered that the number of vaginal birth is greater than CS. This might be due to the fact that vaginal birth is domicile in Africa as they prefer VA than

CS and also, the likelihood of CS availability as well as cost in most developing countries and fear of being sterilized during CS [9, 42]. It is likely, that in vaginal delivery, as the baby passes through the birth canal and is exposed to any HIV in the mother's blood or cervico-vaginal secretions, the baby might get infected especially in high viral load which in this study the viral load were not analyzed against the mode of delivery. Furthermore, [23] in their study suggested that HIV 1 in cervico-vaginal secretions increased during pregnancy. In contrast, [17] recorded that MTCT was not related to mode of delivery. In another study, it was reported that the risk of HIV transmission by CS is higher than VA probably because some of the CS cases studied were done as a result of complications [21]. Hence, a decision regarding mode of delivery is supposed to be made before onset of labor, which has to be based on the introduced antiretroviral treatment and the latest viral load not on emergency CS. Nevertheless, policy to perform an elective CS varies from regions, as most patients' decision regarding route of delivery should be honored regardless of the viral load [1]. Alternatively, in recent times, if a country can achieve a low viremia and very good delivery handling, vaginal delivery can be achieved with minimal MTCT [39].

Some study suggested that 65% of infants were infected with HIV intrapartum or early postpartum [32, 24]; hence non accredited places of child delivery, inadequate human capacity, limited infrastructure could contribute to MTCT of HIV especially during the time of labour. In a study by [13], 40% women in Nigerian give birth at home or in makeshift clinics managed by traditional birth attendants, where they are not likely to get tested. The findings in this study suggests that child birth at home had the highest percentage in HIV infected children despite the lower number of infants born at home, followed by general hospital and private hospitals. Other studies also reported that infants born at home were more likely to be infected with HIV than those delivered at health facility [26, 34]. The reason for the higher increase in infection at home might be related to access to delivery units, disinfectants, gloves and clean needles. Furthermore, in Africa PMTCT is primarily provided in clinics and hospitals mostly which may not be available for women and newborns that occur at home. Additionally, in most cases, the pregnant women might probably not get the routine care practice at home during labour for HIV positive mothers. Despite the higher percentage of child HIV infection in home delivery, the percentage of home delivery is minimal compared to public and private hospital child birth considering that most of the women in this study had previous knowledge of where to get help. Furthermore, mothers that enrolled in antenatal, PMTCT or self-reported being HIV-positive before delivery will be less likely to deliver at home. Other studies in Africa had also reported various high percentage of health facility delivery other than home [25, 11, 33, 34]. Women should be encouraged to give birth in health facilities where skilled attendants are available and Universal precautions applied in managing women in labour. Despite the admonishment not to deliver at home, some authors reported a greater number of

home delivery especially in rural setting [3, 12, 20].

Globally, every four minutes three young girls between the age of 15 and 19 are plagued with HIV; three out of four new HIV infections in girls are in sub-Saharan Africa [37]. In Nigeria, NACA documented that women from the North Central Nigeria who attend antenatal clinic had the highest prevalence of HIV and only 24.4% and 25% of young individuals (15-24) had ample knowledge regarding HIV transmission and prevention, respectively [37]. This study found out that children born to HIV infected younger mother age 17-25, are more likely to have higher infection than the older women. Young women are more vulnerable to HIV infection, stemming from the fact that most of them are minors with low economic status in the society and cannot make decision on their own; for example, practicing safe sex, having the final say on their own healthcare and also access to information [35, 37]. In most African country including Nigeria, it was found out that young girls are vulnerable to HIV in some measure due to laws and policies that uphold traditional gender roles [7, 29, 36, 37]. These factors presumably increase HIV risk on the young women and also their children. In older women, there is possibility of overcoming partner violence and unplanned pregnancy, increased educational achievement, have better reproductive health and rights, seek proper assistance if infected and participate in PMTCT. These could also reduce the risk of contracting HIV in older women and also transferring it to their babies.

In addition to mode, place of delivery and age of mothers as factors associated with MTCT; mother's mode of livelihood might also affect the transmission rate. This study suggests that mothers that were student had the highest rate of MTCT followed by house wives and government workers. This also revealed that inadequate knowledge of PMTCT despite the exposure and assumptions of being more learned as student and working mother might increase the risk of transmission. Unemployed mothers presented a number with least MTCT. The reason might probably be that most of the unemployed data collected were relatively educated but have no job; most of them may likely make decision on their own without partner interference. They are also more likely to utilize PMTCT services than the employed and student counterpart which may not have adequate time to go for the services; to acquire knowledge on how to protect their unborn child against HIV infection. In contrast to this work, a study conducted in Ethiopia showed that unemployed mothers were less likely to have knowledge on PMTCT of HIV than employed women [6]. In another study, Mothers who were housewives were more likely to use PMTCT service than women in other occupational categories [28]. More so, variations in the results might be as a result of differences in source population which may also be linked with different perception regarding way of livelihood and MTCT.

The synergy between HIV and different states in Nigeria has to be understood and continue to be studied to allow for more efficient investments in response and planning for provision of HIV services including care, treatments, and focus and also take it closer to the key states. The North Central zone of Nigeria is second to South-South zone in

HIV prevalence among adult aged 15-49 [39]. Despite mother-to-child transmission being made a priority in Nigeria more than a decade now with reduction seen in children born with HIV, the progress is slow [13]. Assessment of data collected in this study suggests Benue and Plateau State had the highest prevalence of MTCT of HIV among the four states analyzed. Benue state has been associated with having high HIV prevalence as against Niger state in the North Central part of Nigeria according to 2015 estimates with 15.5% and 1.7% respectively, in adults [13]. More so, Nigeria Premium Times in 2019 documented Benue as the state with the highest prevalence in North Central and second highest in the country [2]. Among the 36 State in Nigeria, Plateau State ranked the 15<sup>th</sup> highest in HIV prevalence in Nigeria while Nassarawa and Bauchi ranked 9<sup>th</sup> and 32<sup>nd</sup>, respectively [2]. The high rate in Plateau State might be as a result of large number of HIV infected mothers having access to the health facility as it is located in Plateau State. Conveniently, Plateau State was ranked among the medium HIV prevalence rate in Nigeria where new HIV infections and the burden of HIV may remain high [29].

Nigeria has progressed steadily in access to treatment for people living with HIV, with the implementation of a test and treat policy in 2016 and beyond [41]. Much progress is yet to be achieved in early infant diagnosis and treatment which is recommended for infants born to HIV infected mothers. There is established technology which makes it possible to diagnose infants early and receive the result within hours. This also makes it possible for HIV positive infants to start ARD immediately and reduce viral load if any. However, access to this point of care facility is limited especially in developing countries like Nigeria [37]. Again, among the reasons pregnant women in Nigeria do not attend antenatal or seek help for their babies is long distance to testing facility [5, 17]. For example PLASVIREC is one of the facility that can detect HIV status of a baby as early as one week and above covering about 141, 208 m<sup>2</sup> from the other surrounding states which makes accessibility difficult.

## 5. Conclusion

In conclusion, to ensure that the next generation is free from HIV, everyone infected with HIV must get treatment to achieve viral suppression especially pregnant women and also enhance support for HIV positive mothers.

Nigeria has made some remarkable health system-related achievements in its PMTCT response, but the challenges it faces on early diagnosis may hinder elimination of mother-to-child transmission of HIV. Early infant diagnosis and treatment should be brought closer to the most vulnerable population. Also, to improve coverage and reduce MTCT, high facility testing services especial for children below the age of 18 months should be available to every state and to pregnant women attending antenatal either onsite or by recommendation to a nearby facility. Home delivery should be avoided especially to HIV infected mothers, as it could increase MTCT of HIV. Pregnant women especially the

young ones should be encouraged to enroll in PMTCT as the government provides affordable and functional health care system. More attention by the government is needed in states with high HIV prevalence to MTCT.

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