

# Prevalence, Morbidity Pattern and Outcome of HIV Exposed Infants admitted into The Special Care Baby Unit of Rivers State University Teaching Hospital, Nigeria

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## ABSTRACT

**Background:** HIV/AIDS remains a major cause of morbidity and mortality in the paediatric age group including the neonatal age.

**Materials and Methods:** A prospective study carried out from January 5<sup>th</sup> 2021 to 4<sup>th</sup> December, 2023 in the neonatal unit of the Rivers State University Teaching Hospital.

**Results:** Of 1412 neonates admitted, 48 were HIV exposed with prevalence rate of 3.4%, M:F ratio of 1:1.2 and mean birth weight of  $2.82 \pm 0.93$ kg. Most mothers were >30years, 31(64.6%) with secondary level of education 28(58.3%). Majority commenced antenatal care in the 1<sup>st</sup> trimester 26(54.7%) and delivered via emergency Caesarean section 24(50.0%). Most maternal HIV status was known before index pregnancy 28(58.2%) and commenced HAART 29(67.4%). Most baby's feeding option was exclusive breast feeding (75.0%) while mixed feeding was 6.3%. Nevirapine was given to 31(64.6%) infants and nevirapine/zidovudine to 17(35.4%). The commonest morbidities were probable neonatal sepsis 27(58.7%), hypoglycaemia 13(28.3%), neonatal jaundice 9(19.6%) and perinatal asphyxia 9(19.6%). There was mortality rate of 4.2% with HIV seropositivity rate at 6-8 weeks being 10.9%. Mothers' level of education and occupation were significantly associated

with HIV seropositivity rate ( $P=0.041, 0.049$ ) whereas the pattern of morbidity had no significant association with the infants seropositivity rate.

**Conclusion:** The prevalence of HIV exposed infants admitted was 3.4% with M:F ratio of 1:1.2. The commonest morbidities were probable neonatal sepsis, hypoglycaemia, neonatal jaundice and perinatal asphyxia. There was a mortality rate of 4.2% with high infants seropositivity rate of 10.9%. This therefore calls for an intensification of the PMTCT program.

**Key words:** HIV exposed infants; Prevalence; Morbidity; Outcome

## INTRODUCTION

HIV/AIDS is a disease of public health importance and new-born infants may get infected majorly when the mother has the disease condition [1,2]. Nigeria has the 2<sup>nd</sup> largest global burden of HIV/AIDS with about 380,000 children being affected as at the end of 2014 [2] constituting about 30% of the global burden of children living with HIV/AIDS [2].

HIV infected women may transmit the virus to their babies during pregnancy, labour, delivery and postnatally via breastfeeding and this accounts for more than 90% of paediatric HIV infections [1-5]. This risk of mother-to-child-transmission (MTCT) is up

to 25-40% in the absence of any interventions [2]. The high burden of MTCT observed in Nigeria has been attributed to high rates of transmission of HIV via the heterosexual routes, high prevalence of HIV in women of reproductive age, high fertility rates, low coverage rates of prevention of MTCT (PMTCT), mixed feeding of HIV exposed infants, the culture of prolonged breastfeeding, poor access to health facilities for antenatal care & delivery as well as loss to follow up [2].

Several factors contribute to mother-to-child-transmission of HIV/AIDS. Factors that predispose to infection of the foetus during pregnancy includes maternal high viral load due to new infection or advanced disease, infection of the placenta, maternal malnutrition and antepartum haemorrhage [2]. Risk factors during labour and delivery includes rupture of membranes > 4hours before labour, invasive delivery procedures (forceps/vacuum deliveries) and episiotomy [2]. Other factors are preterm births and 1<sup>st</sup> infant in multiple births [2]. Breast feeding also predisposes to infection postnatally. Prolonged breastfeeding beyond one year, early mixed feeding, oral disease in the infant as well as maternal breast abscess, nipple fissure, mastitis and poor maternal nutritional status are other predisposing factors postpartum [2].

Prevention of MTCT services includes the prevention of unwanted pregnancies, safe child birth practices, life-long antiretroviral (ARV) drugs to infected women, ARV prophylaxis to HIV exposed infants, infant feeding counselling with appropriate choices and early infant diagnosis [6]. To prevent MTCT, all pregnant women are screened for HIV/AIDS at booking for antenatal care irrespective of their gestational age. Highly active antiretroviral therapy (HAART) is urgently commenced in all positive cases irrespective of their gestational age, mother's CD4+ counts, WHO clinical stage of the disease and even during labour and this is continued during the period of breastfeeding and throughout life.

It is noteworthy that HIV infection is not an indication for operative delivery-Caesarean section (CS) [2]. Elective CS however could be considered for HIV positive women that are not on HAART or cases of high maternal viral load before the onset of labour or rupture of membranes [2,5]. This mode of delivery has been observed to reduce the risk of transmission by more than 50% as compared to vaginal deliveries [2]. The Nigerian guideline on PMTCT however, does not recommend this form of delivery to any group of HIV positive pregnant women [2]. Instrumental deliveries such as forceps or vacuum delivery is usually avoided because of their high risk of HIV transmission [2].

Infants born to HIV positive women are referred to as HIV exposed. A high-risk infant is defined as one delivered to a woman with established HIV infection who received HAART for < 4 weeks at the time of delivery or whose viral load is > 1000 copies/ml 4 weeks before delivery or one with incident HIV infection during pregnancy/breastfeeding or detected for the 1<sup>st</sup> time during the postpartum period with or without a negative test prenatally [2]. All HIV exposed infants are therefore commenced on antiretroviral (ARV) prophylaxis to prevent MTCT. Daily nevirapine (NVP) is commenced orally within 72 hours of birth and continued until 6 weeks of age [2]. For high-risk HIV exposed infants however, dual prophylaxis of twice daily zidovudine (ZDV) and daily nevirapine are commenced orally within 72 hours of birth for the 1<sup>st</sup> 6 weeks of life irrespective of the feeding option [2,5].

Infant feeding counselling and support is another PMTCT service rendered to HIV exposed infants. This is commenced during pregnancy as well as after delivery before commencement of feeds. The 2 main feeding options are exclusive breast feeding in the 1<sup>st</sup> 6 months of life thereafter continuing breastfeeding until 12months of age and exclusive breast milk substitute (BMS) or formula. Mixed feeding or predominant breastfeeding which is a combination of breast milk and breastmilk substitute is contraindicated as it has very high risk of

transmission [2]. Breastfeeding is responsible for transmission rate of about 1% per month in the absence of intervention and this percentage is drastically reduced to 0.2% per month with ARV drug therapy and even lower to 0.06-0.13% per month when combined with other interventions [7-10]. This is contrary to breast milk substitutes which has zero HIV transmission risk [2]. It is pertinent to note that BMS however, has increased risk of morbidity and mortality from other disease conditions in developing countries such as malnutrition, diarrhoea and pneumonia [2]. The Prevention of MTCT guidelines in Nigeria therefore recommends that exposed infants are breastfed exclusively for the 1<sup>st</sup> 6 months of life, complementary feeds introduced at 6 months along side breast milk and breastfeeding stopped at 12 months of age [2]. This is however not the same in developed countries where BMS are considered a safe and healthy alternative to breast milk and as such HIV exposed infants are not allowed to breast feed rather are given exclusive BMS [5]. Other services rendered to HIV exposed infants are commencement of routine immunization, growth monitoring, commencement of cotrimoxazole prophylaxis from 6 weeks of age and early HIV diagnostic testing - Dried blood spot (DBS) test via DNA polymerase chain reaction (PCR) at 6-8 weeks of age and repeated 6 weeks after breastfeeding has been stopped. HIV seropositive infants are thereafter offered ARV drugs for life and further care.

HIV seroconversion rates vary in different geographic regions depending on the effectiveness of the PMTCT program. In Zambia [11], 6.5% was reported whereas in some studies in Nigeria [12-15], 6.3%, 3.2%, 2.2% and 1.8% were documented.

Maternal HIV leads to increased risk of still births as well as increased morbidity and deaths in the neonatal period and infancy. The poor outcome of HIV exposed neonates could be attributable to the interaction of HIV with other infections in the neonatal age as well as its indirect effect such as poverty and

illnesses in the mother that could affect the infant [2].

The present study was carried out to determine the prevalence of HIV exposed neonates admitted in the Special Care Baby Unit as well as the morbidity pattern and outcome of these infants as this was the 1<sup>st</sup> of its' kind in the Rivers State University Teaching Hospital. Findings from this study will add to the body of knowledge as well as strengthen existing policies in the prevention of MTCT of HIV.

## **MATERIALS AND METHOD**

It was a prospective study carried out in the Special Care Baby Unit (SCBU) of the Rivers State University Teaching Hospital (RSUTH), Nigeria over 3 years from 5<sup>th</sup> January, 2021 to 4<sup>th</sup> December, 2023.

The Rivers State University Teaching Hospital, one of the tertiary hospitals in the state is Government owned with 375 beds located in the Government reserved area of the state. The SCBU, a unit in the department of Paediatrics consist of 20 infant cots, 14 incubators, 3 resuscitaires/warmers, phototherapy machines, hand held pulse oximeters, multiparameter monitors, oxygen cylinders/concentrators, suction machines and CPAP machines etc. The unit consist of an inborn and out-born unit. The inborn unit admits babies whose mothers were booked and delivery carried out in the hospital (RSUTH) or any of the Rivers State Government owned Primary Health Centres (PHC), cottage/general hospitals or military hospital and transferred from these hospitals to RSUTH SCBU. The out-born unit admits babies although delivered in the above facilities had gone home or delivered and brought to RSUTH from private health facilities, churches, maternities supervised by traditional birth attendants. The SCBU is overseen by 3 consultant Paediatricians, resident doctors, house officers and nurses as well as other support staff such as cleaners. This unit admits sick new-borns aged 0-28 days old from the labour ward, postnatal ward, labour ward theatre, children emergency ward and the Paediatric

outpatient clinic. Other clinical departments in the hospital includes Obstetrics & Gynaecology, Surgery, Internal medicine, Family medicine, Anaesthesia, Pathology etc. The study population consisted of all infants of HIV positive mothers aged 0-28 days old admitted into the SCBU.

The inclusion criteria were all infants of HIV positive mothers 0-28 days old who gave consent whereas same infants whose parents/caregivers did not give consent were excluded from the study.

A convenient sampling size of 48 infants of HIV positive mothers admitted into the SCBU during the period of study whose parents/caregivers consented to the study were consecutively recruited into the study.

A research assistant was engaged before commencement of the study and was properly trained on the inclusion/exclusion criteria as well as the correct administration of the questionnaire.

Ethical clearance was obtained from the RSUTH research ethics committee.

In RSUTH, all pregnant women were routinely tested for HIV, free of charge irrespective of the gestational age of the pregnancy and also in un-booked women who came in Labour. All infected pregnant women were enrolled into the PMTCT program irrespective of their gestational age as well as the un-booked cases who came during labour, were commenced on ARV drugs according to the Nigerian guidelines on PMTCT and followed up closely until delivery [2]. Infant feeding counselling was provided during pregnancy, labour and postpartum and mothers were supported on their choices. Exclusive breastfeeding (EBF) or exclusive breastmilk substitute (BMS) were the options recommended while mixed feeding was discouraged vehemently i.e. combination of breastmilk and breastmilk substitute. Pregnant women were encouraged to choose the recommended feeding option according to the Nigerian guideline which is exclusive breastfeeding for the 1<sup>st</sup> 6 months of life thereafter complementary feeds commenced and breastfeeding continued until 12 months of age with continuation of

HAART in the mothers [2]. All HIV exposed infants admitted into the SCBU were commenced on ARV drugs either nevirapine only for low-risk infants or combination of nevirapine/zidovudine for high-risk infants.

A pretested questionnaire was employed to obtain data from the parents/caregivers on a one-on-one basis by the researcher or research assistant. Information obtained were socio-demographic characteristics of both infants and parents, maternal pregnancy history, maternal HIV status history and the type of antiretroviral drug(s) commenced in the exposed infants. For every HIV exposed infant recruited, clinical features observed were documented as well as diagnosis based on both clinical manifestations and/or results of laboratory investigation(s). Treatment was based on the unit's standard protocols and the outcome & duration of hospital stay was recorded. Outcome measures were discharged home, died or discharged against medical advice.

Early infant diagnosis (EID) - HIV seropositivity rate was carried out at 6-8 weeks of life (mostly after discharge). The Gene Xpert instrument was utilized for testing using the Xpert<sup>R</sup> HIV Qual assay (Cepheid, Sunnyvale, CA) using 1ml of whole blood in an ethylenediaminetetraacetic acid (EDTA) specimen bottle and specimen were processed into DBS samples (4-5 spots/cards) [16]. An infant is considered uninfected when DBS tested negative at 6-8 weeks of life and positive when there was a positive result. An infant is said to have been lost to follow up in this study when the infant was not seen at 6-8 weeks for DBS test. HIV positive infants at 6-8 weeks were continued on ARV drugs with continuation of care.

Data was entered into an Excel sheet and Statistical Package for Social Sciences (SPSS) version 23 was used for data analysis. Results were presented in simple frequencies, percentages, pie and bar charts. Chi ( $\chi^2$ ) square test and Fishers' Exact test were used for test for association. Statistical significance was set at *P* value .05 at 95% confidence interval.

## RESULTS

### Demographic characteristics of HIV exposed infants

There was a total of 1,412 admitted infants of which 48 were HIV exposed giving a prevalence rate of HIV exposed infants admitted into the SCBU as 3.4%. Females predominated 26(54.2%) with a Male: of 37-42 weeks 27(56.2%) with a mean gestational age of  $36.79 \pm 3.12$  weeks, Table I.

Female ratio of 1:1.2. Majority were admitted within the 1<sup>st</sup> 2 hours of life 27(56.2%), with mean age at presentation of  $3.01 \pm 2.82$  hours and were of first birth order 18(37.5%). Most had birth weights of 2500-3999g 22(45.8%), mean birth weight of  $2.82 \pm 0.93$ kg and gestational age

**Table I: Demographic characteristics of the study population**

Variables	Frequency, n = 48 (%)
Sex	
Male	22 (45.8)
Female	26 (54.2)
Age at presentation (hours)	
1-2	27 (56.2)
$\geq 3$	21 (43.8)
Birth order	
First	18 (37.5)
Second	16 (33.3)
Third and above	14 (29.2)
Birth weight (grams)	
< 2500	19 (39.6)
2500-3999	22 (45.8)
$\geq 4000$	7 (14.6)
Gestational age (weeks)	
< 37	21 (43.8)
37-42	27 (56.2)

### Sociodemographic characteristics of the mothers of HIV exposed infants

Most mothers were  $> 30$  years old 31(64.6%) with mean age of mothers being  $32.46 \pm 5.28$

years and were married 36(75.0%). Most mothers had secondary level of education 28(58.3%), were mainly involved in business 24(50.0%) and of middle socioeconomic status 21(43.8%), Table II.

**Table II: Sociodemographic characteristics of the mother**

Variables	Frequency, n = 48 (%)
Mother's age group (years)	
$\leq 30$	17 (35.4)
$> 30$	31 (64.6)
Marital status	
Single	8 (16.6)
Married	36 (75.0)
Separated	1 (2.1)
Co-habiting	3 (6.3)
Mother's level of education	
Primary	4 (8.3)
Secondary	28 (58.3)
Tertiary	16 (33.4)
Mother's Occupation	
Civil servant	3 (6.3)
Business	24 (50.0)
Artisan	7 (14.6)
Housewife	14 (29.1)
Father's level of education	

No formal education	1 (2.1)
Primary	3 (6.3)
Secondary	25 (52.0)
Tertiary	19 (39.6)
Father's occupation	
Civil servant	8 (16.7)
Business	20 (41.7)
Artisan	11 (22.9)
Professional	6 (12.4)
Unemployed	3 (6.3)
Socio-economic status	
Lower	16 (33.3)
Middle	21 (43.8)
Upper	11 (22.9)

### Maternal pregnancy history

Majority of mothers of HIV exposed infants had a parity of one (52.1%) and of singleton pregnancy 39 (81.2%). Most mothers commenced antenatal care in the 1<sup>st</sup> trimester of pregnancy 26 (54.2%), in RSUTH 31

(64.5%), delivered via emergency Caesarean section 24(50.0%) and did not have pregnancy complications 29 (60.4%). Of 12 mothers who delivered vaginally, most 7(58.3%) were not given episiotomy, Table III.

**Table III: Maternal pregnancy history**

Variables	Frequency, n = 48 (%)
Parity	
One	25 (52.1)
Two	12 (25.0)
Three and above	11 (22.9)
Pregnancy type	
Singleton	39 (81.2)
Multiple	9 (18.8)
When ANC was commenced	
1 <sup>st</sup> trimester	26 (54.1)
2 <sup>nd</sup> trimester	20 (41.7)
3 <sup>rd</sup> trimester	2 (4.2)
Place of ANC	
RSUTH	31 (64.5)
PHC	13 (27.1)
General hospital	1 (2.1)
Private hospital	3 (6.3)
Mode of delivery	
Vaginal delivery	12 (25.0)
Elective Caesarean section	12 (25.0)
Emergency Caesarean section	24 (50.0)
Episiotomy in index delivery, n=12	
Yes	5 (41.7)
No	7 (58.3)
Presence of pregnancy complication	
Yes	19 (39.6)
No	29 (60.4)

ANC=Antenatal clinic; RSUTH=Rivers State University Teaching Hospital; PHC=Primary Health Care

### Maternal HIV status history

Most mothers knew their HIV status before the index pregnancy 28 (58.3%) and commenced HAART 43(89.6%). Majority commenced HAART before the index pregnancy 29(67.4%) and were compliant

with the drugs 38(79.2%). Most mothers did not have their viral load tested 34(70.8%). Majority of fathers knew the HIV status of their wives 29(60.4%), had positive HIV status 20(41.6%) with more of their other

children being tested for HIV 18(54.5%),  
Table IV.

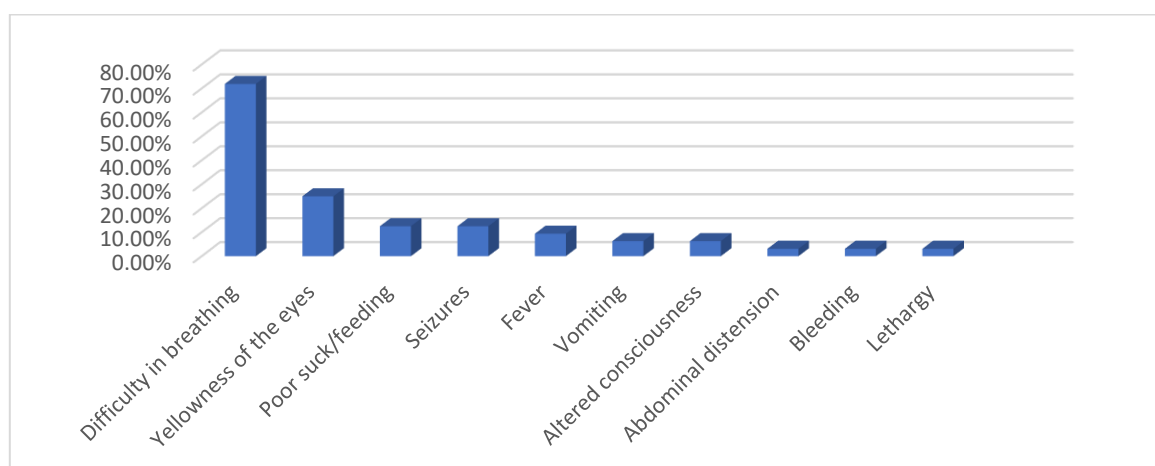
**Table IV: Maternal HIV status history**

Variables	Frequency, n = 48 (%)
When maternal HIV status was known	
Before index pregnancy	28 (58.2)
1 <sup>st</sup> trimester	8 (16.7)
2 <sup>nd</sup> trimester	8 (16.7)
3 <sup>rd</sup> trimester	2 (4.2)
During labour	2 (4.2)
Commenced HAART	
Yes	43 (89.6)
No	5 (10.4)
When HAART were commenced, n = 43	
Before index pregnancy	29 (67.4)
1 <sup>st</sup> trimester	6 (14.0)
2 <sup>nd</sup> trimester	7 (16.3)
3 <sup>rd</sup> trimester	1 (2.3)
Compliant with HAART	
Yes	38 (79.2)
No	10 (20.8)
Latest viral load before delivery (copies/ml)	
≤ 20	8 (16.7)
< 1000	4 (8.3)
> 2000	2 (4.2)
Not known	34 (70.8)
Father being aware of maternal HIV status	
Yes	29 (60.4)
No	19 (39.6)
Fathers HIV status	
Positive	20 (41.6)
Negative	14 (29.2)
Not known	14 (29.2)
Other children been tested for HIV, n = 33	
Yes	18 (54.5)
No	15 (45.5)

HAART=Highly active antiretroviral therapy

### Clinical features of HIV exposed infants

The commonest clinical feature among HIV exposed infants was difficulty in breathing 23(71.9%) followed by yellowness of the eyes 8(25.0%), Figure 1.



**Figure 1: Clinical features of HIV exposed infants**

### Feeding options of HIV exposed infants

Majority of HIV exposed infants were on exclusive breast feeding 36(75.0%) while the least were on mixed/predominant breast feeding 3(6.3%), Figure 2.

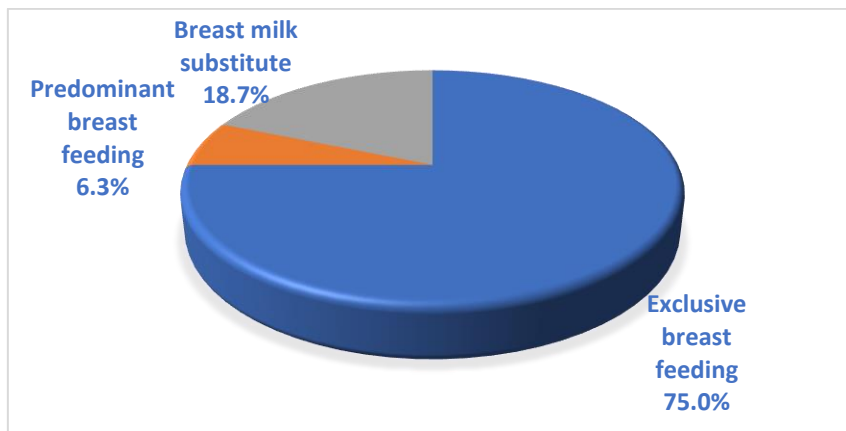


Figure 2: Feeding option of HIV exposed infants

### Type of antiretroviral drugs commenced on HIV exposed infants

Most neonates 31(64.6%) were commenced on Nevirapine only, Figure 3.

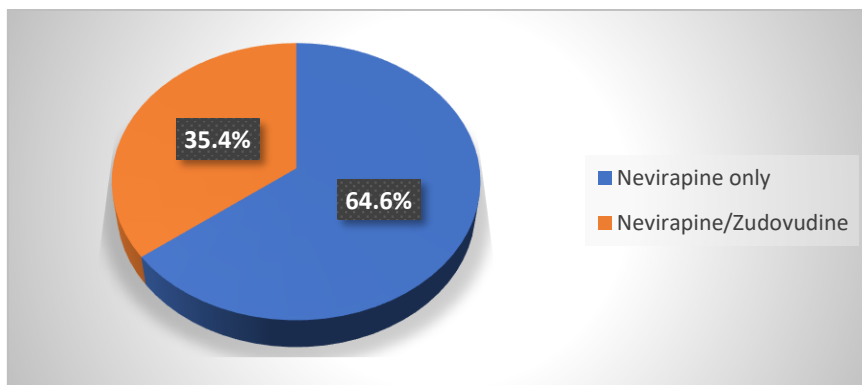


Figure 3: Type of antiretroviral drugs commenced on HIV exposed infants

### Morbidity pattern of HIV exposed infants

Most HIV exposed infants had probable neonatal sepsis 27(58.7%) followed by hypoglycaemia 13(28.3%), neonatal jaundice 9(19.6%) and perinatal asphyxia 9(19.6%), Figure 4.

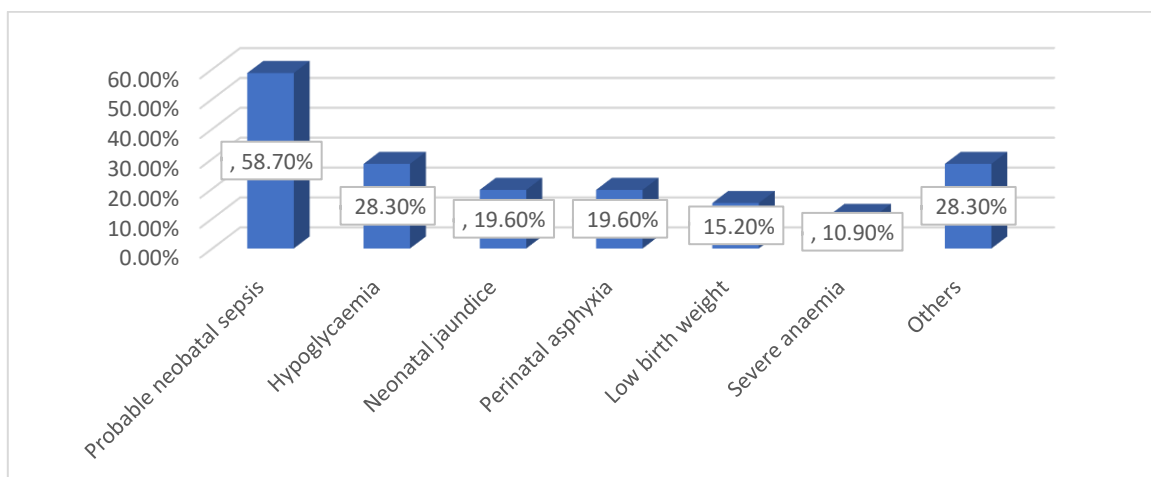


Figure 4: Morbidity pattern of HIV exposed infants



**Outcome and duration of hospital stay of HIV exposed infants**

Most HIV exposed infants were discharged home 40(83.3%) while 2(4.2%) died.

Majority stayed in the hospital for 8-14 days 25(52.1%) with a mean duration of stay of  $9.25 \pm 2.31$  days, Table V.

**Table V: Outcome and duration of hospital stay of HIV exposed infants**

Variables	Frequency, n = 48 (%)
Admission Outcome	
Discharged	40 (83.3)
Died	2 (4.2)
DAMA	6 (12.5)
Duration of hospital stay (days)	
≤ 7	16 (33.3)
8 – 14	25 (52.1)
> 14	7 (14.6)

**Association of HIV seropositivity of infants and morbidity pattern**

Of 48 HIV exposed infants admitted in the SCBU of which 2(4.2%) died, 5(10.9%) tested positive at 6-8 weeks, 40(87.0%) tested negative while 1(2.1%) was lost to

follow up. There was no significant association between the morbidity pattern and the seropositivity of the infants ( $P > 0.05$ ), Table VI.

**Table VI: Association of HIV seropositivity of infants at 6 weeks and morbidity pattern**

Morbidity pattern	HIV seropositivity of infants		Fishers' Exact P value
	Positive, n (%)	Negative, n(%)	
Probable neonatal sepsis	5 (100.0)	20 (50.0)	0.056
Hypoglycaemia	2 (40.0)	10 (25.0)	0.598
Neonatal jaundice	1 (20.0)	8 (20.0)	1.000
Perinatal asphyxia	1 (20.0)	7 (17.5)	1.000
Low birth weight	1 (20.0)	4 (10.0)	0.461
Severe anaemia	0	5 (12.5)	1.000
Others	1 (20.0)	12 (30.0)	1.000

**Association between HIV seropositivity of infants and some maternal factors**

Mother's level of education and mother's occupation were significantly associated with the HIV seropositivity of the infants,  $P$  value 0.041 and 0.049 respectively, Table VII.

**Table VII: Association between HIV seropositivity of infants and some maternal factors**

Variables	HIV Seropositivity of infants		Fishers' Exact P value
	Positive, n(%)	Negative, n(%)	
Mother's age (years)			
≤ 30	3 (60.0)	13 (32.5)	0.330
> 30	2 (40.0)	27 (67.5)	
Mother's level of education			
Primary	2 (40.0)	2 (5.0)	0.041
Secondary	1 (20.0)	24 (60.0)	
Tertiary	2 (40.0)	14 (35.0)	
Mother's occupation			
Civil servant	1(20.0)	2 (5.0)	0.049
Business	0	22 (55.0)	
Artisan	1 (20.0)	6 (15.0)	
House wife	3 (60.0)	10 (25.0)	
Commencement of HAART			
Yes	4 (80.0)	36 (90.0)	0.461
No	1 (20.0)	4 (10.0)	
Time of commencement of HAART			

Before index pregnancy	4 (100.0)	23 (63.9)	
1 <sup>st</sup> Trimester	0	6 (16.7)	0.776
2 <sup>nd</sup> Trimester	0	7 (19.4)	
Mode of delivery			
Vaginal	1 (20.0)	10 (25.0)	
Elective CS	1 (20.0)	11 (27.5)	1.000
Emergency CS	3 (60.0)	19 (47.5)	

## DISCUSSION

There were more HIV exposed female infants in the present study with a Male: Female ratio of 1:1.2. This was similarly reported by Oluwayemi et al [12] and Tsehay [17] in Ado Ekiti, Nigeria and Ethiopia respectively. In contrast, other researchers in other parts of Nigeria [14,18], Cameroun [19] and Ethiopia [20] documented male preponderance. Although males predominated in the Cameroun [19] study, there was no statistical significance between HIV exposed and non-HIV exposed infants. This difference in gender could be attributed to difference in study designs, sample sizes, sample populations and geographic locations.

More than ½ (58.3%) of mothers of HIV exposed infants had secondary level of education and more than ¾ (77.1%) were of lower and middle socioeconomic classes. Similarly, Monebenimp et al [19] in Cameroun reported that HIV positive mothers had low levels of education as compared to HIV negative mothers as also documented in Zambia [21]. In northwest Ethiopia [17], close to ¾ (72.3%) HIV infected pregnant women were unable to read and write. This observation was not surprising as education has been reported to impact health as documented by Raghupathi & Raghupathi [22] who reported that adults with higher level of education had better health and lifespans when compared to less-educated peers.

In the present study, majority of the mothers (89.6%) commenced HAART as similarly reported by Ugochukwu et al [14] in Nnewi, Southeast Nigeria. In Abuja [13], North central Nigeria, 92.5% of pregnant women were reported to be on HAART while 7.5% were not on the therapy. Similarly, Oluwayemi et al [12] in Ado Ekiti, South west Nigeria reported 8.9% while Onankpa and

Tahir [15] in Sokoto, North west Nigeria reported 7% of HIV positive mothers were not on HAART. This should not be the case as every pregnant woman was expected to have been tested for HIV irrespective of the time of booking for ANC or even in labour according to the National and the Nigerian guidelines on the prevention of MTCT and urgently commenced on HAART [2]. Training and retraining of health care workers on prevention of MTCT of HIV is therefore key to mitigate the scourge of HIV/AIDS.

About 2/3<sup>rd</sup> (67.4%) of pregnant women were commenced on HAART before pregnancy while the rest (32.6%) during pregnancy with the least (2.3%) commenced in the 3<sup>rd</sup> trimester of pregnancy. None was commenced during labour in the present study. Interestingly, more pregnant women (82.3%) were reported to be on HAART before pregnancy in Jos [18], North central Nigeria whereas other studies documented 57.4%, 55.7%, 52.8% in Ethiopia [20] and Nigeria [12,14] respectively. The prevalence of HIV in the geographic region, availability & accessibility of the PMTCT program, level of education of pregnant women may account for these differences. In the present study, the mother's level of education and mother's occupation were significantly associated with the infant's HIV seropositivity rate.

Three-quarters (75%) of these infants were delivered via Caesarean section with elective CS accounting for 25% and emergency CS 50%. This may be because a good number of the mothers (39.6%) had pregnancy complications that may have necessitated an operative delivery which has been said to be protective against MTCT of HIV [2]. The finding of the present study was contrary to most other studies which documented predominance of vaginal deliveries [12,17-20]. The reason for this difference could not be

ascertained. The present study did not show any significant advantage of any of the modes of deliveries whether vaginal or operative deliveries ( $P = 1.000$ ). This was also the case in other studies [12,23,24]. This may thus discountenance the previous believe that operative deliveries were protective of MTCT.

Three-quarters (75%) of HIV exposed infants were been exclusively breastfed, 18.7% gave breast milk substitute exclusively while 6.3% practiced mixed feeding/predominant breastfeeding. Exclusive breast feeding similarly accounted for 73.4% in Jos [18], north central Nigeria whereas there were much higher exclusive breastfeeding rates of 95.6%, 92.9%, 89.9%, 84.0% and 85.3% in Ethiopia [17,20], Zambia [25] and other parts of Nigeria [12,15] respectively. This high exclusive breastfeeding rates is not surprising because in Africa, exclusive breastfeeding is the preferred feeding option for infants who are HIV exposed according to the PMTCT guideline [2]. Although breastfeeding is not without risk of HIV transmission, its' risk is low especially when PMTCT interventions are carried out as compared with morbidities such as malnutrition, diarrhoea and respiratory tract infections (pneumonias) associated with the use of breast milk substitutes [26-28]. Close to ¼ (18.7%) HIV exposed infants were given breast milk substitutes in the present study. This could be due to the fact that the initial Nigerian guideline for prevention of MTCT was in favour of BMS. There is therefore the possibility that mothers who previously may have practiced this feeding option with good outcome of their infants being seronegative would be unwilling to adhere to the present guideline of EBF for the minute chance of infection transmission. It is sad to note that as much as 6.3% of HIV exposed infants practiced mixed feeding in the present study. This was also the case in North west Ethiopia [17] and other parts of Nigeria [12,14] which documented 5.7%, 3.6% and 1.9% respectively. In the present study, both inborn and out-born infants were part of the study

population and this practice was observed in the out-born babies in which mixed feeding was commenced even before admission. On the contrary, all mothers of inborn HIV exposed infants were counselled and given the option of either exclusive breast feeding or exclusive breast milk substitute feeding. Mixed feeding leads to HIV transmission as it is associated with ulceration of the gastrointestinal tract due to diarrhoea diseases leading to entrance of the virus into the blood stream of the infant [29]. This was in consonance with findings by Tsehay [17] where mixed feeding was significantly associated with MTCT of HIV. In Makurdi [30], North central Nigeria mixed feeding increased the risk of HIV infection in infants born to HIV positive mothers by 26 times while in Angola [31], this risk was 5 times. In addition, mixed feeding commenced early in life has been associated with up to 4-fold risk of the transmission of HIV at age 6-months in HIV exposed infants who previously tested negative at age 6-weeks [15,32,33]. Thus, health education of all pregnant women in health facilities where deliveries take place including maternity homes, traditional birth attendants as well as the general public on the dangers of mixed feeding will go a long way in the prevention of MTCT of HIV. Availability of antenatal care services even in remote places with PMTCT will also curb the practice of mixed feeding of HIV exposed infants. It is however pertinent to note that in the developed climes, HIV exposed infants are not allowed to breastfeed due to the ready availability of breast milk substitutes which is considered a safe and healthy alternative to breastmilk unlike in developing countries [5]. All HIV exposed infants in the present study received post exposure prophylaxis (PEP) as recommended by the National guideline on prevention of MTCT [2]. In this study, majority of infants (64.6%) received nevirapine (NVP) monotherapy while 35.4% received a combination of nevirapine (NVP)/zidovudine (AZT). In a facility based cross sectional study carried out in a PMTCT clinic in North west Ethiopia [17] close to a decade ago, only 95.3% infants received post

exposure prophylaxis (PEP). This is contrary to the WHO guideline on the prevention of MTCT as every HIV exposed infant is expected to be commenced on the medication(s) for a period of 6-8 weeks before early infant diagnosis is carried out. The exposed infants being on admission in the SCBU could have accounted for the observation in the present study unlike in the other studies where HIV exposed infants were monitored in the PMTCT clinic on outpatient basis. Also, change in the guideline on PMTCT over time could have been responsible for the difference observed. Sagay et al <sup>[18]</sup> in Jos, North central Nigeria also reported, 99.4% had PEP. This was a retrospective study carried out about a decade earlier and so could be responsible for the lower percentage of PEP been recorded. Nevirapine monotherapy predominated in other studies <sup>[13,14]</sup> as observed in the present study. It is noteworthy that combination therapy is given to infants that have high risk of MTCT such as mothers with high viral load, those that were not on HAART etc. It is pertinent to note that ARV constitutes the bedrock of the PMTCT program as observed in the study in Nnewi <sup>[14]</sup>, South east Nigeria where infants who did not receive ARV drugs were significantly more likely to have MTCT of HIV ( $P = 0.000$ ).

The commonest clinical features observed in HIV exposed infants in the present study were difficulty in breathing (71.9%) and yellowness of the eyes (25%). This is similar to a previous report in the same study centre of all neonates admitted in the SCBU <sup>[34]</sup>. The commonest morbidity pattern among HIV exposed infants in the present study was probable neonatal sepsis (58.7%) followed by hypoglycaemia (28.3%), neonatal jaundice (19.6%) and perinatal asphyxia (19.6%). This pattern was consistent with a previous study in the same study centre of all inborn neonates in the neonatal unit <sup>[34]</sup>. This observation was in line with the findings in the present study which showed no association between the morbidity pattern and the seropositivity of the infants. This also corroborates a case control study carried out

in a neonatology unit in Cameroun <sup>[19]</sup>, which showed that there was no statistical significant difference between new-borns from HIV positive and HIV negative mothers in respect to their body temperature, hypoglycaemia, hypocalcaemia, neonatal sepsis and neonatal meningitis ( $P > 0.05$ ).

Among the HIV exposed infants in the present study, 2 neonates died giving a mortality rate of 4.2%. A much higher rate of 10% was recorded in a neonatology unit in Yaounde, Cameroun <sup>[19]</sup>. It was however observed in the latter study that there was no statistical difference between the 10% HIV exposed infants who died and the 9.4% in the control group ( $P=0.52$ ). In Jos <sup>[18]</sup> North central Nigeria, 1.4% mortality was documented among HIV exposed infants between birth and 18 months of age. In contrast in another study in Jos <sup>[35]</sup>, of 65 HIV exposed infants born to HIV seropositive women on HAART, fed only BMS and followed up from birth to 6 weeks, there was 0% mortality rate. The finding in the latter study was not unexpected as all the mothers were on HAART treatment with zero transmission risk via BMS and 40% had no morbidity unlike in the present study were all the infants were sick, on admission in the SCBU and most were breastfed exclusively. Monebenimp et al <sup>[19]</sup> in their study in Cameroun, documented that neonatal mortality was similar in both HIV exposed infants and the controls. This observation corroborates with the report that HIV may not be a direct cause of neonatal death rather foetal, neonatal and infant survival could be a reflection of the maternal HIV status <sup>[36]</sup>. In the neonatal period, this is irrespective of whether the infant is HIV positive or negative <sup>[36]</sup>. This could be attributable to the effects of maternal illnesses as well as the interaction of HIV infection and other infections in the neonatal period. Research has shown that HIV exposed infants have higher mortalities than non-HIV exposed infants <sup>[37]</sup>.

The HIV seropositivity rate of exposed infants in the present study was 10.9% which was close to 8.1% reported by Ugochukwu et

al<sup>[14]</sup> in Nnewi, southeast Nigeria but much higher than the 6.5%, 6.1%, 5.8%, 6.3%, 3.2%, 2.2%, 1.8% and 1.5% reported in Zambia<sup>[11]</sup>, Ethiopia<sup>[17]</sup> and other parts of Nigeria<sup>[12-15,35]</sup> respectively. The very low percentage in the Jos<sup>[35]</sup> study, could be attributed to the fact that only HIV exposed infants of women on HAART was recruited and not sick babies on admission in the SCBU as in the present study. In addition, the high seropositivity rate in the present study could be because close to a quarter (20.8%) of the women had poor compliance to their medications in addition to the infants been ill. Also, the HIV exposed infants in Jos<sup>[35]</sup> were fed only with BMS which has zero transmission rate unlike the present study where mixed feeding was practiced in addition to EBF and exclusive BMS. In addition, in the study in Abuja<sup>[13]</sup> only 7.5% of the pregnant women did not commence HAART unlike the present study which accounted for up to 16.9% and thus may have contributed to the high seroconversion rate. This corroborates the findings in Ado Ekiti<sup>[12]</sup> in which the HIV seropositivity rate of 28.6% was significantly higher in infants whose mothers did not receive HAART during pregnancy as compared with the 5.4% in infants whose mothers commenced during pregnancy and lowest (3.4%) in infants whose mothers commenced HAART before pregnancy ( $P = 0.01$ ). This finding was the same in other studies<sup>[13,15,25]</sup>. Other factors responsible for the difference could be variations in the study designs, duration of the study, inclusion criteria whether inborn only or both inborn and out-born as well as the recruitment of only infants of mothers who participated in the prevention of MTCT program. The finding of the present study thus calls for strengthening of the Prevention of MTCT program in the state. Thus, all women of child bearing age must be tested for the virus and ARV commenced, all pregnant women must be tested irrespective of the gestational age with urgent commencement of HAART if positive, ANC must be made available and affordable in all parts of the state and women encouraged to

make use of this service, counselling of pregnant women on safe infant feeding option, commencement of ARV to all exposed HIV infants as well as early infant diagnosis will drastically reduce the seropositivity rates of HIV exposed infants. Government, global health donors and other partners are also encouraged to ensure ready availability of testing kits and ARV drugs for all infected women and HIV exposed infants for the effectiveness of the prevention of MTCT program.

There was a fairly high proportion of discordant couples in the present study being more than  $\frac{1}{4}$  (29.2%) although this same percentage (29.2%) were not aware of their HIV status as reported by the mothers. A much higher percentage of 39.9% discordant couples was documented in Ado Ekiti<sup>[12]</sup>, Nigeria. In the latter study, up to 57.6% of the fathers were not aware of their HIV status. This was sad as HIV testing is free in Nigeria and most parts of the world especially in developed countries. Thus, mass enlightenment on this subject will increase awareness and improve testing thereby also prevent MTCT. In the present study, more than  $\frac{1}{3}$ <sup>rd</sup> (39.6%) fathers were not aware of the mothers HIV status. In addition, only about  $\frac{1}{2}$  (54.5%) of the other children had been tested for HIV in the present study. This may suggest lack of family support of HIV positive women and their infants. This is dangerous as disclosure could lead to mixed feeding and lack of compliance of their infants' treatment thereby increase the HIV seropositivity rates. The finding of the present study negatively impacts on the importance of disclosure in the prevention of HIV/AIDS where infected persons are encouraged to disclose their HIV status to their current husbands if married and past sexual partners so they can be tested as well and possibly seek medical care if found positive. Health education of the general masses on free HIV testing, importance of disclosure carried out via social media, television, radio, churches, hospitals will therefore prevent HIV transmission. Discouragement of stigmatization would

also go a long way to improve testing and disclosure.

## CONCLUSION

The prevalence of HIV exposed infants in the SCBU of the RSUTH was 3.4% with female preponderance and mortality rate of 4.2%. The commonest disease condition among HIV exposed infants was probable neonatal sepsis followed by hypoglycaemia, neonatal jaundice and perinatal asphyxia. The seropositivity rate of HIV exposed infants at 6-8 weeks was high, being 10.9% and there was no significant association of the infants seropositivity and the pattern of morbidity. There was high discordant couples (29.2%) and low testing rate of fathers and the siblings of HIV exposed infants.

I therefore call on the Government, NGOs, global health donors and other partners not to relent in the fight against this deadly disease condition. HIV test kits should be made available free of charge in all health organizations and everywhere women deliver babies as well as urgent commencement of ARVs to infected persons. Health education of the masses on HIV/AIDS is also key in the elimination of stigmatization with improved disclosure practice.

## Declaration by Author

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