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Sero - Status Of HIV-Exposed Infants Delivered By HIV-Positive Mothers In Health Facilities Of Imo State, Nigeria: A 5year Survey.

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Abstract :
***Background**: Mother-to-child transmission (MTCT) of infants with the Human Immunodeficiency Virus (HIV) is a public health concern especially in Sub-Saharan Africa.*
***Objective**: To assess the sero-status of HIV-exposed infants delivered by HIV-positive mothers between 2008-2012 in health facilities of Imo State, Nigeria.*
***Methods**: A cross sectional survey conducted in Imo State University Teaching Hospital, Orlu (tertiary), General Hospital Umuguma (non-tertiary public) and Holy Rosary Hospital Emekuku (non-tertiary private). Data was abstracted from the hospital records using a proforma, and analysed with SPSS at a statistical significance level of 0.05.*
***Results**: A total of 478 infant-mother pairs were studied, with overall MTCT rate of 19.7% (tertiary 5.7% and non-tertiary 29% respectively). Of the HIV positive infants, 88% were delivered in the non-tertiary health facilities. Mothers of 53% of infected infants did not attend antenatal clinic and ANC attendance was protective against MTCT of HIV. Also delivery in a tertiary facility irrespective of booking status was significantly associated with sero-negative baby.*
***Conclusion / recommendation**: Concerted effort must be made by all stakeholders to improve the quality of PMTCT services in the non-tertiary facilities for a uniformly effective MTCT prevention, while sustaining the gains in the tertiary facilities.*
***Keywords :**Sero – status, HIV- exposed infants, Imo state.*

I. Introduction

The mother-to-child transmission (MTCT) of HIV refers to the transmission of HIV from an HIV-positive woman to her child during pregnancy, labour, delivery or breastfeeding with MTCT contributing 90% of HIV infections in children.[1] The elimination of MTCT of HIV otherwise called vertical transmission of HIV is a global priority. It occurs principally during labour and is of particular concern in Sub Saharan Africa where women account for 59% of adults with HIV and children having the highest burden of new HIV infections worldwide. [2]

In 2011, a Global Plan initiated by the United Nations was launched to reduce by 90% the number of new infant HIV infections through MTCT by 2015.[3] By 2012 over 900,000 HIV pregnant women (62%) globally were accessing PMTCT services with new HIV infections among children in low and middle income countries estimated at 260,000 representing a 35% reduction of the 2009 estimate.[4] The stepped up access to PMTCT services have prevented more than 670, 000 children from acquiring HIV from 2009 to 2012;[4] so with effective PMTCT interventions, the risk of transmitting HIV to the infants can be reduced to less than 5%.[5] Effective PMTCT interventions require the uptake of antenatal services, HIV testing during pregnancy, use of antiretroviral therapy (ART), safe childbirth practices, appropriate infant feeding, infant HIV testing and adherence to care post-natally.[6] PMTCT programmes not only need to be scaled up but be uniformly effective in the different tiers of the health institutions that provide them in order to meet the target of reducing new HIV infections among children.

ART is the core intervention among other interventions of the PMTCT service package, as antiretroviral drugs can reduce the risk of HIV vertical transmission from 15 to 45% in the absence of any other intervention to less than 5%.[7] The low antiretroviral treatment coverage among children in resource poor

countries has been attributed to the challenges in early infant diagnosis (EID) resulting in reduced effectiveness of PMTCT services.[4] While some African studies[8,9] identified high levels of maternal knowledge of HIV and MTCT as factors for effective PMTCT services, a Nigerian study reported that factors such as stigma and discrimination despite high levels of maternal knowledge were associated with interruption to treatment adherence and retention thereby resulting in reduced effectiveness of PMTCT services.[10] In fact, it has been estimated that more than 50% of vertical transmissions of HIV can be attributed to the cumulative effect of stigma.[11]

In resource-poor settings, the shortages of PMTCT staff, inadequate counselling services, poor monitoring of PMTCT services, interruptions in treatment and medical supplies can reduce the effectiveness of PMTCT services[12,13] and thereby can result in the disparities in the quality of PMTCT services offered at the different tiers of the health institutions (tertiary and non-tertiary). A Study across four African countries[14] has reported the presence of inadequately trained staff and poor counselling skills at the level of the health facility as potential barriers to the effectiveness of PMTCT. Subsequently, a positive relationship between an antenatal quality score and PMTCT coverage was established. A study in Nigeria reported that some of the barriers to effective PMTCT in their health institution were insufficient and inconsistent counsellors, lack of antiretroviral drugs and unaffordable caesarean delivery.[15]

Long-standing health-system issues such as staffing and community-level factors such as stigma have not changed over time and continue to burden PMTCT programmes more than 10 years after their introduction[16] and as such health institution systems that deliver PMTCT services in low and middle income countries continue to underperform. So, it is critical to identify and improve performance gaps at each step of the PMTCT pathway and a systems improvement strategy may offer a much needed approach to rapidly improve under-performing PMTCT implementation programmes.[17]

Consequently, this study indirectly examined the early years of PMTCT services in the state, by assessing the sero-status of HIV-exposed infants born to HIV-positive mothers in facilities providing integrated PMTCT, Maternal, neonatal and Child Health and Paediatric HIV services[18] in the state for the period under review. The justification for the use of only facilities offering integrated services is the need for accuracy of assessment, so only infant-mother pairs who had exposure to some form of integrated PMTCT services such as: provider-initiated counselling and testing (PITC); highly active anti-retroviral therapy (HAART) / anti-retro-viral (ARV) prophylaxis; opportunistic infection prevention (including Co-trimoxazole prophylaxis (CPT) if indicated); safe child birth practices / caesarean section; infant feeding counselling and support; infant ARV prophylaxis and early infant diagnosis (EID) would be assessed.

II. Methods

2.1 Study area / setting

The study was conducted in three health facilities in Imo State, one tertiary, and two non-tertiary health facilities (one public and one private). The tertiary institution was Imo State University Teaching Hospital, Umuna, in Orlu Local Government Area (LGA), the non-tertiary institutions were General Hospital (now specialist hospital), Umuguma, in Owerri West LGA and Holy Rosary Hospital, Emekuku in Owerri North LGA (a non-tertiary faith-based facility). Imo State is in the South East of Nigeria, it had a total population of 3.93 million (2.03 million males and 1.9 million females) by 2006 census, with an expected population in 2013 of 4.95 million based on an annual growth rate of 3.2% between 2006 and 2013.[19] The State occupies an area of 5289.49 square kilometres with a population density of about 707.9 per square kilometre.[20]

The State has two tertiary facilities, namely the State Teaching Hospital, and a Federal Medical Centre. The Non-tertiary facilities include the State Specialist Hospital, 10 General Hospitals, Comprehensive Health Centres, 535 primary health centres and health posts and about 577 private / faith-based hospitals. Yet there is still the problem of inadequate provision of health care.[21] The major Implementing Partner (IP) for the ART Programme (cum PMTCT) in the state presently is Centre for Clinical Care and Research Nigeria (CCCRN), but for the period under review, the major IPs in the state included Institute for Human Virology Nigeria (IHVN) and Global HIV/AIDS Initiative Nigeria (GHAIN). As at the study period integrated PMTCT services were provided only in the two tertiary facilities, two of the General Hospitals (one of which is now the specialist hospital) and one of the private hospitals.

2.2 Study population, sample size and sampling

Target population was infants delivered by HIV-positive pregnant women in the health facilities during the survey period. Exclusion criteria were health facilities not providing integrated PMTCT services and infant- mother pairs with in-complete records.

The minimum sample size (100) was estimated using Cochran formular[22]: $n= Z^2pq/ E.^2$ ('equation 1') Where n = sample size, E = tolerable error of margin = (0.05), p = proportion of a target population estimated to have a certain characteristics; p is the proportion of mother-to-child transfer of HIV = 0.07 (7%).[23] :q = 1 – p =

0.93 ('equation 2'), while Z = standard normal deviate at 95% confidence interval. However, 478 infant-mother pairs were studied.

One facility each was randomly selected from the three eligible categories of health facilities (except for faith-based non tertiary with only one eligible facility), namely, Imo State University teaching hospital, Orlu, General Hospital Umuguma and Holy Rosary Hospital Emekuku. At the facilities all eligible infant-mother pair records were abstracted.

2.3 Study design, data collection and analysis

The study was a 5 year retrospective cross sectional survey of all infants delivered by HIV-positive mothers between 2008 and 2012; data was collected during the third quarter of 2013. A pro-forma was developed to collect data from the medical records of all eligible infant-mother pairs which included mother's occupation and antenatal care status, infant gender, infant's HIV status and type of health facility the infant was delivered. Two research assistants were trained on data abstraction. Early infant diagnosis in the study centres were done at 6weeks, ≤6months and ≤18 months via a reference laboratory (at Nnamdi Azikiwe University Teaching Hospital, Nnewi) through dry blood spot (DBS)[24] with HIV-Deoxyribonucleic acid-Polymerase Chain Reaction using Cobas Ampliprep / Tapman 96 (CAP/CTM96) HIV DNA PCR (Roche Molecular Systems, Branchiburg, NJ, USA) according to manufacturer's instructions[25] and in keeping with Nigerian PMTCT guideline.[26]

Data was collated and analysed using International Business Machine Statistical Package for Social Sciences (IBM SPSS version 20, Armonk. NY: IBM Corp.2011). Frequencies distribution and percentages were tabulated, bi-variate analysis was with Chi-square for proportions and results considered significant at two-sided P-value of <0.05. Multi-variate analysis was done and Odds ratio cum confidence interval calculated when applicable.

2.4 Ethical considerations and limitations of study

Ethical approval for the study was obtained from Imo State University Teaching Hospital Ethics Committee, and permission obtained from appropriate authorities in the health facilities. Anonymity of information was ensured and important findings would be disseminated appropriately.

III. Results

It was observed the highest number of mothers 170 (35.6%) was into trading and 59.8% of the HIV-positive pregnant mothers attended non-tertiary health facilities. Seventy-percent (336/478) of the mothers booked for antenatal care in their facility of delivery (Table 1).

Four hundred and seventy eight exposed infants were delivered of which all were single birth deliveries. Sixty percent (286/478) of the HIV exposed infants were delivered in non-tertiary health facilities. A 5 year HIV MTCT sero-prevalence of 19.7% was recorded, with non-tertiary facilities contributing majority (n = 94, 88.3%) of this prevalence. Only 1.1% of the positive infants at earlier PCRs were available for the 18 months assay. The facilities used serology test (applying serial algorithm with rapid test kits) after 18months for those not presented for the 18months assay and between 12 – 18months for confirmation of those negative at first assay, there was 100% concordance with the PCR results. About 63% of the HIV positive infants were females (Table 2).

There was a statistically significant association (p = 0.000, OR = 0.28, 95% CI: 0.17 – 0.44) between the HIV status of the exposed infants with the ANC status of their mothers, as 87% (292/336) of booked exposed infants were negative against 64% (92/142) of un-booked exposed infants. Likewise the type of hospital used by the mothers was significantly associated with the HIV status of exposed infants (p = 0.000, OR = 0.15, 95% CI: 0.08 – 0.28), as 29% (83/286) of those delivered in non-tertiary facilities were positive against 5.7% of those delivered in tertiary facilities (Table 3).

A statistically significant proportion of HIV-positive mothers booked and received antenatal care in the non-tertiary health facilities (76%) compared to the tertiary facilities (63%). However, among the booked HIV-positive mothers who received antenatal care, a significantly lower proportion of HIV positive infants were delivered in the tertiary facility (1.7%) than in the non-tertiary facilities (19.4%) (Table 4).

IV. Discussion

This study assessed the HIV status of 478 HIV-exposed infants in tertiary and non-tertiary hospitals. The majority of the HIV exposed infants were delivered in the non-tertiary hospitals and this was not unusual as these hospitals are more in number and are supposed to be more accessible to the patients, though the boundaries between the levels of health care are often blurred especially for maternal and child care in our environment.

An overall HIV MTCT prevalence of 19.7% (tertiary = 5.7% and non-tertiary = 29%) was reported in this study. The tertiary prevalence is comparable with report of 7% from a tertiary facility in Nigeria [23]for samples of 2011 to 2012 (reported in 2014). The overall prevalence however differs with an earlier report of 33.7% in the country as at 2008 [27] (a period during which PMTCT activities were not optimal), but is

comparable with 12.2% from Zambia in 2012.[28]The poor turn-out for the 18months assay is indicative either of poor community home base activities for tracking appointments and tracing defaulters or a need to revisit schedule for EID in the area.

Studies have reported gender differences in peri-natal HIV infection of exposed infants stating that female infants were significantly more likely to be HIV infected perinatally[29,30] This was corroborated in this study where 63% of the HIV positive infants were females, further highlighting the theory that female infants could be more susceptible to HIV infection in the in-utero and peripartum period compared with male infants. The basis for this is unclear yet.

It was observed generally that 70% of mothers of the HIV exposed infants booked and received antenatal care, a finding comparable to another hospital based study in the same region of the country which reported 66.8% ANC attendance,[31]but, differs with a community based study in the same state which reported 83.7% attendance to hospital care by pregnant women,[32] also with an Ethiopian study which reported 59.6% ANC attendance among HIV-positive mothers.[33] The benefits of antenatal care especially for HIV exposed infants has been reported previously, [34] as shown in this study ANC attendance was protective against MTCT of HIV (OR = 0.28, 95% CI: 0.17 – 0.44); with significantly higher proportion of booked mothers giving birth to HIV-negative babies. This calls for increased enlightenment to achieve the maximum ANC attendance rate possible among HIV-positive mothers, especially in resource poor settings.

A significantly higher proportion (88.3%) of the HIV-positive babies was delivered in the non-tertiary facilities, implying that great majority of the vertical transmission of HIV in the state during the review period occurred in non-tertiary facilities. This is worrisome in view of the preponderance of non-tertiary facilities and attendant accessibility to the mothers. It calls for training and re-training of the personnel in such facilities in PMTCT and provision of equipments / consumables by the government (state and federal), IPs and proprietors.

When antenatal care was assessed against hospital type, the non-tertiary health facilities had a significantly higher proportion of HIV-positive mothers who delivered there-in being booked (76%) against the tertiary facilities (63%). This could be explained by their greater accessibility to patients which provide the opportunities for antenatal care advocacy. Also, since the tertiary facilities are referral centres, some high risk or complicated cases are referred there-in for delivery at late stage.

Despite the lower proportion of HIV-positive mothers that received antenatal care in the tertiary facilities, it still had a lower prevalence of MTCT of HIV as earlier stated. Therefore each stratum of ANC status (booked and un-booked) was assessed according to the hospital type and the HIV status of the infants. Result showed the tertiary facilities had a significantly lower proportion of HIV-positive infants in both strata. This could be further evidence for the need to improve PMTCT services in non-tertiary facilities. Though quality improvements of PMTCT services through a process of mentoring and support of antenatal clinic nurses and other staff are needed, further studies are required to identify the factors promoting HIV vertical transmission in such facilities in order to close the gap in PMTCT effectiveness between tertiary and non-tertiary hospitals. A community-based approach to care of women and children infected with or exposed to HIV has been used in Nevada, United States to reduce MTCT from 23% to 0%[35] and could be replicated here. Overall however, quality improvements to PMTCT services in our terrain should be based on strengthening the health care system.

4.1 Limitations of study

Inadequacy of PMTCT records was a challenge as it was difficult to get all the records for a few infant-mother pairs. Likewise it was difficult to match some babies with their mothers due to difference in surnames; such babies were traced by matching their dates of birth and sex on the DNA-PCR register with the days of delivery of the mothers on the delivery register. Only 1.1% of the eligible infants had a repeat assay at 18 months, hence the study was based on DNA-PCR of 6weeks and 6months. This is supported by a clinical report which asserts that with Nucleic Acid Amplification Tests diagnosis or presumptive exclusion of HIV infection within first several weeks of life can be established and that a diagnosis of HIV infection can be made on the basis of two separate samples positive for HIV DNA or RNA.[36]

V. Conclusion

The prevalence of MTCT of HIV in the state was comparable with what obtained in Sub-Saharan Africa. However, the study revealed is a yearning gap in effectiveness of PMTCT services between the tertiary and non-tertiary facilities. The attendance of ANC by HIV-positive mothers and consequent reception of PMTCT services was a significant factor in the reduction of MTCT. The facilities in the state depended on a referral laboratory from a neighbouring state for EID, with delays in receiving result and its attendant effects. Only a negligible proportion of infants presented for the 18months assay.

There is should be more enlightenment packages directed towards HIV-positive women on the need to attend ANC and receive PMTCT services when they are pregnant; emphasizing the benefits on their children. There is an urgent need by government and IPs to target improving PMTCT services in non-tertiary health

facilities, while sustaining the gains in tertiary facilities for uniform effectiveness of PMTCT services and effective reduction of MTCT in state and Sub-Saharan Africa in general. The individual facilities need to explore more effective means to track appointments and trace defaulters. The state is ripe to have one of its laboratories equipped for Nucleic Acid Amplification Tests to aid efficient EID in the state.

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TABLES

Table 1: Frequency distribution of HIV-positive mothers' characteristics

Characteristics	Frequency (n=478)	Percentage
Occupation of mothers		
Civil service	56	11.7
House wife	127	26.6
Trading	170	35.6
Others*****	125	26.1
Type of hospital attended		
Tertiary	192	40.2
Non-tertiary	286	59.8
ANC status of mothers		
Booked	336	70.3
Un-booked	142	29.7

*****Included professionals, artisans, public servants, and farmers

Table 2: Frequency distribution of HIV-exposed infants' characteristics

	IMSUTH n(%)	Gen. Hosp n(%)	Holy Rosary n(%)	Total n(%)
Exposed infants				
HIV-exposed infants	192(40.2)	148(31.0)	138(28.8)	478(100)
Positive infants				
Infants positive by 6weeks and 6months assay				
Infants available for 18Months assay	11(11.7)	31(33.0)	52(55.3)	94(19.7)
	1(100)	0 (0)	0 (0)	1(1.1)
Gender of positive infants				
Male	4(11.4)	12(34.3)	19(54.3)	35(37.2)
Female	7(11.9)	19(32.2)	33(55.9)	59(62.8)
Total	11(11.7)	31(33.0)	52(55.3)	94(100)

TABLE 3: HIV-exposed infants' sero-status versus: mothers' ANC status and hospital type

	Positive n (%)	**Negative n (%)**	**Freq (%)**	**X^2**	**P-value**	**OR (CI)**
ANC status						
Booked	44 (44.8)	292 (76.0)	336 (70.3)	30.9 (df=1)	0.000	0.28 (0.17-0.44)
Un-booked	50 (53.2)	92 (24.0)	142 (29.7)			
Total	94 (19.7)	384 (80.3)	478 (100)			
Hospital type						
Tertiary	11 (11.7)	181 (47.1)	192 (40.2)	39.5 (df=1)	0.000	0.15 (0.08-029)
None - tertiary	83 (88.3.)	203 (52.9)	286 (59.8)			
Total	94 (19.7)	384 (88.3)	478 (100)			

TABLE 4: Hospital type versus ANC status of mothers and sero- status of booked and un-booked HIV-exposed infants

	Tertiary n (%)	**Non tertiary n(%)**	**Freq (%)**	**X^2**	**P-value**	**OR (CI)**
ANC status of mothers						
Booked	120 (62.5)	216 (75.5)	336 (70.3)	9.3 (df=1)	0.002	0.54 (0.36-0.80)
Un-booked	72 (37.5)	70 (24.5)	142 (29.7)			
Total	192 (40.2)	286 (59.8)	478 (100)			
Booked infants status						
Positive	2 (1.7)	42 (19.4)	44 (13.1)	21.4 (df=1)	0.000	0.07 (0.02-0.30)
Negative	118 (98.3)	174 (80.6)	292 (86.9)			
Total	120 (35.7)	216 (64.3)	336 (100)			
Un-booked infants status						
Positive	9 (12.5)	41 (58.6)	50 (35.2)	33.0 (df=1)	0.000	0.10 (0.04-0.24)
Negative	63 (87.5)	29 (41.4)	92 (64.8)			
Total	72 (50.7)	70 (49.7)	142 (100)			