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Follow-Up Care of HIV-Positive Pregnant Women in North Central Nigerian: A 15-Year Review

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Abstract

Background: Pregnant women bear the greatest burden of people living with HIV in the West Africa sub-region, and the country requires continuous optimal follow-up care for their disease after delivery. Documentation of such very important services is rarely done in this high-burden environment, and hence the present study. **Method:** A 15-year retrospective review of medical records of HIV-positive pregnant women who attended antenatal care services from January 2006 to December 2020 at the prevention of the mothers-to-child transmission unit of the health facility was carried out to document the HIV service provided at the unit, and the follow-up care at the adult HIV special treatment clinic for the continuation of their HIV treatment. **Results:** Of the 1245 HIV-positive pregnant mothers reviewed during the period, 702 (56.4%) were between the ages of 26 - 35 years, 1043 (83.8%) were on HIV treatment before their index pregnancy, 202 (16.2%) were diagnosed of HIV infection during their last trimester and labor, while 878 (70.5%) continued their HIV services at adult HIV special treatment clinic after delivery. The predictors of continuous care include: maternal parity with [OR] 0.51 (0.35 - 0.73), p = 0.02, time of presentation in trimester with [OR] 1.54 (1.15 - 2.06), p = 0.003, duration on antiretroviral therapy [OR] 2.14 (1.57 - 2.9) p < 0.0001, time of diagnosis of HIV infection [OR] 16.98 (2.29 - 125.9), p = 0.006 V, and maternal parity with [OR] 0.7 (0.5 - 0.97, p = 0.034), thus translating to younger mother, those on HIV treatment before index pregnancy, those diagnosed during last trimester of pregnancy and labor, those that presented during the 1st or 2nd trimester of their pregnancy, and those with fewer number of children are more likely to continue with optimal HIV services after delivery. **Conclusion:** The high rate of optimal follow-up care of HIV-positive mothers after delivery in the adult special treatment clinic in this study speaks

of the preparedness and good supportive services provided to these mothers in the health facility. However, the high rate of loss to follow-up among this cohort of women requires a more focused intervention during their postpartum period for a better outcome.

Keywords

Follow-Up, HIV, Quality of Life, Pregnant Women

1. Introduction

Sub-Saharan Africa (SSA) is worst hit by HIV pandemic, recording the highest incidence of 4.2% among adult population [1]. Nigeria is second to South Africa in this global burden, and women of reproductive age make up 57% of adults living with HIV [2]. Pregnant women bear the greatest burden of PLWH globally, with approximately 1.4 million living with the virus in low-and middle-income countries [3]. Studies have shown that HIV pregnant mothers have up to 8 times greater risk of dying than the uninfected ones, with deaths ranging from 7% - 21% globally, and over 24% in the SSA [4] [5] [6]. Nigeria accounts for 24% of pregnant women living with HIV worldwide who are not on antiretroviral therapy (ART) [7], making it the largest contributor among the seven countries that account for half of all new HIV globally [7]. In the absence of well-tailored HIV management strategies, low maternal healthcare service utilization, low rate of facility delivery, and very low post-delivery long-term medical care, this pandemic will continue to pose very big challenge in the lives of women from poor communities of developing nations. These challenges were attributed to factors such as limited access to medical services, and HIV testing secondary to poverty and other socio-economic factors [8]. Studies have shown HIV-infected women to be more likely than men to report postponing medical care services because of lack of transportation money, illness, or other competing needs [9]. Optimal recommended standard longitudinal follow-up care for HIV-infected women after delivery advocates at least two follow-up visits with HIV provider within 1 year of delivery [10]. The HIV maternal and child health care services include antenatal care (ANC), delivery services, postpartum care, and integrated prevention of mother-to-child transmission of HIV (PMTCT) services [11]. The PMTCT cascade is a comprehensive package of services that includes maternal antenatal care, HIV testing, and initiation of antiretroviral therapy, and long-term postpartum health system engagement for HIV-positive women [12]. Their post-partum care according to Nigerian guideline among others included: couple or partner testing and counselling, contraception and provision of condoms, providing the infant with ARV prophylaxis, educating and reinforcing on optimal infant care, providing adherence counselling to continue on ARV, and referral newly delivered mothers to the adult ART clinic for continuation of ART medications [13]. Follow-up care had remained an unmet need for many HIV-positive newly deli-

vered mothers in many communities. In fact, a study by Rana *et al.* [14] from Mississippi in USA reported only 37% of HIV-positive mothers to have attended follow-up visits to HIV health care provider within 1 year of their delivery. This they attributed to low wages of the women, their limited health literacy, and competing responsibilities, such as employment, and management of their illness. Studies by HIV Cost and Services Utilization [15], and Women's Interagency Study [16], showed positive women to likely have low income, less likely to receive combination of ART, more likely to postpone care from transportation issues, their illness, and caring for their child. This may complicate their ability to manage their own illness [15] [16].

The prevalence of HIV in women of childbearing age of 15 - 49 years in Nigeria is high, 1.9%, its prevalence among pregnant mothers is also high, these women gave birth to over 60,000 exposed babies yearly in the country [17] [18]. In spite of this huge burden on pregnant women, there is dearth of information on quality of care provided to these mothers during their ANC and follow-up visits in our health facility since the inception of HIV services in the center. Hence, this study is aimed at documenting the HIV clinical services provided for our positive pregnant women during their ANC visits, and their referral to adult ART clinic after delivery for continuous ART services in our health facility.

2. Materials and Methods

A 15-year retrospective review (January 2006-December 2020) of medical records of HIV-positive pregnant mothers who attended ANC services at the University of Abuja Teaching Hospital (UATH) PMTCT unit was carried out to document the services provided at the unit, as well as their follow-up visits at the adult ART special treatment clinic after delivery. Optimal follow-up visit, defined as at least two visits to HIV provider in the postpartum year, is expected to be carried out in our adult ART unit, 3 monthly for stable patients for their drug refill/ clinical, and laboratory evaluations. PMTCT unit of ANC is an out-patient clinical service area where HIV infected pregnant women is followed up for treatment and monitoring. It has consulting rooms for the obstetricians, nurses, and adherence counselors. Record clerks, monitoring and evaluation staff, pharmacists, laboratory scientist and technicians, are also at their disposal on week days (Monday-Friday, from 7.30 am to 4 pm). Adult ART special treatment clinic is also an out-patient service unit of Medicine department of our institution that provides HIV treatment and monitoring services to adult positive patients. They have similar but different health care providers as in PMTCT unit of ANC (doctors, nurses, adherent counsellors, laboratory scientists and technicians, pharmacists, record clerks, monitoring and evaluation staff) in addition to home base care services, volunteers, support groups, and nutrition services attached to the unit. UATH is a 500-bed capacity referral hospital, sub-serving the people of federal capital territory (FCT) Abuja and four neighboring states of Kogi, Nassarawa, Niger, and parts of Kaduna state. Is one of the first centers to

start offering free HIV/AIDS services in the country, through the President Emergency Plan for AIDs relief (PEPFAR) and Federal Government of Nigeria (FGN) since 2005?

The proforma was developed to extract information on computer and folder and entered into a data sheet developed for the purpose Dart socio-demographics and HIV-related parameters of the pregnant mothers were collected from the PMTCT Tools (Registers), were collected. Monthly summary form in hard copies domiciled in the unit. Information collected included: their age, parity, marital status, time of diagnosis of HIV infection/commencement on ART, whether before, during the index pregnancy, or during labor, duration on ART, type of ART, time of enrollment to ANC/PMTCT services, place of residence, religion, level of education of the mothers, employment status, socio-economic status, their CD4 cell count, and viral load (VL) during pregnancy and at 6 months post-delivery at the adult ART clinic, the type delivery, and the outcome of the mother at the follow-up visits, whether active, lost to follow-up, transferred to other facilities or dead. Referral for post-delivery follow-up care/visits to HIV service provider in the adult ART clinic will be obtained from their PMTCT tools/hard copies of the monthly summary sheets, and their records at adult ART clinic.

Their CD4 cell count was measured using automated PartecCyflow easy count kit (Partec code no. 05-8401 Western Germany), while VL measurement was with (Roche Smp/prep/cobs Taqman 96, USA). According to Nigerian guideline of 2014 and 2020, severe immunosuppression in adults was defined as an initial CD4 count < 200 cells/mm^3 or <15%, moderate immunosuppression was CD4 count of 200 to 350 cells/mm^3 or between 15% to 25%, and no immunosuppression was CD4 count ≥ 350 cells/mm^3 or ≥25% [13]. Because the VL assay used in clinical care until 2015 had a limit of detection of <400 copies/mL, this was the cutoff value during that period, but more recently, good viral suppressions is VL of ≤20 copies/mL was also used.

In this study, the demographic and clinical characteristics of the HIV post-delivery women attending adult ART special treatment clinic for follow-up care services will be subjected to univariate and multivariate analysis for predictors of optimal follow-up care. Data collection was with SPSS version 22 for the generation of frequency tables, mean, and standard deviations. Univariate and multivariate logistic regression analyses were used to identify predictors for optimal follow-up visits. Covariates in the multivariate model with p < 0.05 were considered significant.

Ethical issues: Ethics approval was obtained from the health research, and ethics committee of the hospital before the commencement of the study, and principles of research ethics were meticulously adhered to.

3. Results

Table 1: Depicts the characteristics of HIV-positive pregnant mothers during

Table 1. Characteristics of HIV pregnant mothers during antenatal care (N = 1245).

Variables	Frequency (%) or Mean (±SD)	Variables	Frequency (%) or Mean (±SD)
Maternal age (years)		**Mothers' SES**	
Mean age	29.40 ± 5.65	Upper	347 (27.9)
16 - 25	335 (26.9)	Middle	450 (36.1)
26 - 35	702 (56.4)	Lower	448 (36.0)
36 - 45	208 (16.7)	**Place of residence**	
Parity		Urban	551 (44.3)
Mean parity	2.5±1.6	Rural	694 (55.7)
1	461 (37.0)	**Mothers religion**	
2 - 4	598 (48.0)	Christianity	932 (74.9)
5 - 7	186 (15.0)	Islam	313 (25.1)
Year of index pregnancy		African religion	0 (0.0)
2006-2010	533 (42.8)	**Mode of delivery**	
2011-2015	525 (42.2)	Vaginal	1126 (90.4)
2016-2020	187 (15.0)	C/S	119 (9.6)
Trimester presentation (weeks)		**ART regimen**	
1 - 13 (1st trimester)	163 (13.1)	1st line	1137 (91.3)
14 - 26 (2nd trimester)	716 (57.5)	2nd line	108 (8.7)
27 - 40 (3rd trimester)	366 (29.4)	**Types of ART**	
Time of diagnosis of HIV		AZT + 3TC + NVP	507 (40.7)
Before pregnancy	1043 (83.8)	AZT + 3TC + EFV	46 (3.7)
During pregnancy	169 (13.5)	TDF + FTC + EFV	362 (29.1)
During delivery	33 (2.6)	TDF + FTC + DTG	181 (14.5)
Duration on ART (years)		TDF + FTC + ATV/r (LPV/r)	108 (8.7)
0 - 3	233 (18.7)	ABC + 3TC + NVP	41 (3.3)
4 - 6	250 (20.1)	**CD4 cell count (cells/μL)**	
7 - 10	361 (29.0)	Mean CD4 cell count (10 - 1126)	538.8 ± 222.4
>10	401 (32.2)	<200	273 (21.9)
Mothers' level of education		200 - 350	362 (29.1)
None	1 (0.1)	>350	610 (49.0)
Primary	119 (9.6)	**Viral load (copies/mL)**	
Secondary	755 (60.6)	Mean viral load	3837.7 ± 731.2
Tertiary	370 (29.7)	<20	473 (38.0)
Mothers employment status		20 - 400	367 (29.5)
Employed	1144 (91.9)	>400	405 (32.5)
Unemployed	101 (8.1)	**Outcome after delivery**	
Adherence		Active	878 (70.5.)
>95%	921 (74.0)	Loss to follow-up	202 (16.2)
<95%	324 (26.0)	Transferred out	119 (9.6)
		Dead	46 (3.7)

ANC and delivery. Information of over 60 mothers was not analyzed because of the incompleteness of data. Of a total of 1245 HIV study population analyzed, most 702 (56.4%) were between the ages of 26 - 35 years, with mean age of 29.40 ± 5.65 years. Majority 598 (48.0%) were para 2 to 4, most enrollment into PMTCT services in the year 2006-2010, 533 (42.8%), and 2011-2015; 525 (42.2%)], and during the 2nd trimester 716 (57.5%) of their pregnancy. The greater percentage of the mothers 1043 (83.8%) were diagnosis of their HIV infection before the index pregnancy, while only a hand full was during labor 33 (2.7%). Majority 361 (30.0%), and 401 (32.2%) were on ART for 7 - 10 years and over 10 years respectively. Most 755 (60.6%) had secondary level of education, majority 1144 (91.9%) were employed, and majority were of middle 450 (36.1%), and lower 448 (36.0%) SEC. Majority of the mothers 694 (55.7%) reside in rural area, 932 (74.9%) were Christians, and 1126 (90.4%) had normal vaginal delivery. The greater percentage of the mothers 1137 (91.3%) were on 1st line ART, mostly AZT + 3TC + NVP 507 (40.7%), TDF + FTC + EFV 362 (29.1%), and TDF + FTC + DTG 181 (14.5%) during their pregnancy. Their mean CD4 cell count was 538.8 ± 222.4 cells/mm^3 with majority 610 (49.0%) having good immune status of >350 cells/mm^3, while their mean VL was 3837.7 ± 731.2 copies/mL with majority 840 (67.5%) having good viral suppression with VL < 20 - 400 copies/mL. Majority 878 (70.5%) were still in HIV services at the adult ART special treatment clinic of the hospital after delivery, 202 (16.2%) were lost to follow-up, 119 (9.6%) were transferred to other health facilities on request, while 46 (3.7%) were reported died.

Table 2: Is the characteristics of HIV-positive mothers at their 2nd follow-up visit after 6 months of delivery. The mean age of the mothers, the highest age range, the year with most enrollment, their predominant place of residence, their religion, and the mode of delivery shares similarity with their ANC visits. Some variables however showed some differences, and predictors better follow-up visits. They include: mother's educational level, where mothers with tertiary level of education 368 (41.9%) were recorded to have greatest follow-up visits. Others were those from high SES 340 (38.7%), employed mothers 817 (93.1%), those on 2nd line ART 169 (19.2%), those on TDF + FTC + DTG 350 (39.9%) and TDF + FTC + EFV 265 (30.1%) 1ST line medications, those with good adherence of >95% 866 (98.6%), those with CD4 cell count of >350 cell/μL 597 (68.0%), and those with good viral suppression 771 (87.8) of between <20 - 400 copies/mL.

Table 3 shows univariate analysis of some predictors of optimal follow-up visits at 6 months post-delivery. Factors evaluated included maternal age, year of enrollment for PMTCT services, duration on ART, time of diagnosis of HIV, weather before, during index pregnancy or during labor, place of residence, maternal parity, educational level of the mother, CD4 cell count, type of ART at follow-up visits, and time of registration at the ANC. For maternal age, age > 35 years decreases the likelihood of coming for follow up visit, [OR], 0.51 (0.35 - 0.73), p < 0.0001. Variables with good predictors of optimal follow-up visit include: those that presented late in trimester and during delivery, [OR] 1.38 (1.04

Table 2. Characteristics of HIV-positive mothers at their follow-up visit after 6 months of delivery (N = 878).

Variables	Follow-up visits (%) or Mean (± SD)	Variables	Follow-up care (%) or Mean (± SD)
Maternal age (years)		**Duration of ART (years)**	
Mean, range	29.1 ± 5.5 (17 - 44)	0 - 3	61 (7.0)
16 - 25	244 (27.8)	4 - 6	116 (13.2)
26 - 35	514 (58.5)	7 - 10	312 (35.5)
36 - 45	120 (13.7)	>10	389 (44.3)
Year of Follow-up		**Mothers level of education**	
2005 - 2010	377 (42.9)	None	0 (0.0)
2011 - 2015	379 (43.2)	Primary	53 (6.0)
2016 - 2020	122 (13.9)	Secondary	457 (52.1)
Total		Tertiary	368 (41.9)
Mothers parity		**Adherence level**	
1	340 (38.7)	>95%	866 (98.6)
2 - 4	432 (49.2)	<95%	12 (1.4)
5 - 7	106 (12.1)	**Time of diagnosis of HIV**	
Mothers employment status		Before pregnancy	815 (92.8)
Employed	817 (93.1)	During pregnancy	63 (7.2)
Unemployed	61 (6.9)	At labor	0 (0.0)
Place of residence		**Mothers SES**	
Urban	386 (44.0)	Upper	340 (38.7)
Rural	492 (56.0)	Middle	323 (36.8)
Trimester presentation (weeks)		Low	215 (24.5)
1 - 12	101 (11.5)	**CD4 cell count (cells/µL)**	
13 - 24	502 (57.2)	Mean, range	589.9 ± 203.5 (110 - 1280)
25 - 40	275 (31.3)	<200	77 (8.8)
Delivery		200 - 350	204 (23.2)
Type of ART		>350	597 (68.0)
AZT + 3TC + NVP	58 (6.6)	**Viral load (copies/mL)**	
AZT + 3TC + EFV	25 (2.9)	Mean, range	1802.6 ± 642.3 (20 - 27000)
TDF + FTC + EFV	265 (30.1)	<20	376 (42.8)
TDF + 3TC_DTG	350 (39.9)	20 - 400	395 (45.0)
TDF + 3TC + ATV/r (LPV/r)	169 (19.2)	>400	107 (12.2)
D4T (ABC) + 3TC + NVP	11 (1.3)	**Mode of delivery**	
ART regimen		Vaginal	795 (90.6)
1st line	709 (80.8)	C/S	83 (9.4)
2nd line	169 (19.2)		

Table 3. Univariate analysis showing predictors of optimal care follow-up visits of HIV-positive mothers.

Variables	OR (95% CI)	p value
Maternal age		
15 - 25 (young age)	1	
26 - 35 (median age)	1.02 (0.70 - 1.37)	0.896
>35 (older age)	0.51 (0.35 - 0.73)	<0.0001
Time of presentation in trimester		
1st and 2nd (early)	1	
3rd and delivery (late)	1.38 (1.04 - 1.82)	0.021
Duration of ART		
<1 year (short)	1	
1 - 5 years (medium)	1.04 (0.77 - 1.41)	0.798
>5 years (long)	1.94 (1.45 - 2.59)	<0.0001
Time of HIV diagnosis		
Before pregnancy	1	
During pregnancy	15.54 (2.12 - 113.9)	0.007
During labor	1	
Place of residence		
Rural	1	
Urban	0.96 (0.75 - 1.22)	0.747
Mothers educational level		
Primary and secondary	1	
Tertiary	1.08 (0.82 - 1.41)	0.580
Mothers socio - economic class		
Lower	1	
Middle	0.96 (0.72 - 1.3)	0.805
Upper	1.09 (0.8 - 1.5)	0.593
Parity		
≤2	1	
>2	0.63 (0.49 - 0.801)	<0.0001
Mother employment status		
Unemployed	1	
Employed	1.64 (1.08 - 2.49)	0.021
Adherence during pregnancy		
<95	1	
≥95	0.2 (0.03 - 1.52)	0.119

Continued

CD4 cell count level (cells/µL)		
<200	1	
200 - 350	1 (0.71 - 1.43)	0.972
>350	0.82 (0.6 - 1.12)	0.214
Viral load (copies/mL)		
<20	1	
20 - 400	1 (0.73 - 1.38)	0.970
>400	1.07 (0.81 - 1.41)	0.640

- 1.82), p < 0.02, those that have been on ART greater than >5 years, [OR] 1.94 (1.45 - 2.59), p < 0.0001. Otherwhere: those diagnosed with HIV during pregnancy/delivery, [OR] 15.54 (2.12 - 113.9), p < 0.007, those with parity of >2, [OR] 0.63 (0.49 - 0.801) p < 0.0001, and employed mothers; [OR] 1.64 (1.08 - 2.49), p < 0.021.

Table 4 is the multivariate analysis of predictors that were statistically significant with univariate. They include: maternal age, employment status, time of presentation in trimester, duration on ART, parity, and time of HIV diagnosis. All the significant predictors for optimal follow-up visit after delivery with univariate analysis had similar predictors with multivariate, except for maternal employment status [OR] 1.49 (0.96 - 2.31), p < 0.08, which was not statistically significant. The positive predictors of optimal follow-up care include: maternal age, [OR] 0.51 (0.35 - 0.73), p < 0.021, those that presented late in trimester and during delivery, [OR] 1.54 (1.15 - 2.06, p < 0.003), those that has been on ART greater than >5 years [OR] 2.14 (1.57 - 2.9, p < 0.0001), those diagnosed of HIV during pregnancy/delivery, [OR] 16.98 (2.29 - 125.9, p < 0.006, and maternal parity of >2 [OR] 0.7 (0.5 - 0.97, p < 0.034).

4. Discussion

One of the significant findings in this study is prenatal diagnosis of HIV infection in 83.0% of the pregnant women who came for ANC services in the PMTCT unit of our hospital. This was in keeping with a similar study by Rana et al. [14] from Mississippi in USA where over three-quarters of the pregnant women in this cohort were diagnosed with HIV during the prenatal period, thus buttressing the support of routine opt-out testing strategies for women in their reproductive years for early diagnosis and treatment of HIV infection even before conception, to minimize the risk of the disease to their health, to their unborn children and to their partners [13] [19] [20] [21].

Continuous ART is currently recommended for all pregnant mothers with HIV to reduce the risk of disease progression, and prevent sexual and vertical transmission, and should be continued after delivery. The national guidelines on PMTCT, and integrated management of HIV in children, adolescents and adults

Table 4. Multivariate analyses of predictors of optimal follow-up care of HIV-positive mothers.

Variables	OR (95% CI)	p value
Maternal age		
15 - 25 (young age)	1	
26 - 35 (median age)	1.02 (0.73 - 1.44)	0.901
>35 (older age)	0.51 (0.35 - 0.73)	0.021
Time of presentation in trimester		
1st and 2nd (early)	1	
3rd and delivery (late)	1.54 (1.15 - 2.06)	0.003
Duration of ART		
<1 year (short)	1	
1 - 5 years (medium)	0.95 (0.70 - 1.31)	0.770
>5 years (long)	2.14 (1.57 - 2.9)	<0.0001
Time of HIV diagnosis		
Before pregnancy	1	
During pregnancy	16.98 (2.29 - 125.9)	0.006
During labor	1	
Parity		
≤2	1	
>2	0.7 (0.5 - 0.97)	0.034
Mother employment status		
Unemployed	1	
Employed	1.49 (0.96 - 2.31)	0.078

has provided a framework on how to respond and manage this infection in pregnant women with effort to reduce both maternal and infant deaths [13] [19] [20] [21]. Postnatal care also provides the opportunity to protect their lives by optimizing HIV care and treatment. To receive optimal medical care and desired outcomes, HIV-positive mothers during their postnatal visits must be consistently engaged in care of uninterrupted ART treatment. Creating a patient-centered, stigma-free environment with fewer barriers at the societal, health system, clinic, and individual levels is essential for achieving such. Because the immediate postpartum period poses unique challenges to ART adherence and retention in HIV care, arrangements for continuous supportive services should be made available to mothers during pregnancy before postpartum hospital discharge. The retrospective analysis in this study demonstrated a high follow-up rate of 70.5% among HIV post-delivery mothers to adult ART special treatment clinic for continuation of their ART in our hospital. Likely reasons for this high follow-up rate include: availability of robust, integrated, good referral HIV program for positive

pregnant mothers, adults and children/adolescents in the health facility. Being one of the 1st tertiary health institution to start offering HIV service to the populace since 2005, the hospital has access to state-of-the-art facilities for treatment and monitoring of HIV patients, together with well train and highly motivated health care providers. In addition to the free medical service offered, the availability of treatment support program by trained peer counselors, volunteers, and home-based support staff that provide both in-clinic counseling and outreach service at home with active patient tracing system for defaulters to ensure high retention rates is an added advantage to the clients. The finding in this study was however contrast to what was earlier reported by Rana *et al.* [14] from the southern part of USA where a much lower longitudinal follow-up rate of 37% was reported of newly delivered HIV-positive mothers to adult ART facilities for continuation of ART treatment. Their finding was also much lower than what was recommended by the HIV Medicine Association of the Infectious Diseases Society of America [10]. Reasons provided for such low follow-up rate are due to poverty of the mothers, lack of access to medical care, and competing responsibilities of caring for the newborn and themselves altogether.

Loss to follow-up (LTFU) was also reported to be high (16.2%) in this study. These are post-partum HIV-positive mothers referred to adult ART clinic who refused to go, or those lost from mortality, or those accessing ART services elsewhere without formal transfer. Part of the reasons for the high LTFU include: lack of transport fare to the health facility as most of the mothers (36.7%) were from low socio-economic background, and 55.7% residing in rural communities with very poor road network. This finding is particularly worrisome among this cohort of women as it will not only impact negatively on their morbidity and mortality, but also increase risk of transmission to their children and their discordant partner. A recent diagnosis HIV infection during antenatal assessments or during delivery leave the affected mothers with little time to process their new diagnosis or deal with the issues surrounding disclosure of their status to their spouses and family members, and therefore not adequately prepared to continue treatment because of this major life-altering event. The high LTFU rate in this study was similar to 19.8% and 17.1% reported among HIV pregnant and non-pregnant women in South Africa by Kaplan *et al.* [22] and Wang *et al.* [23] and attributed such to none provision of free medical services to their clients, and lack of comprehensive treatment support system. [23] [24] Studies have shown that the high LTFU rate of newly diagnosed HIV pregnant women continues at a relatively constant hazard for 3 years, indicating that the mother's circumstances post-delivery continue to influence adherence to their HIV program, and points to the need for a more focused intervention during this period for a better outcome.

The predictors of optimal follow-up care for HIV pregnant mothers after delivery in this study using multivariate logistic regression were maternal age, time of presentation in trimester, duration on ART, time of diagnosis of HIV, and maternal parity with [OR] 0.51 (0.35 - 0.73), p = 0.021 for maternal age, [OR]

1.54 (1.15 - 2.06), p = 0.003 for time of presentation in trimester, [OR] 2.14 (1.57 - 2.9) p < 0.0001 for duration on ART, [OR] 16.98 (2.29 - 125.9), p = 0.006 for time of diagnosis of HIV, and [OR] 0.7 (0.5 - 0.97, p = 0.034) for maternal parity. This was similar to early presentation trimester with odds ratio [OR] 2.1, p = 0.02) by Rana *et al*. [14]. On further analysis of their women with early presentation in trimester with good optimal follow-up care, they found out that these mothers were more likely to be non-black (p = 0.02), aged 25 - 32 (p = 0.04), and have an established HIV primary care provider (p = 0.003). Similar findings were also reported in this study where women seeking care in their early trimester, newly diagnosed, younger women, those on ART treatment before conception, and women with fewer children were more likely to have optimal follow-up postpartum HIV services.

The decreasing number of pregnant women with HIV infection as the year progresses in this study from 42.8% in 2016-2010, to 42.2 % in 2011-2015, and 15.0% in 2016-2020 reflects the decreasing prevalence of the infection in the country with decreasing trend of 5.8% in 2001, through 3.0% in 2014, 2.9% in 2016, and presently 1.3% in 2020 [25] [26]. This buttresses the effective of various interventions richly influenced by expansion of access to HIV counselling and testing, to ART services, PMTCT and other supporting services in various communities at both national and state levels.

The immunological status of the mothers at both antenatal and follow-up period evidence by mean CD4 cell count of 538.8 ± 222.4 cells/μmm^3 at antenatal period, and 589.9 ± 203.5 cells/μmm^3 during postnatal follow-up is a reflection of good adherence to ART of 74.0%, and 98.2% during the two periods and the effectiveness of the ART. Their mean VL, though not very commendable during ANC, and follow-up visits (3837.7 ± 731.2 copies/mL during ANC, and 1802.6 ± 642.3 copies/mL during follow-up), the percentage of those with adequate viral suppression of <20 - 400 copies/mL for the two periods were however quite encouraging 67.5% during ANC, and 87.8% during the follow-up period. This equally speaks of good adherence to their treatment, effectiveness of both 1st and 2nd line ART, and the supportive services provided in the facility.

5. Limitation of the Study

The data was collected retrospectively and some data were missing.

6. Conclusion

The study showed high optimal follow-up rate of postpartum HIV-positive to adult ART clinic for continuation of their treatment, as well projecting predictors of optimal follow-up visits among this cohort of women. The LTFU was however high, and points to the need for more focused intervention for these positive mothers after delivery for a better outcome.

Ethical Approval

UATH HREC PROTOCOL NUMBER: UATH/HREC/PR/196.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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