



OPEN Beyond HAART: unveiling the reality of antiretroviral therapy knowledge among pregnant women living with HIV in Kaduna State, Nigeria

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To ensure the prevention of mother-to-child-transmission of HIV (MTCT), 81% of pregnant women received antiretroviral therapy (ART) in 2021 worldwide. Despite the global efforts to prevent MTCT of HIV, significant knowledge gaps persist among these women including a lack of basic knowledge of HIV and ART. This study aimed to determine the levels of HIV knowledge, knowledge of ART, and attitude toward ART in HIV-positive pregnant women in Kaduna State. It was a hospital-based, cross-sectional study among 318 HIV-positive pregnant women attending antenatal care in the nine selected hospitals using a three-stage sampling technique. Data was collected using the *Open Data Kit*. Up to 54.4% had a fair knowledge of ART while 75.4% of the respondents had good knowledge of HIV, and up to 98.6% had a positive attitude towards ART. Knowledge of ART and attitude to ART are positively influenced by receiving multiple counselling ($p = 0.031$, aOR = 6), being on ART for ≥ 2 years ($p = 0.021$, aOR = 6); and not taking unprescribed medications ($p = 0.047$, aOR = 17) respectively. Sustained, focused counselling and patient education are necessary to establish and optimise the required adherence in this group. Also, implement clear task-sharing strategies for health personnel to provide tailored services.

Keywords ART knowledge, HIV, Pregnant women, PMTCT, Attitude to ART

One of the most serious public health challenges globally is human immunodeficiency virus (HIV) infection with the majority of people living with HIV in low- and middle-income countries. About 38.4 million people live with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) globally now^{1–3}. HIV is the leading cause of morbidity and mortality in sub-Saharan Africa (SSA), and it affects all age groups^{4–7}. There are about 20.6 million people (57%) with HIV in eastern and southern Africa, 5.0 million (13%) in western and central Africa^{2,8}. About 81% of pregnant women received antiretroviral therapy (ART) in 2021 compared to 49% in 2010, worldwide^{2,9}. The fastest-growing group of adults living with HIV is women. In SSA, females account for 63% of new infections while only 60% of pregnant women are accessing antiretroviral drugs in Western and Central Africa³. In 2018, 1.9 million people were living with HIV in Nigeria with a prevalence of 1.5% amongst adults which is though, much less than in other SSA countries like most southern African countries^{10,11}. However, due to its large population, Nigeria has the second-largest HIV epidemic in the world with about 58% of people living with HIV being women. As these women contract HIV, the number of children infected in utero, intrapartum, and during breastfeeding increases^{3,12–14}. HIV-positive women can transmit HIV to their children during pregnancy, childbirth, and breastfeeding^{15–17}. Nigeria records the highest absolute number of mother-to-child transmission globally¹⁸.

To terminate vertical transmission of HIV by 2025, pregnant women need to gain access to testing, engage in appropriate and constant treatment, care, and preventive mechanisms for themselves and their infants, acquire knowledge of their HIV status, etc^{19,20}. Pregnant women living with HIV without treatment have a 15–45%

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likelihood of the virus being transmitted to their children and ART can reduce the risk to below 5% (for countries where breastfeeding is practiced) or below 2% (for countries where breastfeeding is not practiced)^{17,21–23}. The use of ART has provided hope to HIV-positive women considering pregnancy and minimised mother-to-child HIV transmission²⁴. Available data from the Kaduna State Ministry of Health shows that as of 2015, Kaduna State had about 8707 HIV-positive pregnant women with only 3388 (38.9%) commenced on highly active antiretroviral therapy (HAART).

Having a basic knowledge of HIV transmission and prevention, an understanding of antiretroviral therapy, the side effects of treatment, and a positive attitude to ART are some of the documented recommendations crucial for the reduction of mother-to-child-transmission^{25–28}. Most studies performed to assess knowledge of HIV were in the general population of *People living with HIV/AIDS* (PLWHA) (i.e., not specific to HIV-positive pregnant women). There is a scarcity of information on the evaluation of knowledge, attitude, and beliefs of HIV-positive pregnant women in Nigeria, especially in northern Nigeria. Thus, the purpose of this study is to assess the levels of knowledge of HIV, knowledge of ART, and attitude to ART in HIV-positive pregnant women in Kaduna State. Kaduna State was selected as it is a state currently practicing option B+ whereby pregnant HIV-positive clients are commenced on HAART as soon as the baseline investigations are ready, and the client is stable.

Aim: To determine the levels of knowledge of HIV, levels, and factors associated with knowledge of ART, and attitude to ART in HIV-positive pregnant women in Kaduna State.

Methods

Study setting

This study was conducted in all three *senatorial districts* of Kaduna state, north-central Nigeria. Kaduna State is one of the 36 states in Nigeria with a projected population of 10.4 million people (from the 2006 Population Census) spread across 23 local government areas (LGAs) and 255 wards²⁹. Kaduna State is Nigeria's twelfth largest State, accounting for some 5% of Nigeria's total landmass.

Study design

It was a hospital-based cross-sectional study.

Study population

The study population was HIV-positive pregnant women attending the antenatal and antiretroviral therapy clinics receiving ART. These women were selected out of the 3,388 from nine HFs out of the 30 secondary HFs offering HAART to HIV-positive pregnant women³⁰.

Sample size calculation

The study sample size was calculated using the formula for cross-sectional studies:

$$n = \frac{Z\alpha^2 pq}{d^2}$$

where, n = minimum sample size: 264, p = proportion of HIV-positive women with non-adherence = 21.7% (Igwegbe et al., 2010), q = 1 – p, d = margin of error/level of precision: 0.05 (5%), $Z\alpha^2$ = normal deviate for two-tailed alternative hypothesis at 5% level of significant. Assuming the non-response rate is 10%, this brings the minimum sample size to 293³¹. A total of 318 respondents were eventually selected for the study.

Sampling method

A multi-stage random sampling procedure was used to recruit study participants. In stage one, the three senatorial districts in Kaduna State were stratified into three, and local government areas (LGAs) were selected by balloting (the three senatorial districts are Kaduna North, Kaduna Central, and Kaduna South). Three health facilities (HFs) that offer prevention-of-mother-to-child-transmission of HIV (PMTCT) services from the three selected local governments in each senatorial district were selected by the use of random numbers in stage two (three HFs per senatorial district = 9 HFs in total). Please refer to Fig. 1. The systematic random sampling method was used on clinic days from the HFs to select 318 HIV-positive pregnant women attending antenatal care in the nine selected hospitals. Proportionate sampling from weekly clinic attendance was used to determine the number of respondents selected per HF over ten weeks (April–June 2018). All eligible clients at the treatment site (HAART and the antenatal care centre, ANC) were recruited in this study.

Data collection

Kaduna State currently practices option B+. In between investigations, three adherence counselling sessions are conducted. Screened clients are assessed for treatment, then commenced on antiretrovirals (ARVs) once the investigation results (including the following: CD4 count, HIV VL, full blood count, electrolytes, urea and creatinine levels, liver function tests, abdominopelvic ultrasound, urinalysis) are available and at least two counselling sessions have been satisfactorily completed. An interviewer-administered, semi-structured questionnaire on the open data kit (ODK) was used to collect data. Information was obtained under the following sub-headings in the questionnaire: Socio-demographic characteristics, client's knowledge of HIV/AIDS with questions on HIV and its transmission, ways of prevention, sources of information about HIV/AIDS, clinical features of HIV/AIDS, clinical history of HIV and treatment (including side effects) with questions on knowledge and perception about antiretrovirals and their adverse effects, signs of AIDS, CD4 Counts, viral load

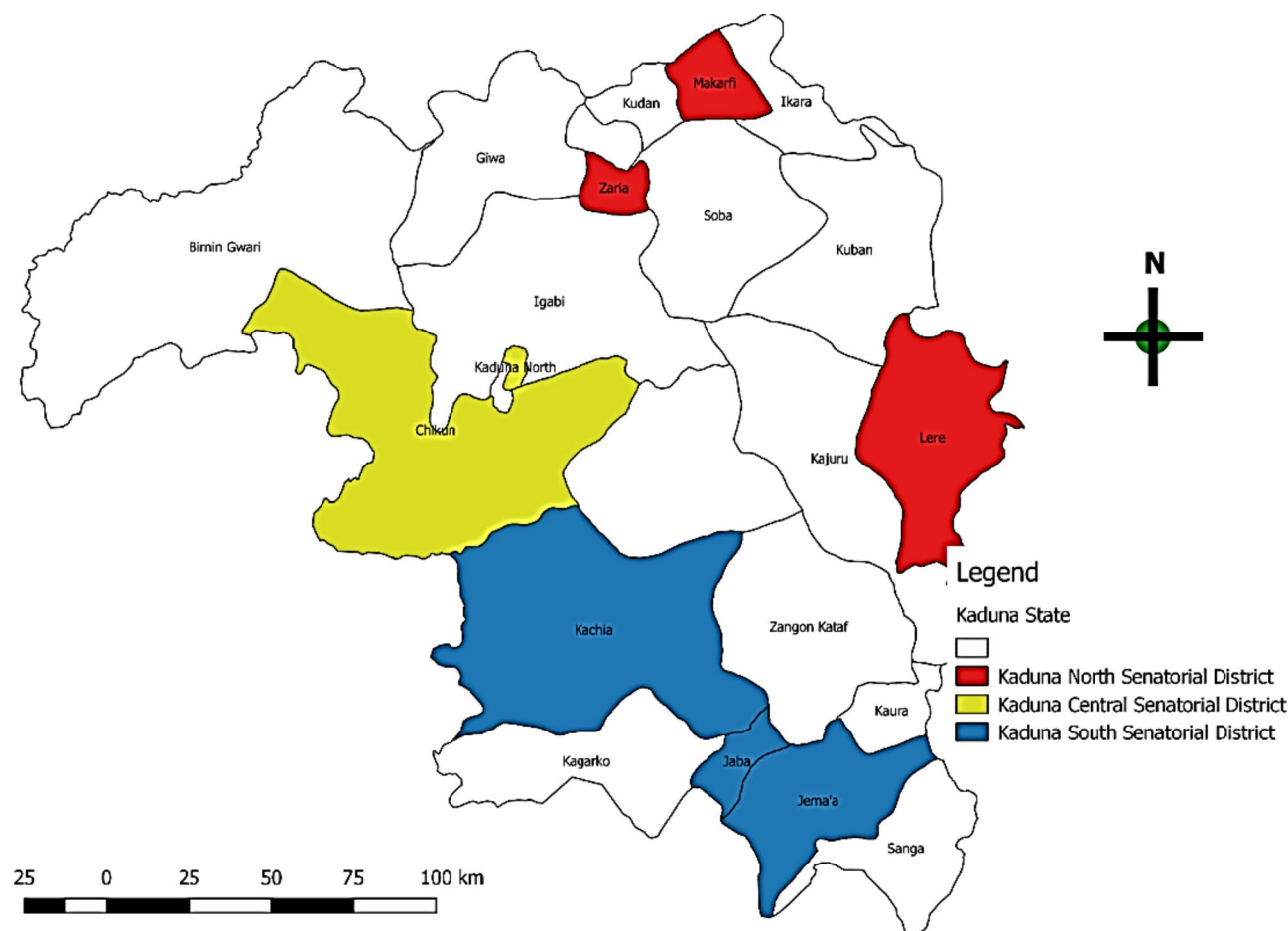


Fig. 1. Map of Kaduna State showing the nine LGAs where the study was conducted.

and antiretroviral therapy. The questionnaire was translated to Hausa (the predominant language spoken in the study area), and backtranslated to English, pretested, and validated thoroughly to detect errors.

Data measurements

Kasumu et al., (2014) scoring system was adapted in the scoring systems for *Knowledge of HIV, Knowledge, and Attitude of pregnant women to ART*. There were ten questions for the *Attitude of pregnant women to ART*, each question constituted 10%. Respondents with an overall score of $>50\%$ were categorised as having a positive attitude and those with total scores of $\leq 50\%$ were categorised as having a negative attitude. Knowledge of HIV/AIDS and knowledge of ART were categorised into 'poor', 'fair' and 'good' based on the scoring tools. See Appendix 1 (Supplementary information file_1) for details of these and the other scoring systems used in this study. Also, knowledge of ART was grouped into "Good" (4–7 score) vs. "Poor" (0–3 score) for this analysis.

Data analysis

The respondents' characteristics were described using frequencies and percentages. Chi-square tests (or Fisher's exact tests when the expected value of any cell is less than five) were employed to identify relationships between qualitative variables such as knowledge of ART, attitude toward ART, and variables. Multivariable logistic regression was conducted to determine the adjusted effect of variables on ART knowledge and attitude toward ART (associated factors). We conducted a backward stepwise selection (with a probability of entry $p < 0.30$ from bivariate analysis) to select variables for the multivariable logistic regression. A pairwise correlation coefficient comparison among independent variables to check for multicollinearity revealed low correlation coefficients. Theoretically relevant interactions between dependent and independent variables were assessed but were not significant. The final models for the multivariable regression for ART knowledge and attitude to ART were adequately suited (the goodness of fit test) with 0.27 and 0.39 McFadden's pseudo R^2 generated. Data was analysed using *Epi Info 7.1* and *SPSS* after cleaning with *Microsoft Excel 2010* spreadsheet.

Ethical considerations

Ethical clearances were obtained from the Kaduna State Ministry of Health Ethical Review Board and Barau Dikko Teaching Hospital (BDTH) Health Research Ethical Committee (Kaduna State University Teaching Hospital). See Appendix 2 (Supplementary information file_2). Permission was sought and obtained from the

Medical Directors of the facilities, PMTCT Focal Persons, and other relevant stakeholders. All respondents signed voluntary, written informed consent forms. Respondents were assured of absolute confidentiality. The research was executed according to global ethical regulations of the Declaration of Helsinki.

Results

Study participants' socio-demographic characteristics

A total of 318 HIV-positive pregnant women on HAART were analysed for this study with an average age of 31.4 years (SD = 5.6). About 57.5% (183) were urban residents, 42.5% (135) were rural residents, and though none of the respondents smoked cigarettes, up to 6.6% consumed alcohol. Only 30 (9.4%) admitted not to having any form of formal education. Table 1 shows the socio-demographic characteristics of the respondents.

Knowledge of HIV, ART, and attitude to ARV

Using scoring tools, 227 (75.4%) demonstrated good knowledge of HIV. Some respondents, 173 (54.4%) demonstrated fair knowledge of ART, while only 141 (44.3%) demonstrated good knowledge of ART. Most of the participants, 287 (98.6%) had a positive attitude to ARV use. See Figs. 2 and 3.

As shown in Table 2, 276 (86.8%) admitted to having heard of STIs and all the respondents knew at least one possible source of HIV infection. About 89.9% agreed that condom use during sex, when not planning to have conception can reduce the risk of HIV infection and over 90% responded that a healthy person can have HIV. The most common source of information on HIV is the clinic.

As shown in Table 3, 280 (88.1%) of the respondents were aware that ART can be used to reduce HIV progression, 276 (86.8%) admitted to the success of PMTCT through the use of ARVs, 278 (87.4%) admitted missing ARVs can lead to disease progression, and 274 (86.1%) were aware of their CD4 count. However, only a few (18.6%) knew their viral load and 176 (55.3%) admitted a minimum of 95% adherence is required for viral suppression and effective therapy. An overwhelming 285 (97.6%) feel the appropriate use of antiretrovirals prolongs life, while 286 (99.3%) agreed that it gives more benefits than harm. Almost all the respondents, 285 (97.9%) agreed that ARVs help clients to gain weight and enhance their quality of life. See Table 4 for further details.

Variable	Frequency (<i>n</i> = 318 unless otherwise stated)	Percentage (%)
Locality		
Urban	183	57.5
Rural	135	42.5
Education (formal)		
Yes	288	90.6
No	30	9.4
Highest education		
None	21	6.6
Qur'anic	17	5.4
Primary	98	30.8
Secondary	116	36.4
Tertiary	66	20.8
Marital status		
Single	8	2.5
Co-habiting	1	0.3
Married	308	96.9
Separated	1	0.3
Family Type (<i>n</i> = 310)		
Monogamous	221	71.3
Polygamous	89	28.7
Alcohol		
Yes	21	6.6
No	297	93.4
Alcohol types (<i>n</i> = 21)		
Spirit	1	4.8
Beer	12	57.1
Locally brewed	8	38.1
Counselled		
Yes	303	95.3
No	15	4.7

Table 1. Study participants' socio-demographic characteristics.

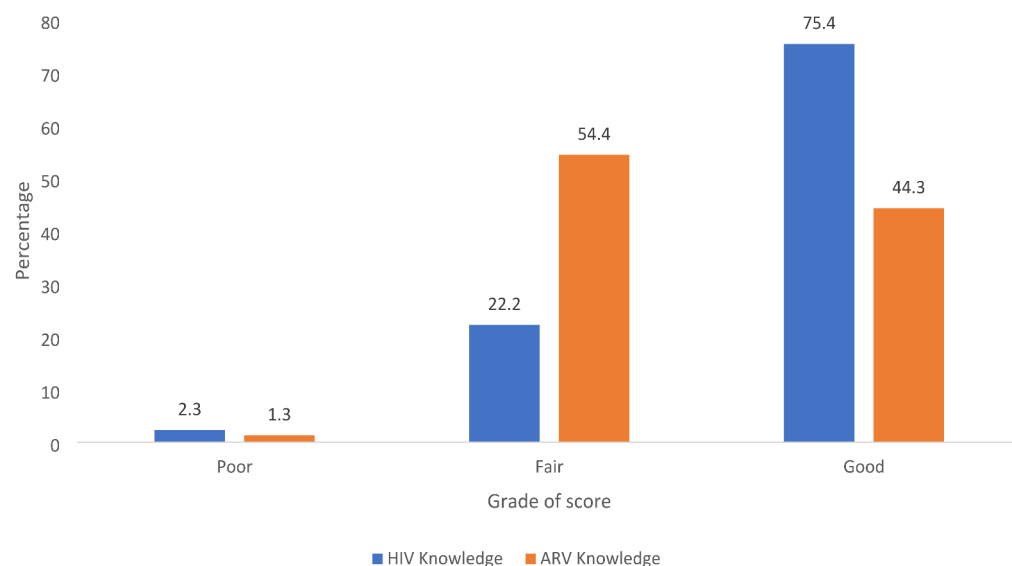


Fig. 2. Knowledge of HIV and knowledge of ART among participants.

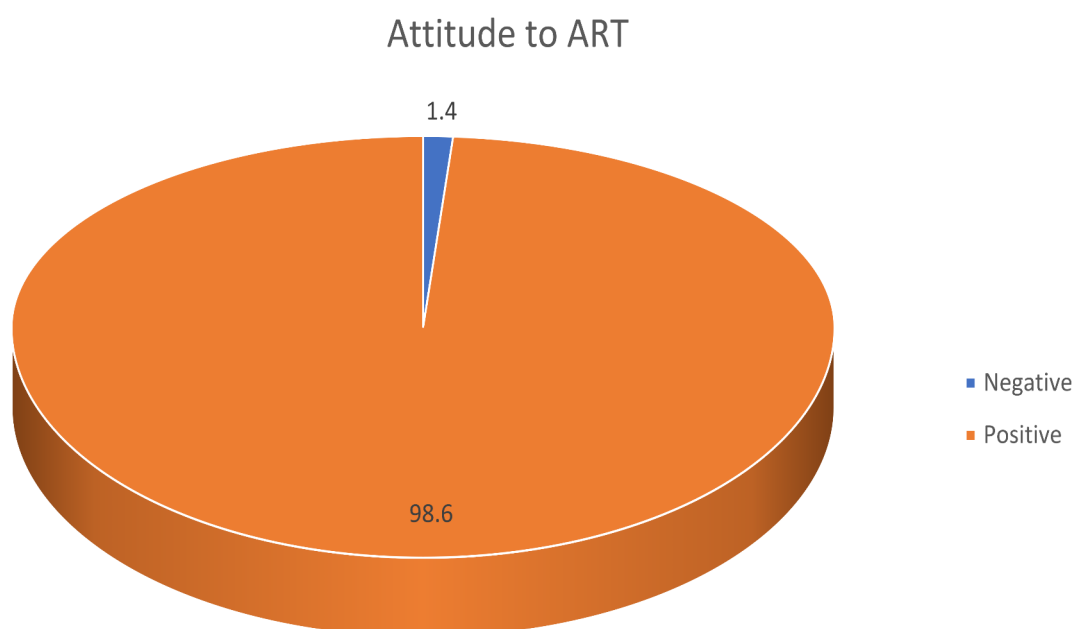


Fig. 3. Attitude of HIV-positive pregnant women on HAART.

Factors associated with knowledge of ART, positive attitude to ART

Bivariate analysis (Supplementary Table 1) showed that having a formal education, being counselled more than once (two or three times as compared with being counselled only once), and having been on ART for 2–6 years (compared with being on ART for less than 2 years) were all associated with having good knowledge of ART. However, after adjusting for confounders, multivariable analysis reflected only frequency of counselling and duration on ART as being significantly related to ART knowledge: those who received more than one counselling session were six times more likely to have good knowledge of ART compared to those counselled only once ($p=0.031$, aOR=5.7, CI 1.2–27.5; Table 5). Also, those who have received ART therapy for over two years were six times more likely to have good knowledge of ART ($p=0.021$, aOR=5.6, CI 1.3–24.3).

According to bivariate analysis, those not taking unprescribed medications are 13 times more likely to have a positive attitude toward ART than those taking [p -value=0.023, OR=13.3, CI (1.4–129.6)] See supplementary Table 2. In the multivariable analysis, those not taking other medications are more likely to have a good attitude towards ART (aOR=17, $p=0.047$ (Table 6).

Question (knowledge of HIV)	Frequency (n = 318)	Percentage
Heard of STIs	276	86.8
Know at least 1 source of HIV infection	318	100.0
Having one sexual partner reduces risk.	263	82.7
Using a condom can reduce the risk	286	89.9
A healthy person can have HIV	293	92.1
Transmission is not through contact with saliva	234	73.6
Knowledge of clinical features of AIDS	188	59.1
Knowledge of PMTCT	245	77.0
Abstinence is not the only absolute prevention of HIV	209	65.7
Means of PMTCT	287	90.3

Table 2. Knowledge of HIV among participants.

Knowledge	Frequency (n = 318)	Percentage
ART reduces HIV progression	280	88.1
Respondents on ARV can produce an HIV-free child (PMTCT)	276	86.8
At least 95% minimum adherence is required	176	55.3
Can missing ARV lead to disease progression	278	87.4
Awareness of VL	59	18.6
Awareness of CD4 count	274	86.1

Table 3. Knowledge of ART/ARV among HIV-positive pregnant women on HAART in Kaduna state.

Attitude	Frequency (n = 291)	Percentage
ARVs have positive effects on health	266	91.4
ARV gives more benefits than harm	289	99.3
ARV causes fewer financial difficulties	252	86.6
ARV makes one feel forced to take meds	170	58.4
Side effects of ARVs can lead to organ failure	97	33.3
Use of ARVs prolongs life	283	97.2
ARVs enhance the quality of life	284	97.6
ARVs help gain weight	285	97.9
ARVs reduce the frequency of illness	268	92.1
ARVs assist in fulfilling family obligations	282	96.9

Table 4. Attitude to ARV among HIV-positive pregnant women on HAART in Kaduna state.

Discussion

Knowledge of HIV/AIDS, PMTCT, and attitude to ARTs influence respondent's motivation and uptake of ARVs for PMTCT²⁵. Poor knowledge and attitude are hindrances to good adherence³². This study reveals that most of the pregnant women on PMTCT in Kaduna State have good knowledge of HIV/AIDS (75.4%), fair knowledge of ART (54.4%), and an overwhelming number possess a positive attitude toward ART (98.6%). See Figs. 2 and 3.

Previous cross-sectional studies done to assess knowledge of HIV in PLWHA revealed participants had “fair knowledge” or “good knowledge” of HIV^{25,33–36}. A study conducted in Ethiopia showed “high” knowledge (56.7%) of HIV/AIDS in these women which is lower than that of this study³⁷. However, the Ethiopian study did not stratify their respondents into duration on ART. Possible explanations for the high prevalence of good knowledge of HIV/AIDS in this study include that most respondents have been on the ART programme for 2 years or more (about 90% of respondents with good ART knowledge have been on ART for ≥ 2 years, Supplementary Table 1). Being on ART for two years or more has been reported to be associated with possessing a good knowledge of ART since they have more frequent periodic medical exposure through clinical interactions, counselling, support group participation, and educational materials^{38,39}. There is an association between possession of good knowledge of ART and being on ART for two or more years in bivariate and multivariable analyses (Supplementary Tables 1 and Table 5).

Also, concerning knowledge of antiretrovirals, a previous study documented the majority of their respondents demonstrating good knowledge 83.1%³². This is higher than the figure obtained in this study where 54.4% demonstrated fair knowledge of ARVs. However, Kasumu et al. carried out their study in a predominantly

Risk factor	aOR	p-value	95% CI	
Formal education				
Yes	Ref.	0.307		
No	0.409		0.073	2.276
Taking other meds				
Yes	Ref.	0.683		
No	1.384		0.290	6.594
Number of times counselled				
1	Ref.	0.031		
> 1 (2 or 3)	5.684		1.174	27.530
Duration on ART treatment				
1–2 years	Ref.	0.021		
> 2–6 years	5.624		1.3015	24.303
Locality				
Urban	Ref.	0.665		
Rural	0.732		0.179	2.994

Table 5. Factors associated with good ART knowledge among respondents.

Risk factor	aOR	p-value	95% CI	
Alcohol consumption				
No	1.76	0.81	0.02	170.96
Yes	Ref.			
Taking other meds				
No	16.67	0.047	1.042	272.765
Yes	Ref.			
Counselled				
Yes	1.310	0.915	0.009	191.043
No	Ref.			
Duration on treatment				
2–6 years	18.299	0.066	0.823	406.932
1 – <2 years	Ref.			

Table 6. Factors associated with having a positive attitude to ART score among participants.

cosmopolitan area where clients have multiple access to information and increased awareness as opposed to a nearly half rural, half urban population in this study⁴⁰. Just as reported by Kasumu, other studies done in other Nigerian tertiary hospitals reported the majority of respondents demonstrated good knowledge of ARVs: 80.8% and 70.0%^{34,35}. These relatively higher percentages may not be unconnected with the fact that these studies were conducted in PLWHA in tertiary health centres. The PLWHA have greater access to support systems and typically receive a longer continuity of care compared to HIV-positive pregnant women. Similarly, tertiary healthcare centres provide more specialised, comprehensive, up-to-date, and robust care to clients than secondary healthcare centres.

It has been documented that being armed with good knowledge of HIV/ARV/ART motivated respondents to seek and remain in the ART programme^{41–43}. Our multivariable analysis revealed that clients who had been on ART for two or more years had more knowledge ART than those who had been on ART for less than two years. This is similar to a prospective study conducted in Gugulethu, South Africa where the longer patients remained in the study, the higher their knowledge of ART⁴⁴. Counselling sessions provide clients with necessary information to navigate their journey through treatment. Assessing the frequency of counselling was crucial since over 95% of our respondents had received counselling before the commencement of HAART. Multivariable analysis in this study showed that clients that received counselling more than once (two or three times) have good knowledge of ART. Multiple counselling sessions for HIV-positive pregnant women have been shown to enhance their knowledge of ART^{45,46}.

An overwhelming proportion of respondents showed a positive attitude towards ARVs, a finding consistent with previous studies in which all showed a “positive attitude to ARVs” ranging from 77.0 to 78.9%, and 98.1%^{5,25,32,33,35,37}. Interestingly, not taking other medications ($p = 0.047$, $aOR = 17$) was significantly related to having a positive attitude to ART in multivariable analysis. Taking other medications not prescribed against HIV indicates a lack of confidence in the ART. While there is a paucity of information on previous similar studies in this group, culture-related barriers have been known to compel women to HIV care and treatment against ART⁴⁷. Hence, those not taking other unprescribed medications in this study showed a positive attitude towards

ART ($p=0.047$, $aOR=17$). Taking unprescribed medications has other potential implications apart from a negative attitude towards ART; drug resistance, drug-drug interactions, and unwanted effects, among others^{48,49}.

It should be noted that 6.6% of the respondents agree to the use of alcohol. (Table 1) with several of them also being on a varying number of unprescribed medications, including antimalarials, analgesics, and traditional herbs apart from being pregnant. Also, the effects of the use of alcohol, supplements like “moringa” and other herbs, in this group of respondents were not studied in this study. Documented consequences of unprescribed drugs and alcohol use in pregnancy, especially in the first trimester by HIV-positive pregnant women can form the basis for future research.

Recommendations

Though the study revealed that most (75.4%) of the pregnant women on PMTCT in Kaduna State have good knowledge of HIV/AIDS, a quarter of these women still need to catch up. Also, they possessed fair (54.4%) knowledge of ART, but an overwhelming proportion (98.6%) had a positive attitude toward ART. We recommend that the Kaduna State Ministry of Health (KSMoH) and its partners create additional awareness on HIV/AIDS and ART to HIV-positive pregnant women utilising client-specific approaches. These tailored techniques should be delivered regularly (every contact) by well-trained counsellors, HCWs, and support groups, using appropriate educational materials, prior to the start of ARVs. They (KSMoH and implementing partners) should implement task-shifting and task-sharing strategies to ensure that HCWs at all levels are equipped to provide comprehensive HIV and ART services. They should provide ongoing training and capacity-building programmes for HCWs on HIV, ART, and eMTCT. We also suggest that HIV-positive pregnant women on ART in Kaduna State (and their spouses, if possible) attend multiple counselling sessions to improve their understanding of ART with emphasis on potential challenges with the use of unprescribed medications. Periodic monitoring and evaluation of HIV and ART services, including the eMTCT programme, is recommended through the enhancement of the eMTCT surveillance system to track HIV and ART trends and results.

Strength and limitation

This study uses primary data to provide insight into knowledge of HIV/AIDS, ART, and attitudes toward ART in HIV-positive situations that cover the whole of Kaduna State of Northern Nigeria. However, it is a hospital-based study, and it does not capture clients' situations in the community (if there are any on ART). As a cross-sectional study, our findings may not reflect changes over time. Nevertheless, our study provides a picture of the situation in the State. Also, there may have been recall bias.

Conclusion

An outstanding level of positive attitude towards the use of ART which has been demonstrated to improve adherence to ART exists in pregnant HIV-positive women on ART in Kaduna State. A sustained positive attitude and behaviour is a prerequisite to the reduction in transmission of HIV to children and resistance to HAART⁵⁰. These will lead to an eventual reduction in the incidence and impact of HIV/AIDS. Since the use of unprescribed medication was significantly associated with a negative attitude toward ART, active efforts should be made to sensitise citizens on the importance of consulting healthcare providers before commencing unprescribed medications. Naturally, respondents who have good HIV knowledge are more likely to seek, adhere to, and remain in ART. Most respondents having fair knowledge of ART may affect adherence to HAART eventually since issues such as the need for viral load testing, CD4 counts, and side effects may be misunderstood. However, this study shows that some HIV-positive pregnant women on HAART who have a good knowledge of HIV do not readily understand the concept of adherence and only about one in five knew their viral loads. Owing to this, it is recommended that multiple counselling methods in the ART clinics should emphasise and strengthen the understanding of ART with a focus on the relevance of viral load and minimum required adherence especially as this study revealed the clinic as the most common source of information on HIV, hence improving adherence in this category of clients.

Data availability

The data supporting the results of this study will be made available on reasonable request from the corresponding author Oludare 'Sunbo Adewuyi.

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Author contributions

O.S.A wrote the drafts of the manuscripts, funding of field work O.S.A, J.Y, and J.A.O collected the data. All authors (O.S.A, J.Y, J.A.O, P.N, and M.D.D.) conceptualised the study design, participated in data analysis and interpretation. All authors participated in writing (editing for some) P.N, and M.D.D. reviewed the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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