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Review Article

Antiretroviral Therapy Adherence rate and Associated factors Influencing non-Adherence among hiv/aids Patients Receiving Treatment at imo state Specialist Hospital, Umuguma

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Abstract:

The effective treatment of HIV/AIDS depends on adherence to antiretroviral therapy (ART), which inhibits viral replication, boosts immunological function, and increases patient survival. Non-adherence, however, presents serious problems since it can result in drug resistance, virological failure, and higher rates of morbidity and death. This study assessed the adherence rate to ART and identified factors influencing non-adherence among HIV/AIDS patients receiving treatment at Imo State Specialist Hospital, Umuguma. A descriptive survey design was employed, using both primary and secondary data sources. Primary data were collected through structured questionnaire with 300 HIV-positive patients on ART between August 2023 and July 2024. Secondary data were derived from patient medical records and drug schedule reports. The sample size was determined using the Taro Yamane formula, incorporating an attrition rate. Data were collected using self-administered structured questionnaires and analyzed with Chi-square and SPSS (version 25) significance level ($p < 0.05$). Awareness of ART was high, with hospitals being the primary source of information. Drug adherence was 83%, but below the ideal >95%, with 47.3% reporting at least one instance of non-adherence. Most had been on ART for over a year, with common combinations including Alluvia (+ Lamivudine + Tenofovir). Non-adherence was linked to poverty, forgetfulness, and emotional issues. Strong relationships were observed between adherence and gender, age, marital status, education, and drug combinations ($p<0.05$). While adherence rates were relatively high, factors influencing non-adherence highlight critical areas for intervention. Healthcare providers should prioritize educating patients on ART regimen adherence and addressing specific barriers such as poverty, emotional challenges, and accessibility. Targeted strategies will enhance adherence, improving outcomes for HIV-infected individuals.

Keywords: adherence; antiretroviral therapy; hiv/aids; non-adherence factors

1.Introduction

HIV/AIDS is still a major global public health concern, especially in low-income nations like those in sub-Saharan Africa, where the virus's pervasiveness has caused socioeconomic crises [1]. As of 2019, there were over 37.9 million persons living with HIV/AIDS worldwide, with more than 90% of them living in poor nations [2] Two-thirds of the global incidence occurred in Africa alone, with 1.7 million of these cases occurring in children under the age of 15 [3]

Sub-Saharan Africa had 22.5 million HIV/AIDS-positive individuals and 68% of all cases worldwide in 2016. Nigeria has the second-highest HIV prevalence rate behind South Africa, with an estimated 3 million cases [4]

Since its inception in 1995, antiretroviral treatment (ART) has been widely available and has saved the lives of almost 2.5 million people in underdeveloped nations (86). ART lowers HIV transmission, boosts immunity, inhibits viral replication, and lengthens life expectancy [5]

Globally, tremendous efforts have been made in recent decades to fight the HIV epidemic, including expanding ART programs. Nearly 10 million individuals have received ART by the end of 2022 [6]. An important development in the treatment of HIV/AIDS was the introduction of combination antiretroviral therapy (cART), commonly referred to as highly active antiretroviral therapy (HAART). By lowering morbidity and

mortality and turning HIV into a chronic, controllable illness, it has greatly enhanced the quality of life for those living with the virus (PLWH) [7]

Combination antiretroviral therapy was first introduced in Nigeria in 2002, and by 2010, coverage had increased to 359,181 people [8] Research indicates that better virological and clinical outcomes are associated with higher adherence rates, but that adherence problems frequently compromise the effectiveness of treatment. Adherence, which is defined as the degree to which a patient's behavior conforms to the recommendations of healthcare providers, is crucial for achieving viral suppression and full viral suppression requires a minimum adherence rate of 95% [9]. Despite awareness campaigns and increased access to treatment, adherence is still suboptimal due to a number of factors, including forgetfulness, financial constraints, drug side effects, stigma, depression, and drug stockouts. To address these issues, strategies such as the use of alarms, mobile apps, and reminder charts have been proposed.

Counseling and health education are also essential for encouraging adherence. First-line medications including Dolutegravir, Tenofovir, and Efavirenz are included in the free HAART offered by approved health facilities in Nigeria. Every three months, patients on ART go to follow-up sessions where their CD4+ T cell levels are checked and pill counts are used to promote adherence [10]. However, a number of obstacles, such as inappropriate drug scheduling and dosage, make it difficult for many PLWH to stick to their treatment plans. To overcome these obstacles, focused interventions and ongoing observation are needed.

Even though ART is now widely accessible in Nigeria, non-adherence is still a major obstacle to efficient HIV/AIDS care. Poor adherence leads to drug resistance, treatment failure, increased morbidity, and higher transmission rates. In resource-limited settings such as Imo State, socio-economic, cultural, and systemic barriers exacerbate adherence challenges.

At the Imo State Specialist Hospital, Umuguma, anecdotal evidence suggests varying levels of adherence among patients, but comprehensive data on adherence rates and contributing factors are lacking. Factors such as poverty, stigma, side effects, and lack of awareness are suspected but not well-studied in this context. This knowledge gap hinders the development of tailored interventions to improve adherence and outcomes.

Given the critical role of adherence in achieving viral suppression and improving quality of life for PLWH, it is essential to investigate adherence rates and the factors influencing non-adherence at this facility. Addressing these issues will inform evidence-based strategies to enhance treatment outcomes and contribute to global HIV/AIDS management efforts.

2.Research Methodology

2.1 Research Design

The study employed a descriptive survey design. Survey design allows for the collection of large amounts of data in a structured format, making it easier to measure adherence rates, the factors influencing adherence, and the prevalence of non-adherence across a population of HIV/AIDS patients.

VARIABLE		FREQUENCY	PERCENTAGE (%)
Gender	Male	74	24.7
	Female	226	75.3
	Total	**300**	**100**
Age (Years)	20-35	65	21.7
	36-50	142	47.3
	51-65	86	28.7
	>65	7	2.3
	Total	**300**	**100**
Marital Status	Single	40	13.3
	Married	171	57.0
	Separated	20	6.7
	Widowed	63	21.0
	Divorced	6	2.0
	Total	**300**	**100**
Educational Level	Primary	9	32.3
	Secondary	143	47.7
	Tertiary	43	14.3
	Post-Graduate	11	3.7
	No Formal Education	6	2.0
	Total	**300**	**100**
Employment Status	Student	8	2.7
	Unemployed	53	17.7
	Self-employed	177	59.0
	Employed	54	18.0
	Retired	8	2.7
	Total	**300**	**100**
Religion	Christianty	292	97.3
	Traditionalist	8	2.7

	Total	**300**	**100**

Table 1: Socio-Demographic Data of Respondents

2.2 Study Area

Imo State Specialist Hospital, Umuguma, is a key healthcare facility in southeastern Nigeria, situated in Owerri, the capital of Imo State. This semi-urban hospital serves both urban and rural populations in the region. Located at approximately latitude 5.4700° N and longitude 7.0268° E, the hospital is in a tropical climate zone with distinct rainy (April to October) and dry (November to March) seasons. The climate and location are significant for studying how environmental factors like temperature and humidity impact the prevalence and severity of rheumatoid arthritis (RA) symptoms. Imo State Specialist Hospital, Umuguma, is a government-owned specialist healthcare facility located in Imo State. It houses a government-approved HIV care and control center (HAART to HAART clinic), managed by a consultant and supported by a dedicated team, including specially trained HIV care nurses, community extension workers, social welfare staff, laboratory personnel, and a well-equipped, modern pharmacy/dispensary.

VARIABLE		**FREQUENCY**	**PERCENTAGE (%)**
CD4 Count (cells/mm³)	> 500	90	30
	350-500	73	24.3
	200-349	56	18.7
	< 200	81	27
	Total	300	100
Viral Load (copies/mL)	< 50	105	35
	50-999	94	31.33
	1,000-10,000	56	18.67
	> 10,000	45	15
	Total	300	100

Table 2: Clinical status

The hospital serves both local residents of Owerri and non-indigenes from across the state and surrounding regions, extending its reach throughout Eastern Nigeria aptly reflecting Imo State's title as the "Eastern Heartland."

2.3 Study Population

The study population comprised 5927 HIV-infected adult male and female patients who were receiving ART regimen from August 2023 to July 2024 at Imo State Specialist Hospital, Umuguma. Participants includes any adult male and female subjects living with HIV who completed registration with HAART to HAART Clinic in Imo State Specialist Hospital, Umuguma.

Item	**Frequency**	**Percentage %**
Heard about ART		
Yes	28	94
No	18	6
Total	30	100
Source(s) of Information of ART regimen		
No Idea	18	6.0
In the Hospital	200	66.7
Social media	16	5.3
Books	6	2.0
Other People	60	20.0
Total	300	100

Table 3: Respondents' Awareness and Knowledge of AR

2.4 Instrument for Data collection

A questionnaire was administered to the patients after thorough explanation and obtaining their consent. The questionnaire was designed to collect data on the adherence of HIV-positive patients receiving ART care. A total of 311 questionnaires was distributed, accounting for the attrition rate.

Frequency of Drug Intake	**Frequency**	**Percentage (%)**
Those that don't just like taking the Drug	3	1
Those that take the drug as long it's available	33	11
Those that take whenever they	15	5
As prescribed	249	83
Total	**300**	**100**

Table 4: The adherence level of HIV positive patients on ART regimen

2.4.1 Validity of Instrument

The face and content validity of the instrument was ensured by presenting the questionnaire to the research supervisor and two experts in the HAART to HAART Clinic unit, then their feedback incorporated and making all the necessary corrections for the final refinement of the instrument.

2.4.2 Reliability of the Instrument

This demonstrates the instrument's consistency in measurement. A pilot study was carried out to assess the instrument's reliability using the test-retest method. Ten copies of the questionnaire were initially administered to HIV/AIDS-positive patients on ART at Imo State Specialist Hospital, Umuguma. After two weeks, the same group was given a fresh set of identical questionnaires. The results from the first and second tests were compared and analyzed using Cronbach's Alpha (Coefficient Alpha) to determine the reliability score. The Value obtained was equal to 0.85, showing reliability of instrument.

2.5 Method of Data Collection

With ethical approval and an introduction letter from the Head of the Department of Nursing Science, an administrative permit was secured from the Chief Medical Director and the unit head in charge before data collection commenced. After obtaining consent from respondents willing to participate in the study, self-administered questionnaires were distributed to the patients. The detailed contents of the questionnaire were thoroughly explained, and copies given to patients who met the inclusion criteria during clinical hours. Data collection occurred over 24 days, with two visits each month over the course of 12 months.

Item	Frequency	Percentage %
Duration of ART regimen		
3 Months	24	8
6 Months	23	7.7
1 Year	11	3.7
>1 Year	242	80.6
Total	**300**	**100**
Have you ever skipped medication?		
Yes	142	47.3
No	150	50
Can't Recall	8	2.7
Total	**300**	**100**

Table 5: Duration of ART regimen

2.6 Statistical/Data Analysis

Data was coded or entered using Chi-square and SPSS 25 vision and the data analysis method was used to measure the association of each variable to either negatively or positively affects the outcome (that is adherence level of respondents to ART regimen).

Types of drug combination Taken in ART	Frequency	Percentage %
Abacavir	25	8.3
Aluvia	137	45.7
Atazanavir	37	12.3
Dovato	101	33.7
Total	**300**	**100**

Table 6: The types of drug combination used in ART regimen

2.7 Ethical Consideration

Identification letter was collected from the Department of Nursing and submitted to Imo State Specialist Hospital, Umuguma, T

Types of drug combination Taken in ART Challenges of non-adherence to ART regimen	Frequency	Percent (%) Of ART Users
Poverty	68	22.6
Forgetfulness	60	20.0
Problems with the medication order	53	17.7
Distance	53	17.7
Emotional Problem	53	17.7
Religious Views	13	4.3
Total	**300**	**100**

Table 7: Challenges of non-adherence to ART regimen

Age in Years		N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
18-30		65	42(64.6%)	23(35.4%)			
31-45		142	126(88.7%)	16(11.3%)			
46-60		86	75(87.2%)	11(12.8%)			
>60		7	6(85.7%)	1(14.3%)			
Total		**300**	**249(83%)**	**51(27%)**	**19.99**	**3**	**0.00017**

Table 8: Relationship between Age and Adherence to ART

Gender	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Male	74	48(64.9%)	26(35.1%)			
Female	226	201(88.9%)	25(11.1%)			
Total	**300**	**249(83%)**	**51(27%)**	**22.90**	**1**	**0.00001**

Table 9: Relationship between Gender and Adherence to ART

Marital Status	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Single	40	29(72.5%)	11(27.5%)			
Married	171	157(91.8%)	149(8.2%)			
Separated	20	14(70.00%)	6(30%)			
Widowed	63	44 (69.8%)	19(30.2%)			
Divorced	6	5(83.3%)	1(16.7%)			
Total	**300**	**249(83%)**	**51(27%)**	**24.66**	**4**	**0.000148**

Table 10: Relationship between Marital Status and Adherence to ART

Educational Level	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Primary	97	74(76.3%)	23(23.7%)			
Secondary	143	124(86.7%)	19(13.3%)			
Tertiary	43	40(93.0%)	3(7.0%)			
Postgraduate	11	9 (81.8%)	2(18.2%)			
No Formal Education	6	2(33.3%)	4(66.7%)			
Total	**300**	**249(83%)**	**51(27%)**	**18.06**	**4**	**0.001203**

Table 11: Relationship between Educational Level and Adherence to ART

Employment Status	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Students	8	6(75.0%)	2(25.0%)			
Unemployed	53	41(77.4%)	12(22.6%)			
Self-employed	177	153 (86.4%)	24(13.6%)			
Employed	54	42(77.8%)	12(22.2%)			
Retired	8	7(87.5%)	1(12.5%)			
Total	**300**	**249(83%)**	**51(27%)**	**4.20**	**4**	**0.379373**

Table 12: Relationship between Employment Status and Adherence to ART

Religion	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Christianity	292	243(83.2%)	52(17.8%)			
Traditionalist	8	6(75.0%)	2(25.0%)			
Total	**300**	**249(83%)**	**51(27%)**	**0.37**	**4**	**0.541**

Table 13: Relationship between Religion and Adherence to ART

Types of Drug Combination Taken in ART	N	Number of Patients that Adhered strictly to treatment	Number of Patients that didn't Adhere strictly to treatment	X^2	Df	p-value
Abacavir	25	92(91.1%)	9(8.9%)			
Aluvia	137	117(85.4%)	20(14.6%)			
Atazanavir	37	23(68.2%)	14(37.8%)			
Dovato	101	17(68.0%)	8(32.0%)			
Total	**300**	**249(83%)**	**51(27%)**	**20.62**	**3**	**0.379373**

Table 14: Relationship between Drug combination and number of patients that experienced side effects.

3. Discussion

Among HIV/AIDS patients undergoing treatment at Imo State Specialist Hospital in Umuguma, this study assessed the rate of adherence to antiretroviral medication (ART) and the variables driving non-adherence. A study was conducted on three hundred eligible respondents who were getting ART at the Imo State Specialist Hospital's Community Medicine Department in Umuguma. The majority of respondents (75.3%) were female, 47.3% were between the ages of 31 and 45, and a sizable percentage (57%), according to the sociodemographic data (Table 1).These results are consistent with research by [12,13], which found that women, especially those in reproductive age groups, had greater rates of ART adherence because they frequently use healthcare facilities more frequently. The findings of [14] which connected moderate education levels with better ART awareness and adherence, are in line with the respondents' 47.7% secondary school education. However, the presence of a small fraction of respondents with no formal education(2.0%) suggests a potential gap in HIV awareness, similar with observations by [15] that illiteracy severely effects adherence. The clinical status data (Table 2) demonstrated that 30% of patients had a CD4 count >500 cells/mm³,suggesting excellent immune function, whereas 27% had CD4 levels <200 cells/mm³, indicating serious immune system damage. These results align with research conducted by [16, 17], which observed comparable immune status distributions among ART patients in sub-Saharan Africa. The range of CD4 counts emphasizes the significance of early diagnosis and ongoing ART patient monitoring. In terms of viral load, 35% of responders had viral loads less than 50 copies/mL, which indicates efficient viral suppression; 15% had viral loads greater than 10,000 copies/mL, which indicates inadequate viral control. These results are consistent with [18], which highlighted how important adherence is to attaining viral suppression. As noted by [19], the percentage of patients with unsatisfactory viral load suppression (18.7% with viral loads between 1,000 and 10,000 copies/mL) highlights the difficulty of non-adherence. A significant majority of respondents, 94% (284), were aware of ART, according to the study, while only 6% [20] did not know what it meant. The results of comparable tests carried out in other parts of Nigeria and sub-Saharan Africa are consistent with this high degree of awareness. For example, [21] found that people with HIV had a comparable high level of ART awareness, which they attributed to regular counseling sessions at ART clinics and ongoing healthcare education.

However, the fact that a small percentage of patients do not understand ART highlights the need for focused interventions to guarantee that everyone understands it. Other research has indicated that low awareness

is associated with low adherence rates because patients may not fully understand the significance of consistent ART usage. The hospital was found to be the main source of information for ART regimens, accounting for 66.6% (200) of respondents, followed by social media (5.7%) and books (2.0%). Interestingly, 5.7% (17) of participants did not know where they got their information. This finding is consistent with previous reports by [22] which highlighted the critical role that healthcare facilities play in providing accurate ART-related information.. Given their vital role in patient care and adherence promotion, hospitals are frequently the most dependable and trustworthy source of HIV/AIDS education. Given the growing popularity of digital platforms, social media's little informational contribution is noteworthy. Social media can improve the spread of knowledge, but it's important to be mindful of the possibility of false information. This result supports research showing that social media has two sides when it comes to health education [23]. According to the results, adherence rates are likely to be improved by a solid foundation of ART awareness and reliable information from reliable sources, such as hospitals. Potential obstacles to attaining optimal adherence are indicated by the presence of respondents with little understanding and those getting information from untrustworthy sources. According to the study, 83% of participants followed their ART regimen exactly as directed. Despite being comparatively high, this adherence rate is below the >95% adherence threshold needed for the best viral load suppression and long-term health results. Results from related studies, like those by [24]. which showed adherence rates ranging from 75% to 90% in similar settings, are in line with this.The data showed that while the majority (83%) adhered to their medications as prescribed, a small proportion (5%) only took their drugs when they remembered, and 12% indicated they would take their medications only if available. This aligns with studies by [25] which highlight barriers such as forgetfulness and inconsistent drug availability as significant contributors to non-adherence.

The study also looked at the length of time on ART, and found that most respondents (80.7%) had been on ART for more than a year, with smaller proportions having started within six months to a year. It's interesting to note that only 1% of respondents explicitly stated that they disliked taking their medications, indicating that psychosocial factors may not be as important as logistical issues like drug supply. Research has shown that longer durations on ART are often associated with higher adherence rates, possibly due to increased awareness of treatment importance and the establishment of consistent medication routines. However, problems like medication fatigue may emerge over time, potentially contributing to lapses in adherence, as evidenced by 47.3% of respondents who admitted to skipping doses at least once.

[26] discovered comparable patterns of sporadic non-adherence among long-term ART users, which is consistent with this tendency. Of the respondents, 47.3% acknowledged that they had at least one ART default, while half (50%) said they had never missed a dosage. This significant percentage of occasional non-adherence highlights how difficult it is to sustain rigorous ART adherence and is consistent with findings from [27] who found that default rates varied from 40% to 50%. In comparable populations, factors like treatment side effects, amnesia, and stigma are frequently mentioned as contributing factors.

The suboptimal adherence rate (83%) observed in this study is concerning, as it compromises the effectiveness of ART in suppressing viral replication and preventing drug resistance.

Table 6 highlights the distribution of ART regimens among patients. The most commonly prescribed combination was Alluvia (+ Lamivudine + Tenofovir), used by 137 patients (45.7%). This was followed by Dovato (Dolutegravir + Lamivudine + Tenofovir) at 33.7%, Abacavir (+ Emtricitabine + Tenofovir) at 8.3%, and Atazanavir (+ Lamivudine + Tenofovir) at 12.3%. This distribution aligns with findings from [28], who

reported that Tenofovir-based regimens, particularly those including Dolutegravir, are becoming standard in Nigeria due to their high efficacy, low side effect profile, and better patient adherence.

Similarly, a study by [29] in Southeastern Nigeria also observed a preference for Alluvia among treatment-experienced patients due to its effectiveness in maintaining viral suppression. The relatively lower prescription of Abacavir in this study mirrors findings by [30] in Uganda, where clinicians favored Tenofovir-based regimens over Abacavir due to concerns about hypersensitivity reactions and better tolerability of Tenofovir. Adherence rates in this study were influenced by factors such as side effects, economic constraints, stigma, and access to healthcare facilities. These findings align with [31], who highlighted economic barriers and stigma as significant contributors to non-adherence among ART patients in Lagos, Nigeria. Furthermore, [32] in Northern Nigeria demonstrated that regular counseling and free ART drug availability significantly improved adherence rates, suggesting that strengthening counseling services and reducing systemic barriers could have a similar positive impact in Imo State.

The findings of this study, consistent with those of [33], highlight the need for patient-centered ART management. Tailoring regimens to individual needs, providing consistent patient education, and ensuring accessibility to medications can improve adherence rates. Addressing stigma and transportation challenges, as emphasized [34], is critical to reducing non-adherence.

The findings of this study are consistent with previous studies, which highlight a complex interaction of socio-economic, psychological, and logistical factors contributing to non-adherence.

A significant number of respondents (22.7%) identified poverty as a major barrier to adherence, including factors such as lack of proper food, inadequate finances, and the inability to afford transport costs. This finding is in line with studies conducted by [35], who found that financial hardship and poverty are strongly linked to poor adherence to ART, as they directly impact a patient's ability to access medications, maintain a balanced diet, and attend regular follow-up appointments. Addressing these economic barriers through targeted support programs, such as subsidies for transport or food, could potentially improve ART adherence.

Emotional issues, including stigma, self-discrimination, fear of disclosure, and depression, were noted by 17.7% of respondents as contributing to non-adherence. This mirrors findings from [36], where psychological distress and the fear of being stigmatized led to reluctance in taking ART, thus resulting in lower adherence rates. Stigma remains a pervasive barrier, particularly in sub-Saharan Africa, where HIV/AIDS is often associated with negative social perceptions. The integration of psychological counseling and stigma reduction programs into ART care may improve patients' mental health and, consequently, their adherence.

A further 17.7% of respondents identified issues related to the medication itself, such as difficulty in managing the times, quantities, and duration of medication, as a reason for non-adherence. This finding aligns with research by [37] which suggests that complexities in the ART regimen, including the need for strict adherence to specific times and dosages, can discourage patients from following their treatment plan. Simplifying regimens and providing patient education on managing medications could help mitigate this issue. The most prominent challenge identified was forgetfulness (20%), which is a common issue in medication adherence across a wide range of chronic diseases. A study by [38], also highlighted forgetfulness as a major reason for ART non-adherence. To counter this, the use of reminder tools, such as mobile phone alerts, pillboxes, or even community-based adherence support, could help patients remember their medication schedule.

Interestingly, 4.32% of respondents identified religious views as a barrier to adherence. While this was a relatively smaller proportion, it is worth noting as it has been explored in other studies, such as [39], where religious beliefs sometimes conflict with prescribed ART regimens, leading to reluctance in taking the medication. Interventions that involve religious leaders in promoting adherence and education may help overcome this issue.

Overall, the findings of this study are consistent with recent global research on ART adherence. Socioeconomic factors, psychological issues, logistical barriers, and medication-related challenges all play significant roles in influencing non-adherence. Addressing these barriers through comprehensive, multi-faceted interventions ranging from financial support and mental health counseling to simplifying treatment regimens and improving access to healthcare facilities could enhance adherence rates among HIV/AIDS patients in Imo State and beyond.

4.Conclusion

There is a relatively high level of adherence to the ART regimen among HIV patients attending the HAART Clinic at Imo State Specialist Hospital, Umuguma, with 249 (83%) of patients adhering to the treatment. The drug combinations in use were found to cause minimal side effects. While the preexisting strategies aimed at promoting adherence were found to be effective, their improper implementation hindered better adherence outcomes. However, there remains significant potential for improvement in these adherence levels.

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