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Socioeconomic and Clinical Factors Influencing HIV Viral Load Suppression Among HIV/AIDS Patients Attending Clinic of Federal Medical Centre in Northwestern Nigeria

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Abstract:

- ***Background:***

Viral load suppression remains a central goal of HIV care because it halts disease progression, optimizes quality of life, mitigates transmission risk, and lowers HIV-related morbidity and mortality. Despite the expansion of antiretroviral therapy (ART) accessibility, various socioeconomic, and clinical, determinants continue to shape virological outcomes. This study evaluated the socioeconomic and clinical determinants influencing HIV viral suppression among patients attending a tertiary center in Northwestern Nigeria.

- ***Methods:***

A hospital-based descriptive cross-sectional was carried out among 239 adults living with HIV seen at ARV clinic of Federal Medical Centre, Gusau, Northwestern Nigeria. A structured interviewer-administered questionnaire was used in Data collection. Information obtained included sociodemographic characteristics, clinical parameters, family support structures, medication adherence, and viral load status. Viral load outcomes were categorized into undetectable viral load (<50 copies/mL), good viral load suppression (50–999 copies/mL), and poor viral load suppression (≥1000 copies/mL). Data were analyzed with IBM- SPSS version 25. Associations were assessed using Chi-square and Fisher's exact tests. The variables with significant association were subjected to multivariable logistic regression analysis to determine predictors of viral suppression ($p < 0.05$).

- ***Results:***

The mean age of respondents was within the young adult and middle-aged categories, with females accounting for 64.4% (n = 154). Most participants were Hausa (82.0%), Muslim (85.8%), married (59.4%), and living below the poverty line (69.0%). Overall, 69.5% (n = 166) achieved undetectable viral load, 20.5% (n = 49) had good viral load suppression, and 10.0% (n = 24) exhibited poor viral load suppression. Educational level ($p = 0.034$), marital status ($p < 0.001$), family type ($p = 0.019$), family size ($p = 0.036$), body mass index ($p = 0.024$), antiretroviral regimen ($p < 0.001$), non-ART medications ($p = 0.033$), and perceived family support ($p < 0.001$) were found to be statistically significantly associated with viral load outcomes. Multivariable logistic regression identified family type, family size, higher educational level, body mass index, antiretroviral regimen, concomitant medications, perceived family support, and medication adherence as independent predictors of viral load suppression.

- ***Conclusion:***

Both socioeconomic conditions and clinical parameters significantly govern viral load suppression in PLWHA. Robust family support, high medication adherence, advanced educational status, and tenofovir/lamivudine/dolutegravir (TLD)

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regimens were strongly linked to optimal viral suppression. Strengthening patient-centered HIV care, adherence support programs, family integration, and socioeconomic mitigation strategies will improve treatment success.

Keywords: *Antiretroviral Therapy, Family Support, HIV/AIDS, Medication Adherence, Socioeconomic Determinants, Viral Load Suppression, Nigeria.*

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I. INTRODUCTION

Globally, Human Immunodeficiency Virus (HIV) infection remains a major infectious disease despite significant advances in diagnostic, therapeutic, and preventive strategies.[1] There are millions of people that continue to live with HIV/AIDS globally, particularly in sub-Saharan Africa where the burden of the disease remains disproportionately high.[1] Nigeria has one of the highest rates of HIV infection worldwide and makes a substantial contribution to the epidemic.[1] Despite the significant progress in access to antiretroviral therapy (ART) over the years, achieving optimal treatment outcomes continues to be a challenge for many people living with HIV/AIDS (PLWHA).[1]

Viral load suppression is among the crucial indicators of successful HIV management.[2,3,4] Sustained viral suppression reduces disease progression, improves immune recovery, decreases opportunistic infections, prolongs survival, and significantly reduces the risk of HIV transmission.[2,3,5] Achieving undetectable viral load has therefore become a major target of HIV management programs worldwide.[2,6] However, viral load outcomes are influenced by multiple factors beyond the accessibility of medications alone.[3,4]

Multiple studies have demonstrated that socioeconomic characteristics, including education, earnings, employment, family structure, social support, and marital status, can have an impact on treatment adherence, which in turn affects viral suppression in PLWHA.[7,8,9] People with advanced level of education may have improved understanding of HIV treatment and the significance of adherence to their medications, while those with stronger social and family support systems may cope better with the emotional and psychosocial challenges associated with lifelong treatment.[7,9,10]

Clinical factors such as body mass index (BMI), duration on treatment, type of antiretroviral regimen, comorbidities, and concurrent use of other drugs are associated with HIV treatment outcomes.[11-14] In addition, medication adherence remains strongest predictors of viral load suppression.[15–20] Poor adherence results to virological failure, emergence of drug resistance, disease progression, and increased mortality.[11,14,21]

Despite the increasing availability of HIV treatment services in Nigeria, limited data exist on the combined influence of socioeconomic and clinical factors to viral load suppression in Northwestern Nigeria.[8,11] Understanding these factors is crucial for developing interventions meant to enhance treatment outcome and achieving national and global HIV control targets.[1,8] This study therefore assessed the socioeconomic and clinical factors that influence viral load suppression among PLWHA attending Federal Medical Centre, Gusau, Northwestern Nigeria.[11,22]

II. METHODS

This was a hospital-based descriptive cross-sectional study done among PLWHA attending the antiretroviral clinic of Federal Medical Centre Gusau, a tertiary hospital in Northwestern Nigeria. The hospital is a referral centre for HIV patients and treatment within the region and provides comprehensive HIV services including counselling, laboratory investigations, viral load monitoring, and antiretroviral therapy.[2]

- *Study Population & Inclusion Criteria*

The study consisted of adult PLWHA receiving antiretroviral therapy and attending the HIV clinic during the study period. Participants included adults aged 18 years or older who had received antiretroviral therapy (ART) for a minimum of six months and voluntarily provided written informed consent to participate in the study. Patients presented with critical illness or unwilling to participate were excluded.[1]

- *Sample Size Determination and Sampling Method*

The sample size was determined using the Leslie Kish formula for cross-sectional studies: $n = (Z^2 \times p \times q) / d^2$, where $Z = 1.96$ (95% confidence level), p is the estimated proportion with viral suppression, $q = 1 - p$, and $d = 0.05$ margin of error. The calculated sample size for the study was 239 respondents and recruited.

Participants were recruited through a systematic random sampling technique. At the commencement of recruitment, the first respondent was selected through a simple random balloting method from among eligible patients available at the clinic. Subsequent participants were recruited systematically according to a predetermined sampling interval of $k = 5$ until the targeted 239 sample size was achieved.

- *Data Collection & Data Analysis*

Data collection was conducted through a structured questionnaire administered by trained interviewers and

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review of clinical records. Viral load results were classified into the following categories; Undetectable (<50 copies/mL), Good Suppression (50–999 copies/mL), and Poor Suppression (≥1000 copies/mL). The data collected were entered and analyzed using SPSS version 25.0. Bivariate cross-tabulations evaluated associations with Chi-square, and/or Fisher's exact tests. Significant variables ($p < 0.05$) were subsequently analyzed using binary logistic regression to identify independent predictors.

➢ *Ethical Considerations*

Ethical clearance for the study was secured from the Ethics Review Committee of Federal Medical Centre, Gusau. All participants provided written informed consent before being enrolled in the study, ensuring strict anonymity and confidentiality throughout.

III. RESULTS

The study included a total of 239 respondents. The mean age was 36.64 ± 10.5 years (range: 18–70 years). Females constituted 64.4% (n = 154) of respondents, while males accounted for 35.6% (n = 85). Majority of the respondents were of Hausa ethnicity (82.0%), Muslim (85.8%), married (59.4%), and lived below the poverty line (69.0%). Table 1 provides an overview of the socioeconomic characteristics of the respondents.

Table 1 Socioeconomic Characteristics of Participants (N = 239)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	Young Adult (18-35)	128	53.5%
	Middle-Aged Adult (36-55)	108	45.2%
	Elderly (>55)	3	1.3%
Gender	Male	85	35.6%
	Female	154	64.4%
Ethnicity	Hausa	196	82.0%
	Yoruba	24	10.0%
	Igbo	7	2.9%
	Others	12	5.1%
Employment	Unemployed	112	46.9%
	Self-employed	78	32.6%
	Gainfully employed	49	20.5%
Education	None	28	11.7%
	Primary	48	20.1%
	Secondary	91	38.1%
	Tertiary	59	24.7%
	Postgraduate	13	5.4%
Income Level	Below Poverty Line	165	69.0%
	Above Poverty Line	74	31.0%
Marital Status	Single	62	25.9%
	Married	142	59.4%
	Divorced / Separated	19	8.0%
	Widowed	16	6.7%
Family Size	1-3 members	62	25.9%
	4-6 members	128	53.6%
	7 & above	49	20.5%

In terms of clinical parameters, 57.7% had normal BMI, 30.5% were overweight, and 7.5% were obese.[1] Most participants (86.6%) were on ART medications for 6 months to 2 years.[1] Overall, 69.5% achieved undetectable viral load, 20.5% had good viral suppression, and 10.0% exhibited poor viral suppression. Almost all participants (96.7%) were receiving the TLD regimen.

Table 2 Clinical Parameters and Virological Profiles (N = 239)

Parameter	Sub-category	Frequency (n)	Percentage (%)
Body Mass Index	Underweight (<18.5)	10	4.2%
	Normal (18.5–24.9)	138	57.7%
	Overweight (25.0–29.9)	73	30.6%
	Obese (≥30.0)	18	7.5%
Duration on ART	6 months – 2 years	207	86.6%
	2–5 years	26	10.9%
	>5 years	6	2.5%
Viral Load Outcomes	Undetectable (<50 copies/mL)	166	69.5%

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	Good Suppression (50–999 copies/mL)	49	20.5%
	Poor Suppression (≥1000 copies/mL)	24	10.0%
ART Regimen	TLD (Tenofovir/Lamivudine/Dolutegravir)	231	96.7%
	ZLN (Zidovudine/Lamivudine/Nevirapine)	8	3.3%
Non-ART Medications	Cotrimoxazole alone	208	87.0%
	Cotrimoxazole + Antihypertensives	19	7.9%
	Cotrimoxazole + Antihypertensives + Antidiabetics	12	5.1%

➢ *Prevalence of HIV Viral Load Suppression.*

Majority, 69.5% (n = 166) achieved undetectable viral load, 20.5% (n = 49) had good viral load suppression, and 10.0% (n = 24) exhibited poor viral load suppression.

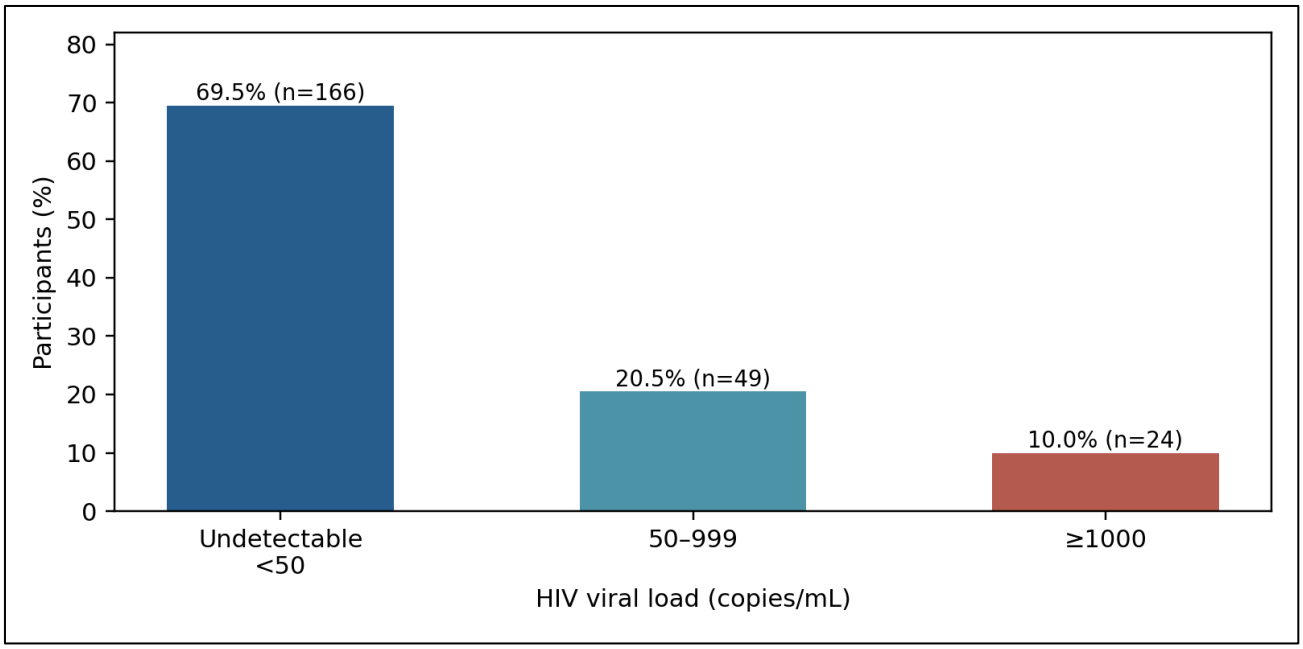


Fig 1 Bar Chart of HIV Viral Suppression

Table 3 Relationship Between Socio-Economic Characteristics of Respondents and Viral Load

	HIVVIRALLOAD		
	Undetectable VL N=166 (%)	**Good VL Suppression N=49 (%)**	**Poor VL Suppression N=24 (%)**
Age			
Young Adult	81 (48.8)	31 (63.3)	16 (66.7)
Middle-Aged Adult	82 (49.4)	18 (36.7)	8 (33.3)
Elderly	3 (1.8)	0 (0.0)	0 (0.0)
P-value = 0.212†			
Occupation			
Not employed	68 (41.0)	32 (65.3)	12 (50.0)
Self-employed	59 (35.5)	11 (22.4)	8 (33.3)
Gainfully employed	39 (23.5)	6 (12.2)	4 (16.7)
P-value = 0.053†			
Educational level			
None	22 (13.3)	2 (4.1)	4 (16.7)
Primary	33 (19.9)	13 (26.5)	2 (8.3)
Secondary	55 (33.1)	22 (44.9)	14 (58.3)
Tertiary	43 (25.9)	12 (24.5)	4 (16.7)
Postgraduate	13 (7.8)	0 (0.0)	0 (0.0)
P-value = 0.034†			

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Ethnicity			
Hausa	133 (80.1)	45 (91.8)	18 (75.0)
Yoruba	17 (10.2)	2 (4.1)	4 (16.7)
Ibo	5 (3.0)	0 (0.0)	2 (8.3)
Others	11 (6.7)	2 (4.1)	0 (0.0)
P-value = 0.153†			
Religion			
Islam	139 (83.7)	45 (91.8)	20 (83.3)
Christianity	23 (13.9)	4 (8.2)	4 (16.7)
Traditional	2 (1.2)	0 (0.0)	0 (0.0)
Others	2 (1.2)	0 (0.0)	0 (0.0
P-value = 0.772†			
Marital status			
Single	35 (21.1)	18 (36.7)	10 (41.7)
Married	111 (66.9)	26 (53.1)	6 (25)
Divorced	8 (4.8)	2 (4.1)	2 (8.3)
Separated	2 (1.2)	0 (0.0)	4 (16.7)
Widow	10 (6.0)	3 (6.1)	2 (8.3)
P-value = 0.000†			
Income			
Below Poverty Line	113 (68.1)	36 (73.5)	16 (66.7)
AbovePoverty Line	53 (31.9)	13 (26.5)	8 (33.3)
Pearson chi2(2) = 0.585, P-value = 0.746			
Family Type			
Monogamy	70 (42.2)	18 (36.7)	4 (16.7)
Polygamy	37 (22.3)	10 (20.4)	2 (8.3)
Single parent	10 (6.0)	2 (4.1)	4 (16.7)
Others	49 (29.5)	19 (38.8)	14 (58.3)
P-value = 0.019†			
Family Size			
1-3	11 (6.6)	0 (0.0)	4 (16.7)
4-6	60 (36.2)	24 (49.0)	6 (25.0)
7 &above	95 (57.2)	25 (51.0)	14(58.3)
P-value = 0.036†			

†*Fisher's Exact Test Applied*

Table 4 Relationship Between Clinical Characteristics of Respondents and Viral Load

	HIVVIRALLOAD		
	Undetectable VL N=166 (%)	**Good VL Suppression N=49 (%)**	**Poor VL Suppression N=24 (%)**
Body Mass Index			
Underweight	6 (3.6)	2 (4.1)	2 (8.3)
Normal weight	103 (62.1)	26 (53.1)	10 (41.7)
Overweight	50 (30.1)	12 (24.5)	10 (41.7)
Obese	7 (4.2)	9 (18.4)	2 (8.3)
P-value = 0.024†			
Duration on drugs			
< 5 years	144 (86.7)	43 (87.8)	20 (83.3)
5-9 years	16 (9.6)	6 (12.2)	4 (16.7)
10 and above	6 (3.6)	0 (0.0)	0 (0.0)
P-value= 0.443†			

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Anti-retroviral drugs			
TLD	166 (100.0)	45 (91.8)	20 (83.3)
ZLE	0 (0.0)	4 (8.2)	4 (16.7)
P-value = 0.000†			
Drugs other than ARV			
Cotrimoxazole only	137 (82.5)	47 (95.9)	24 (100.0)
Cotrimoxazole+antihypertensive	17 (10.2)	2 (4.1)	0 (0.0)
Cotrimoxazole +antihtn+antidm	12 (7.2)	0 (0.0)	0 (0.0)
P-value = 0.033†			

†*Fisher's Exact Test Applied*

Table 5 Binary Logistic Regression Analysis of Independent Factors of Viral Load Suppression

Variable	Category	aOR	95% CI	p-value
Educational Level	None (Ref)	1.00	—	—
	Primary	2.31	1.07 - 5.01	0.034*
	Secondary	4.84	1.20 - 19.58	0.027*
	Tertiary	5.97	1.40 - 25.55	0.016*
	Postgraduate	5.92	2.05 - 17.07	0.001*
Marital Status	Single (Ref)	1.00	—	—
	Married	0.51	0.18 - 1.43	0.201
	Divorced	7.53	2.26 - 25.06	<0.001*
	Separated	3.21	1.60 - 6.43	<0.001*
	Widowed	0.92	0.85 - 1.00	0.052
Income Level	Below Poverty Line	0.54	0.35 - 0.82	0.004*
	Above Poverty Line (Ref)	1.00	—	—
Family Type	Monogamy	15.06	2.99 - 75.75	<0.001*
	Polygamy	3.42	1.64 - 7.11	<0.001*
	Single Parent	2.13	1.36 - 3.34	<0.001*
	Others (Ref)	1.00	—	—
ART Duration	6moth-2 years	3.46	1.65 - 7.25	<0.001*
	>2-5 years	2.22	1.38 - 3.57	<0.001*
	>5 years (Ref)	1.00	—	—
Family Support	Good	3.38	1.47 - 7.75	0.004*
	Weak	1.11	1.01 - 1.22	0.031*
	Poor (Ref)	1.00	—	—

IV. DISCUSSION

This study examined the socioeconomic and clinical factors influencing viral load suppression among PLWHA attending the Federal Medical Centre, Gusau. An Undetectable viral load was found in 69.5% of participants, while 20.5% had viral loads between 50 and 999 copies/mL. Although these findings indicate a favourable treatment response in most participants, the 10.0% with viral loads of at least 1,000 copies/mL remain a concern. Awofala and Ogundele [1] discussed the HIV burden in Nigeria, while Abdullahi et al.[8] examined the extent of viral load suppression among individuals receiving antiretroviral therapy in Northwestern Nigeria. These studies provide relevant Nigerian context for interpreting the present findings, although differences in study populations, treatment duration and outcome definitions may limit direct comparison.

Females accounted for 64.4% of participants, compared with 35.6% for males. This pattern may be due to differences in healthcare-seeking behaviour and access to opportunities for HIV testing and treatment, particularly through maternal health services. Adeniyi et al.[16] investigated the factors influencing adherence to antiretroviral therapy among pregnant women, providing relevant context for women's participation in HIV care and treatment services. However, the predominance of women in this study does not necessarily indicate that they achieved better viral suppression than men, since sex was not established as an independent predictor in regression analysis. Differences in recruitment settings and characteristics of the study populations may also account for variations in sex distribution between studies.

A statistically significant association was observed between respondents' level of education and viral suppression in this study. Participants with secondary, tertiary and postgraduate education had higher reported adjusted odds of suppression than those without formal education. This may be because patients with higher levels of education are better able to understand treatment instructions and the importance of taking medicines consistently. Okafor et al.[7] examined factors associated with adherence to antiretroviral therapy

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among individuals living with HIV in Enugu, while Bhatta and Liabsuetrakul [10] investigated social-cognitive interventions to improve adherence. Their work provides a relevant basis for understanding how patients' knowledge and behavioural factors may influence treatment outcomes. Nevertheless, education alone cannot guarantee adherence, as financial difficulties, stigma and other personal circumstances may affect patients irrespective of their educational background.

Economic circumstances also appeared important. Participants living on an income below the established poverty threshold had lower reported odds of viral suppression than those above the poverty line (aOR = 0.54). Although ART may be available without direct payment for medicines, patients still face expenses associated with transport, food and other household needs. Musa et al.[3] examined adherence ART among HIV/AIDS patient in Kano State, while Tadesse et al.[17] investigated ART among HIV/AIDS patient in Ethiopia. These studies provide relevant comparative evidence on adherence in resource-constrained settings. However, differences in income measurement, social protection and access to treatment services may explain the differences observed across studies. The present cross-sectional study also cannot establish that poverty directly caused poorer viral suppression.

Family support was another important finding. Participants reporting good family support had higher odds of viral suppression than those reporting poor support (aOR = 3.38). In practical terms, supportive relatives may help patients remember their medication, attend clinic appointments and cope with the emotional burden of HIV. Studies conducted by Okafor et al.[7] and Muoghalu [22] investigated the factors associated with adherence to antiretroviral ART in Nigeria, while Bhatta and Liabsuetrakul, [10] explored social-cognitive approaches to improving adherence. These studies are relevant to the role of behavioural and social factors in treatment. Nevertheless, influence of family support may vary according to the strength and quality of family relationships, confidentiality and the patient's experience of stigma. Family involvement should therefore remain voluntary and consistent with patients' preferences.

The findings on marital status and family structure require cautious interpretation. Divorced and separated participants had higher reported odds of viral suppression than single participants, whereas the association for married participants was not statistically significant. This suggests that marital status, when considered independently, may not adequately capture the underlying support available to an individual. The studies conducted by Okawa et al. on patient satisfaction and continued engagement with HIV care and treatment services in sub-Saharan Africa [23], while Nakyanzi et al. [18] who investigated adherence to ART among HIV patients in urban Uganda. Although these studies address related aspects of HIV care, retention and adherence are not equivalent to viral suppression. Differences in social circumstances, HIV status disclosure, and the availability of support outside marriage may help explain variations in findings. The comparatively wide confidence intervals observed in this study for some categories also make it important to avoid over interpreting these associations.

Most participants (96.7%) were receiving tenofovir/lamivudine/dolutegravir (TLD), indicating that this treatment regimen was the most commonly used among the study participants. Dolutegravir-based antiretroviral regimens have demonstrated substantial efficacy in suppressing HIV viral replication and high barrier to resistance. Abdullahi et al.[8] provide relevant evidence from Northwestern Nigeria on successful suppression of HIV replication in individuals on ART, while Fokam et al.[21] examined virological failure and antiretroviral drug resistance among adolescents living with HIV in Cameroon. However, the findings of this study do not provide sufficient evidence to conclude that TLD produced better outcomes than older regimens because only eight participants were receiving zidovudine/lamivudine/nevirapine. The small comparison group and the absence of a clearly reported adjusted regimen comparison limit the conclusions that can be drawn.

Taken together, the findings suggest that viral suppression among PLHIV attending FMC Gusau is associated with educational attainment, economic circumstances, family support and selected family characteristics. These findings are generally in consistence with those reported in the literature on social and behavioural influences on ART adherence.[3,7,10] However, differences in study design, populations and outcome measures mean that agreement should not be assumed across all studies. The findings support strengthening adherence counselling, reducing socioeconomic barriers to care and providing patient-centred psychosocial support. Since the study was cross-sectional, the observed associations did not provide sufficient evidence to establish a causal relationship. In addition, the reported regression estimates and confidence intervals require further validation before definitive conclusions can be reached.

V. CONCLUSION AND RECOMMENDATIONS

This study demonstrates high viral load suppression rates (69.5% undetectable, 20.5% good suppression) among PLWHA in Northwestern Nigeria. Educational attainment, family support, monogamous family structure, TLD regimen, and high medication adherence emerged as key independent predictors of success.

➢ *Recommendations*

- *Adherence Counseling:*

Strengthen routine clinic counseling tailored for people relatively low levels of literacy.

- *Regimen Transition:*

Ensure complete transition of all eligible patients to dolutegravir-based (TLD) regimens.

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- *Family-Centered Care:*
  Promote family involvement in chronic care programs to strengthen social support and reduce stigma.

- *Socioeconomic Support:*
  Integrate economic empowerment, transport subsidies, and nutritional assistance into HIV care packages.

➢ *Funding:*
The research was entirely self-funded by the researcher.

➢ *Ethics Approval:*
Ethical clearance for the study was granted by the Ethics Review Committee of Federal Medical Centre, Gusau.

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