

Factors Associated with HIV Virological Non-Suppression Among Adults Receiving Anti-Retroviral Therapy at Lira Regional Referral Hospital, Northern Uganda

Joseph Niyongira Nturo¹, Neslon Okello¹, Ritah Bakesiima¹, Christine Ayoo¹, Marc Sam Opollo¹

¹Lira University Faculty of Public Health, P.O. BOX 1035, Lira, Uganda.

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Corresponding author:

Joseph Niyongira Nturo

nturojoseph@gmail.com

Abstract: *Background:* By 2030, all Adults with HIV will have been diagnosed, will be receiving antiretroviral therapy (ART), and will have achieved viral load suppression. These goals form the global effort to stop new HIV infections, increase treatment coverage, and end AIDS-related deaths. This study investigated the variables that affect HIV RNA viral non-suppression among Adults living with HIV at Lira Regional Referral Hospital in Uganda.

Methods: For this mixed-methods study, data was collected using a data extraction form, a semi-structured questionnaire, and a key informant interview guide. STATA 17 was used to analyze the quantitative data, and the thematic method was used to analyze the qualitative data. The results were presented in charts, tables, and themes for quantitative data and qualitative data, respectively.

Results: Of the 425 respondents, 235 (55.3%) were female and 190 (44.7%) were male. The majority, 208 (48.9%), were between the ages of 31 and 40. Of those, 238 (56%) had at least a primary education, and 264 (62.1%) were married. The prevalence of HIV RNA viral non-suppression was at 8.5% among Adults living with HIV and 91.5% were HIV RNA virologically suppressed. Recent CD4 counts, Baseline viral load, and WHO clinical stage were significantly associated with HIV RNA virological suppression. In addition to that, adherence (aOR =1.00, 95%CI: 0.004-0.07, p=0.001) was associated with HIV RNA virological non-suppression. Qualitatively, results revealed that Status disclosure is always done by close relatives of the victims, stigma, and discrimination were not common in the community.

There is a need for strategies on how to promote drug adherence among Adults living with HIV rather than just providing the treatment, as viral load suppression is related to baseline viral load, CD4, marital status, and drug adherence. In this study, monitoring the immunological response through scheduled CD4 and viral load tests is critical for maintaining patients' immunity and preventing disease progression. Intensive adherence support and counseling should conclusively be provided through the effective implementation of ART programs by providers to enhance viral suppression and ensure the quality of care and treatment.

Keywords: non-suppression, Adults living with HIV, and antiretroviral therapy.



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1. Introduction

Global efforts to prevent new HIV infections, increase treatment coverage, and end AIDS-related deaths are focused on diagnosing at least 95% of all Adults living with HIV, ensuring that at least 95% of those diagnosed receive antiretroviral therapy (ART), and achieving viral load suppression for at least 95% of those on treatment by 2030 (Doshi et al., 2018). According to (Afrane et al., 2021), the primary goal of ART is to suppress viral replication, which ultimately results in immune system restoration, reduced HIV transmission, and an overall improvement in the quality of life of Adults living with HIV. This is why, in 2013, the World Health Organization (WHO) established viral load (VL) monitoring as a gold standard for monitoring treatment efficacy (WHO, 2014). The Ugandan government, on the other hand, adopted WHO's recommendation in 2016, to increase access to ART, initiate treatment earlier, and expand the use of ARVs for HIV prevention (Uganda MoH, 2016). Uganda's AIDS Control Program (ACP) guidelines recommend VL testing 6 months after starting ART and then annually for Adults who have achieved virological suppression (Uganda MoH, 2018). In this study, virological non-suppression is defined as viral copies greater than 1000 copies per milliliter of blood for a plasma viral load sample after six months of ART initiation (Bulage et al., 2017).

Despite increased VL monitoring in resource-limited settings such as Sub-Saharan Africa (SSA) countries, virological non-suppression persists in some societies (Mwangi & van Wyk, 2021). According to the findings of a prospective cohort study conducted in Congo, the likelihood of having non-suppression remained significantly higher among those in advanced stages of the disease, those with abnormal serum creatinine, those with high baseline HIV viremia of over 1000 copies/mL, etc. (Buju et al., 2022). A cross-sectional study of children on ART at a major treatment center in Southern Ghana discovered a high rate of virological non-suppression at 38.4%, with factors associated with virological non-suppression including a previous history of TB treatment, female gender, severe CD4 immune suppression status at study recruitment, and being on a Nevirapine (NVP)-based regimen (Afrane et al., 2021). Nevirapine (NVP) is frequently used to prevent perinatal HIV transmission. In a similar study conducted in Uganda, virological non-suppression was found to be 50% higher among repeat testers after suspected treatment failure (Bulage et al., 2017). Repeat testing refers to laboratory procedures performed on a blood specimen to verify only an abnormal result reported on the initial or second screen (Law insider, 2022). In the same study, young age, poor adherence, and having active TB were all associated with virological non-suppression. Another study conducted in Eastern Uganda to determine viral load non-suppression among adolescents found it to be 31.4% (Maena et al., 2021). Maena and colleagues discovered that being male, age 16-19 years, education level, duration on ART therapy, WHO Clinical Staging II, second-line ART regimen, and presence of comorbidities were all significantly associated with VL non-suppression (Maena et al., 2021).

In Uganda, VL programs are characterized by the use of limited antiretroviral regimens and the often-limited use of VL testing to monitor treatment outcomes and maximize the long-term effectiveness of ART (Ssemwanga et al., 2020). Nevertheless, there is limited information on the factors associated with virological non-suppression

mostly among adults living with HIV, especially in resource-limited countries like Uganda and specifically among those receiving ART at Lira Regional Referral Hospital. The bed capacity of the hospital in 2012 was 254.

2. Methodology

2.1. Study design

This study adopted a mixed method study with both quantitative and qualitative data collection methods.

2.2. Study setting

This study was conducted at Lira Regional Referral Hospital in Lira City, Northern Uganda. The selection of the hospital was informed by the number of clients served. The hospital has approximately 13000 patients in care, which is indicative of the health facilities in Lango sub-region as well as other ART sites. The fundamental gap in viral load suppression for patients on ART after 6 months of initiation indicates an urgent need for conducting the study.

2.3. Study participants

Adults living with HIV who were receiving HIV services from Lira Regional Referral Hospital comprised the accessible population.

2.4. Eligibility criteria

Inclusion Criteria

Only Adults living with HIV who had been on treatment for at least 6 months and had their viral load test results taken between 6 and 8 months after initiating ART were included in this study. Consent was sought from all respondents.

Exclusion Criteria

Adults living with HIV with mental incapacitation, inability to respond to the interviews and those who were too sick to respond during the interviews were excluded from this study, including those who did not consent.

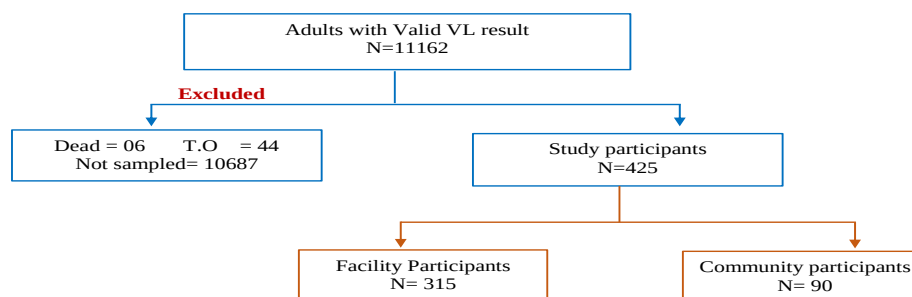
2.5. Sample Size Determination

ART records for Adults living with HIV were selected systematically. Given the total population size of 1, 1162 Adults living with HIV that were receiving ART at Lira Regional Referral Hospital, the sample size (for ART records to be reviewed) was calculated using Slovin's formula and abstained to be 425 participants.

2.6. Procedure

Systematic random sampling was used to select 425 participants from the total eligible Adults living with HIV receiving ART at the Lira Regional Referral Hospital. This technique gave all adults living with HIV and had a valid VL result from January 2021 to October 2022 in the target population equal chance of being chosen as a respondent.

A list of 11162 Adults living with HIV enrolled on ART with an updated viral load result was generated from the viral load dashboard, CD4, VL register and a number was assigned to them and at an interval of 26th (11162/425), an individual on the list was selected until the number 425 was achieved as show below:



2.7. Data Collection Tools

A data extraction form was used to get quantitative data from the ART records that are routinely collected. The form was developed based on the variables of the study. That is, the tool was aligned with Adults living with HIV ART cards to collect data that is captured in the routine health information management system (HMIS) and records. The tool was validated before being used in the study. Data such as gender, marital status, education level, TB status, ART regimen, ART duration, ART-induced side effects, age at ART initiation, ART adherence level, etc. were extracted from ART records from January 2021 to October 2022. Data was extracted by filling out a printed extraction form with the individual's data.

Qualitative data was collected from healthcare providers and Adults living with HIV by using a semi-structured interview tool and a key informant interview guide, respectively. The KII guide and a semi-structured tool both included questions about: the reasons why some adults living with HIV are virologically non-suppressed; the challenges faced by adults living with HIV and health workers; the support needed to improve ART services; and ways to overcome virological non-suppression. Participants in KIIs were selected using purposive sampling based on their knowledge and role in the management of Adults living with HIV.

2.8. Data analysis

Quantitative data analysis

Data was analyzed using Stata version 17 at the univariate, bivariate, and multivariate levels. Univariate analysis was carried out for continuous variables using means and frequencies to describe study sample characteristics and to establish the prevalence of the outcome variable (virological non-suppression). Bivariate analysis was used to determine the strengths of the association between the independent variables (associated factors) and the virological non-suppression). Crude odds ratios (COR) were calculated at the bivariate logistic regression. All significant variables at *P-value*

≤ 0.05 in bivariate analysis were entered into the multivariable analysis. Multivariable logistic regression was used to identify factors independently associated with virological non-suppression. All variables with p-value less than 0.05 from the multivariable analysis were taken as independent predictors of virological non-suppression among adults living with HIV in Lira Regional Referral Hospital.

2.9. Qualitative data analysis

Qualitative data was analyzed using the recursive abstraction method, in which the data were translated, transcribed, coded, grouped into sub-themes and themes, and lastly, the main theme was generated.

2.10. Ethical Considerations

Ethical approval was sought from the Gulu University research and ethics committee (GUREC-2022-298). An introductory letter from the head of Department of Environment and disease control, Faculty of Public Health Lira University was obtained and thereafter, permission (to access ART records and to interview health workers) was sought from the Director LRRH. Informed consent was sought from the respondents and every respondent who agreed to participate in the study were asked to sign a consent form. The participants were neither coerced nor intimidated to participate in the study and were free to withdraw at any time from the study without any consequences. Both abstracted and collected data was accessible by only the research assistants and the investigator. Data collected was specifically used for this study only. Tools were translated to “Leb Lango” and back translated to English to ensure correct translation.

3. Results

3.1. Socio-demographic characteristics of the respondents

The majority of the participants were female: 235 (55.3%), and those aged between 31 and 40 dominated the study 208 (48.9%). Most of the study participants attained a primary level of education 238 (56%), while a minority had a tertiary level of education 36 (8.5%). Regarding the marital status, 264 (62.1%) cited that they were in a marital relationship, and Anglican 186 (43.8%) were highly presented in the study compared to other denominations. Finally, the majority of the study participants 177 (41.7%) reported monthly income between 50,000-100,000 and the least were those who earned monthly income between 260,000-300,000 53 (3.5%) as distributed in Table 1 below.

Table 1. Socio-demographic characteristics of the respondents

Variable	Frequency (N)	Percentage (100%)
Gender		
Male	190	44.7
Female	235	55.3
Age (Completed years)		
31-40	208	48.9
41-50	136	32
51-60	48	11.3
61 and Above	33	7.8
Educational level		
None	59	13.8
Primary	238	56
Secondary	92	21.6
Tertiary	36	8.5
Marital status		
Marital relationship	264	62.1
Non-Marital relationship	161	37.9
Religion		
Catholic	165	38.8
Anglican	186	43.8
Born Again	66	15.5
Islam	3	0.7
Others	5	1.2
Monthly Income		
50,000-100,000	177	41.7
110,000-150,000	72	16.9
160,000-200,000	63	14.8
210,000-250,000	45	10.6
260,000-300,000	15	3.5
310,000 and Above	53	12.5

Data source: Field data (2022)

3.2. Socio-demographic factors associated with HIV RNA virological non-suppression among Adults living with HIV

To determine the association between socio-demographic factors and HIV RNA virological non-suppression, logistics regression was performed as shown in Table 2 below.

Table 2. Association between socio-demographic factors and virological suppression

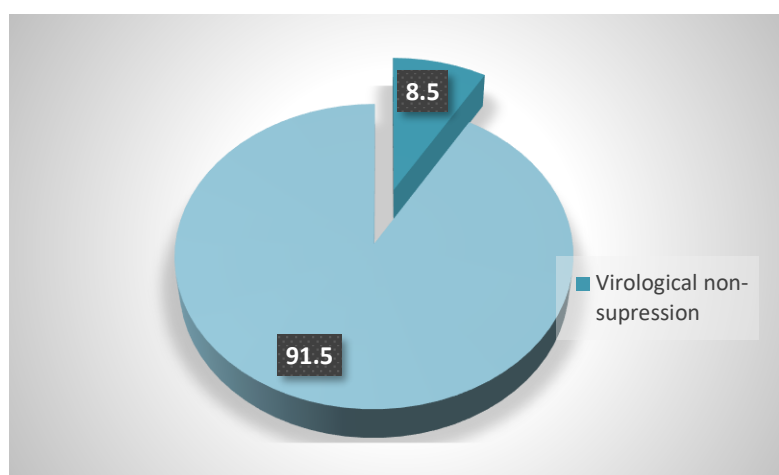
Variables		Virological suppression					
		Suppressed	Non-Suppressed	COR (95%CI)	p-value	AOR (95%CI)	P value
Gender	Male	168(88.4)	22(11.6)	1.00		1.00	
	Female	221(94.0)	14(6.0)	2.27(0.17-4.02)	0.02	3.0(1.87-5.09)	0.001*
Age	31-40	186(89.4)	22(10.6)	1.00		1.00	
	41-50	128(89.4)	08(10.6)	1.74(1.05-2.90)	0.033	1.81(0.90-3.63)	0.09
	51-60	44(91.7)	04(8.3)	2.59(1.41-4.75)	0.002	2.19(0.97-4.97)	0.06
	61 and above	31(94.0)	02(6.0)	1.35(0.78-2.36)	0.285	1.66(0.72-3.88)	0.235
Marital status	Marital Relationship	234(88.6)	30(11.4)	1.00		1.00	
	Non-Marital Relationship	155(96.2)	06(3.8)	1.50(0.99-2.22)	0.011	1.21(0.64-2.26)	0.03*
Religion	Catholic	147(89.1)	18(10.9)	1.00		1.00	
	Anglican	178(95.6)	08(4.4)	1.68(1.10-2.58)	0.018	1.31(0.70-2.45)	0.391
	Born Again	60(90.9)	06(9.1)	2.81(2.28-6.17)	0.010	2.99(0.97-9.24)	0.056
	Islam	1(33.3)	02(66.7)	1.98(1.10-3.58)	0.018	1.31(0.70-2.45)	0.691
	Others	3(60)	02(40)	1.81(2.28-6.17)	0.010	2.79(0.97-9.24)	0.086

The findings in Table 2 show that gender (COR = 2.27, P-value 0.02), age between 51 and 60 (COR = 2.59, P-value 0.002), marital status (COR = 1.50, P-value 0.011), and religion such as Anglican (COR = 1.68, p-value 0.018), Born Again (COR = 2.81, P-value 0.010), and Islam (COR = 1.81, P-value 0.010) were significantly associated with virological suppression among Adults living with HIV. Furthermore, a multivariate analysis was conducted to determine the magnitude of the association between socio-demographic factors and virological suppression. The study found that females (AOR = 2.27, 95% CI 0.17-4.02) are 2.27 times more likely to be virologically suppressed compared to males. It was also revealed in the study that Adults living with HIV who are not in a marital relationship (AOR = 1.50, 95% CI 0.99-2.22) are 1.5 times more likely to be virological suppression compared to Adults who are in a relationship.

3.3. Prevalence of HIV RNA virological non-suppression among Adults receiving ART at Lira Regional Referral Hospital (Lira RRH)

389/425(91.5%) adults living with HIV at LRRH were virologically suppressed while 36/425 (8.5%) were virologically non suppressed as shown in Figure 2 below.

Figure 1. Prevalence of virological non-suppression among Adults living with HIV at Lira RRH



Factors associated with HIV RNA Virological non-suppression among HIV positive adults

Individual factors associated with HIV RNA virological non-suppression among Adults living with HIV

Both qualitative and quantitative data collection methods were employed. Quantitatively, respondents were asked numerous questions, and the responses are captured in Table 3 below.

Table 3. Descriptive statistics on the individual factors

Variable	Frequency(N)	Percentage (%)
Have you ever disclosed your HIV status to your spouse/friend *		
Yes	285	67.1
No	140	32.9
Have you ever experienced HIV-related Stigma and discrimination*		
Yes	138	32.5
No	287	67.5
Do you think age affects your virological suppression?		
Yes	123	28.9
No	302	71.1
Do you think gender affects your viral suppression?		

Yes	127	29.9
No	298	70.1
Do you think your education level influences Virological suppression?		
Yes	87	20.5
No	338	79.5
Do you think your marital status affects virological suppression?		
Yes	153	36
No	272	64

Data source: Field data (2022)

Most of the study participants mentioned that they have ever disclosed their HIV status to their spouse/friend 285 (67.1%), and most of them reported that they have never encountered stigma and discrimination 287 (67.5%). Majority 302(71.9%) of them reported that age and gender 298(71.1%) do not affect Virological suppression. Of the study participants, 79.5 (%) pointed out that education level does not influence Virological suppression, and 153(36%) cited that marital status affects the Virological status.

Individual factors associated with HIV RNA virological non-suppression among Adults living with HIV

To determine the association between individual factors and virological non-suppression, logistic regression analysis was performed, and the results are distributed in Table 4 below.

Table 4. Individual factors and virological suppression among HIV positive Adults

Variables	Virological suppression						
		Suppressed	Non-Suppressed	COR (95%CI)	p-value	AOR (95%CI)	P value
Have you ever disclosed your HIV status to your spouse/friend	Yes	275(96.4)	10(3.6)	1.00	1.00		
	No	114(81.4)	26(18.6)	0.32	0.001	0.80(0.26-2.44)	0.686
Do you think age affects your virological suppression	Yes	101(94.5)	22(17.9)	1.00		1.00	
	No	288(95.3)	14(4.7)	0.26	0.004	0.97(0.21-4.56)	0.968
Do you think gender affects your viral	Yes	98(77.1)	29(22.9)	1.00		1.00	
	No						

suppression							
Do you think your education level influence Virological suppression	No	291(97.6)	7(2.4)	0.28(0.13-0.57)	0.001		
	Yes	59(67.6)	28(32.4)	1.00		1.00	
Do you think your marital status affects virological suppression	No	330(97.6)	8(2.4)	0.08(0.02-0.38)	0.002	0.15(0.02-1.08)	0.06
	Yes	120(78.4)	33(21.6)	1.00		1.00	
	No	269(98.9)	03(1.1)	0.07(0.03-0.13)	<0.001	0.14(0.06-0.36)	<0.001* **

* **p<0.05, **p<0.01, *p<0.05, 1 = Reference category, COR =crude odds ratio, AOR=adjusted odd ratios, CI = confidence interval

As distributed in the Table above, the bi-variate analysis reveals that disclosing of HIV status (COR = 0.32, p-value 0.001,), age of the respondents (COR = 0.32, p-value 0.004,), gender (COR = 0.28, p-value 0.004,), level of education (COR= 0.08, p-value 0.002,) and marital status were significantly associated with virological suppression. The multivariate analysis conducted reveals that Adults who are married (AOR = 0.14, p-value 0.001, 95%CI 0.06-0.36) were less likely to attain virological suppression compared to those who were not married.

These study findings are in congruence with the qualitative results which reveal that Adults living with HIV normally disclosed their status to their close relatives, stigma, and discrimination are not common in the community. It was mentioned by one of the study participants that age, gender, and marital status do not collide with the virological suppression. The following are the respondent's views during the key-informant interview:

"My neighbour no longer fears disclosing her [HIV] status to friends and other relatives. This is because she usually forgets about taking ARVs and is so worried at her age that she may die due to drug failure. She is no longer forgetting because Adults constantly remind her" (KII, a 35-year-old community linkage reported).

"Most Adults are afraid of taking ARVs because they are constantly ashamed, and the most difficult situation is when they are in love but do not tell their loved one." "I always encourage them to take their medicine well and avoid fear" (KII, Clinical Officer, 2022 in his office).

Community factors associated with HIV RNA virological non-suppression among Adults living with HIV

Most respondents 215, (50.4%) reported not belonging to any social network, as shown in Table 5 below.

Table 5. Descriptive statistics on community factors

Variable	Responses	Frequency (N=425)	Percentage (100%)
Belong to social network	Yes	210	49.6
	No	215	50.4
Loss of follow-up	Yes	288	67.9
	No	137	32.1
Distance from services	Short	251	59.0
	Too long	174	41.0
Availability of services	Available	407	95.9
	Not available	18	3.7
Stigma and discrimination	Yes	138	32.5
	NO	287	67.5

Source: Field data (2022)

Majority 288 (67.9%) of them cited that they were not being followed up by the health professionals, and 251 (59.0%) respondents reported that they were not far from the ART clinic. The highest percentage of the study participants reported the availability of services 407(95.9%) and 287(67.5%) participants reported not having been stigmatized or discriminated against.

Community factors associated with HIV RNA virological non-suppression among Adults living with HIV

To determine the association between community factors and virological non-suppression, logistic regression analysis was performed, and the results are distributed in the table below.

Table 6. Relationship between community factors and Virological non-suppression

Variables				Virological status		suppression			
				Suppressed	Non-Suppressed	COR (95%CI)	p-value	AOR (95%CI)	P value
Belong to social network	Yes			180(85.7)	30(14.3)	1.00		1.00	
				No	209(97.2)	6(42.8)	0.20(0.13-0.31)	<0.001	0.33(0.17-0.66)
Loss of follow-up	Yes			261(90.6)	27(9.4)	1.00		1.00	
				No	128(93.4)	9(6.6)	0.19(0.11-0.33)	<0.001	0.53(0.24-1.19)
Distance from services	Short			221(88.0)	30(12)	1.00		1.00	
				Long	168(96.5)	06(3.5)	0.41(0.26-0.64)	<0.001	0.66(0.34-1.27)
Availability of services	Yes			374(91.8)	33(8.2)	1.00		1.00	
				No	15(83.3)	3(16.7)	0.19(0.09-0.37)	<0.001	0.62(0.22-1.71)
Stigma and discrimination	Yes			112(81.1)	26 (8.9)	1.00		1.00	
				No	277(96.5)	10 (3.5)	1.78(1.26-2.64)	<0.001	0.66(0.34-1.27)

* **p<0.001, **p<0.01, *p<0.05, 1 = Reference category, COR =crude odds ratio, AOR=adjusted odd ratios, CI = confidence interval.

The bivariate analysis conducted revealed that HIV-positive patients who belong to a social network (COR = 0.20, p-value 0.001, 95%CI 0.13-0.31), loss of follow-up of patients (COR = 0.19, P-value 0.001, 95%CI 0.11-0.33), Distance to the health facility (COR = 0.41, p-value 0.001, 95%CI 0.26-0.64), availability of HIV related services (COR = 1.19, p-value 0.001, 95%CI 0.09-0.37) were significantly associated with non-virological suppression among Adults patients in Lira Regional Referral Hospital. In addition to that, a multivariate analysis was conducted to determine the strength of the correlation. The study found that HIV-positive patients who do not belong to a social network are less likely to be virologically suppressed than those in a social network (AOR = 0.33, p-value 0.002, 95%CI 0.17-0.66) and those who experience stigma and discrimination are 0.66 times less likely to be non-virologically suppressed (AOR = 0.66, p-value 0.015, 95%CI 0.34-1.27).

In addition to that, the qualitative data collected and analyzed reveals there are numerous factors plausibly associated with virological non-suppression among adults living with HIV in Lira Regional Referral Hospital. These factors include lack of social network, loss of follow-up in the community, stigma and discrimination, lack of family support, inadequate adherence counselling among Adults living with HIV , religious beliefs, distance to the health facility, and the cost of transportation. It was revealed by some of the key informants during the interview, as noted below:

“Adults living with HIV always forget about taking medication because of fear of being stigmatized and discriminated against by their fellow community members and their families” (KII, Nurse reported during Key-informant Informant Interview, October 2022).

Another respondent reported, “HIV-positive individuals are not open about their HIV-positive status, and keeping their secret makes them stressed out, hence abandoning ARV. They don’t follow recommendations given by clinicians on how they should take medication and avoid sexual intercourse” (KII, certified Village Health team in LRRH, on October 2022).

Health Service factors associated with HIV RNA Virological non-suppression among adults living with HIV

The most dominant care entry point was HCT (90.5%), and more than half of the respondents (71.8%) had recent CD4 counts of more than 500 cell/mm³. Furthermore, around half of the respondents (53.5%) were initiated on TDF/3TC/Efr, more than three quarters (%) of the respondents had been on ART for 48 months and 62.9% of patients had their baseline viral load of 1000 and above copies, which is no different from the proportion of patients (62.7%) who had their recent viral load of 1000 or above copies.

This study also revealed that almost all patients (94.1%) were in WHO clinical stage 1, 96.0% had good adherence (>85%), and 98.1% of the patients had negative TB status.

Table 7. Service related factors associated with non-virological suppression among HIV positive adults in Lira RRH

Variable	Frequency (N)	Percentage
Care entry points		
HCT	384	90.5
Referral	32	8.6
Psychosocial	4	1.0
Total	425	100.0
Recent CD4		
<250 cells/mm ³	32	7.3
250-500 cells/mm ³	88	21.0
≥500 cells/mm ³	305	71.8
Total	425	100.0
Art Regimen at initiation		
AZT/3TC/NPr	59	13.8
TDF/3TC/Efr	220	53.5
CBV/NVP	24	6.1
TLD	53	13.3
CO-PACK	7	1.5
GBV/NVP	11	4.1

AZT/3TC/NVP	4	0.8
TDF/3TC/DTG	11	2.8
DTC/3TC/TFV	4	1.0
TDF/3TC/ATV/R	4	1.0
Total	425	100.0
Duration on ART		
<=14 months	5	1.2
15-47 months	79	18.7
48 months	340	80.1
Total	425	100.0
Baseline Viral Load		
<1000 copies	158	37.1
1000 and above copies	267	62.9
Total	425	100.0
Recent viral load		
<1000 copies	158	37.2
1000 and above copies	267	62.8
Total	425	100.0
WHO clinical stage		
Stage I	400	94.1
Stage II	17	4.0
Stage III & IV	8	2.0
Total	425	100.0
Recent adherence		
Good (>95%)	403	96.0
Fair (85-95%)	13	3.1
Poor (<85%)	4	0.9
Total	425	100.0
Current TB status		
Negative	416	98.1
Positive	9	1.9
Total	425	100.0

Source: Field data (2022)

Health services related factors associated with HIV RNA Virological non-suppression among Adults living with HIV

To determine the association between health service factors and virological non-suppression, logistic regression analysis was performed, and the results distributed in the table 8 below.

Table 8. Relationship between service factors and virological suppression among HIV adults at Lira RRH

Variables			Suppression		COR (95%CI)	p value	AOR (95%CI)	P value
			Suppressed	Non-suppressed				
Care point	entry	HCT	384(93.2)	26(6.8)	1.00		1.00	
		Referral	23(71.8)	9(28.2)	0.95(0.27-3.34)	0.935	1.54(0.09-26.7)	0.765
		Psychosocial support	3(75.0)	1(25.0)	0.19(0.04-0.86)	0.032*	0.08(0.01-1.46)	0.09
Recent cell	CD4	<250	19(59.3)	13(40.7)	1.00		1.00	
		250-500	81(92.0)	16(8.0)	2.4(1.07-5.67)	0.034*	6.34(1.56-25.8)	0.01*
		>=500	298(97.7)	7(2.3)	9.29(3.44-25.1)	<0.001**	22.1(4.45-108.6)	<0.001***
Baseline load	viral	<1000 copies	151(95.5)	7(4.5)	1.00		1.00	
		>=1000 copies	238(89.1)	29(10.9)	0.28(0.12-0.67)	0.004**	0.199(0.05-0.76)	0.018*
WHO stage	clinical	I	379(94.7)	21(5.3)	1.00		1.00	
		II	7(41.2)	10(58.8)	0.09(0.04-0.24)	<0.001**	0.07(0.01-0.44)	0.004**
		III	2(25.0)	6(75.0)	0.05(0.01-0.21)	<0.001**	0.06(0.04-0.89)	0.041*
Recent Adherence		>85	338(95.0)	20(3(5.0)	1.00		1.00	

	85-95	2(15.4)	11(84.6)	0.02(0.004-0.07)	<0.001* **	0.003(0.001-0.07)	<0.001***
	<85	0(00)	5(100)	0.02(0.01-0.15)	<0.001* **	0.03(0.02-0.39)	0.007**
Disclosed status	Disclosed	257(90.1)	28(9.9)	1.00		1.00	
	Not disclosed	132(94.2)	08(5.8)	0.46(0.22-0.92)	0.029*	0.31(0.09-1.01)	0.053
Stigmatized	Yes	114(82.6)	24(17.4)	1.00		1.00	
	No	175(60.9)	12(39.1)	0.245(0.08-0.71)	0.01*	0.01(0.001-0.20)	0.003

* **p<0.001, **p<0.01, *p<0.05, 1 = Reference category, COR =crude odds ratio, AOR=adjusted odd ratios, CI = confidence interval

The study found out that, care entry through psycho-social support (COR =0.195, p-value 0.031, 95%CI 0.04-0.86), recent CD4 counts 250-500 (COR= 2.4, p-value 0.034, 95%CI, 1.07-5.67) CD4 count above 500 (COR = 9.29, P < 0.001, 95%CI, 3.44-25.1), Bassline viral load (COR =29, p-value 0.004, 95%CI,0.12-0.67) and WHO clinical staging were significantly associated with virological suppression. In addition to that, recent adherence (p>0.001), Not disclosing HIV status (COR =0.46, P-value 0.029, 95%CI, 0.004-0.07), and stigmatization (COR = 0.245, p-value 0.01, 95%CI, 0.08-0.71) were positively and significantly associated with virological suppression.

In the multivariate logistic regression analysis, those with recent CD4 cell between 250 -500 were 6.34 times (AOR=6.34, CI: 1.56-25.8) more likely to suppress compared to those with a CD4 cell count of <250 and those with a CD4 cell count of >=500 were 9.29 times (AOR=9.29, CI: 4.45-108.6) more likely to suppress. Similarly, patients with treatment adherence below 95 were 0.03 less likely to achieve virological suppression. Patients in WHO clinical stages II and III were 0.07 and 0.06 less likely to achieve virological suppression compared to their counterparts who were categorized in WHO stage I. Patients with adherence rates 85-95 and <85 were 0.02 less likely to be suppressed compared to those at >95% Adherence level. Finally, Adults living with HIV who are not stigmatized were 0.24 times less likely to be suppressed compared to those stigmatized at both facility and community.

Majority of patients said food support would at least ensure a much high proportion of HIV positive adults attain Virological suppression.

Whereas other respondents expressed a desire for CHE workers to be attached to their locations to increase viral suppression among Adults living with HIV, the majority of KIIs stated that "viral load services should be taken close to the pharmacy where they get their ARV."

Another respondent also reported that "the health workers should talk to us in the right way."

4. Discussion of findings

4.1. Prevalence of HIV RNA virological non-suppression among Adults living with HIV in Lira Regional Referral Hospital

The study found that the prevalence of virological non-suppression was 8.5% among adults living with HIV. This means that up to 91.5% of the adults in the study who had HIV were virologically suppressed. These results are compared with a national virological non-suppression rate of less than 10% among adults (Uganda National Viral Load Dashboard). This is similar to other studies in South Africa where the non-suppression rate was found at 15% (Lisa et al., 2014), in Swaziland at 16% (Joseph Davey et al., 2018), in Cambodia at 23.2% (Chhim et al., 2018), in Zimbabwe at 14% (Jobanputra et al., 2015), and in Los Angeles at 27% (Sayles et al., 2012). In a similar study by Jiamsakul et al. (2017), the proportion achieving VL suppression at 3 years from ART initiation changed from 45.1% to 90.2% in adults, and from 60.6% to 80.4% in children. Additionally, 83% of the patients in the cohort had been able to suppress VL after 6 months of first-line ART (Jiamsakul et al., 2017).

This could be based on the fact that adults living with HIV were taking their medication, health workers were conducting adherence counseling, and drug side effects were properly managed as recommended, as statistics show that up to 85% of patients receiving care from Lira Regional Referral Hospital had a high level of adherence. This finding is in congruence with another study that revealed that barriers to VL non-suppression included forgetfulness, changes in the daily routine, side effects, and pill burden, among others (Ndikabona et al., 2021). Another study's findings also show that more than half of patients (66%) had viral suppression as of 2020 (Tomescu et al., 2022).

4.2. Individual factors associated with HIV RNA Virological non-suppression among Adults living with HIV in Lira RRH

The study found that non-virological suppression among adults living with HIV in LRRH is caused by several different factors. Statistics show that the majority of study participants, 285 (67.9%), have ever disclosed their HIV status, with age and gender (298, 71.3%), being factors that can significantly associate with non-virological suppression among Adults living with HIV and on ART. The logistic regression analysis performed between the individual factors and the virological suppression pointed out that individual disclosure of HIV status (COR = 0.32, p-value 0.001, 95%CI), age of the respondents (COR = 0.32, p-value 0.004, 95%CI), gender (COR = 0.28, p-value 0.004, 95%CI), level of education (COR = 0.08, p-value 0.002, 95%CI), and marital status were significantly associated with virological suppression among Adults living with HIV. This clearly shows that younger Adults tend to neglect and ignore taking their medication since they want to live normally like Adults who are not HIV positive, causing viral resistance and drug failure and, in the long run, lowering the CD4 counts. On the other hand, women always survive longer with HIV while on ART compared to men. This could be based on taking drugs as recommended by the clinician since men normally feel that they are strong and can survive without medicine. The multivariate analysis conducted reveals that Adults

who are married (AOR = 0.14, p-value 0.001, 95% CI) are less likely to be suppressed compared to those who are single.

The findings of this study are consistent with those of Maena and colleagues (2021), who discovered that VL non-suppression was associated with several factors, such as being male, being 16-19 years old, having a high education level, and so on. A study conducted in five southern African countries found younger age, male gender, less education, suboptimal adherence, receiving nevirapine, HIV non-disclosure, and never having married to be associated with virological non-suppression (Haas et al., 2020). On the contrary, a study done in the UK among HIV-diagnosed individuals found no evidence that non-disclosure was associated with virological non-suppression (Daskalopoulou et al., 2017).

4.3. Health Services related factors associated with HIV RNA Virological non-suppression among Adults living with HIV in LRRH

The regression analysis performed revealed that some factors like recent CD4 counts between 250-500 (COR= 2.4, p-value 0.034, 95%CI, 1.07-5.67) CD4 counts above 500 (COR = 9.29, P < 0.001, 95%CI, 3.44-25.1), baseline viral load (COR =29, p-value 0.004, 95%CI, 0.12-0.67) and WHO clinical staging were significantly associated with virological suppression. For CD4 counts, the study findings are similar to other studies, as it was observed that being female CD4 count of greater than or equal to 350 cells/mm³ were an independent predictor of viral load suppression after enhanced adherence counseling (Atnafu et al., 2022). Variables associated with viral suppression included unemployment, formal education, high baseline CD4 count, and first-line HAART regimen (Abdullahi et al., 2021).

This is supported by other studies in similar settings, where poor adherence to ARV medication and missed doses daily were more likely to result in non-viral suppression than good adherence (Jobanputra et al., 2015). Non-adherence is associated with non-viral suppression, and adherence to treatment is essential in ensuring viral suppression among patients on ARV therapy.

Another similar study reveals that virological non-suppression appears together with a wide range of factors in different parts of the world including previous treatment failure, long periods on ARV therapy, low baseline CD4, ARV regimen, poor absorption of ARVs, poor adherence to treatment, comorbidities, drug resistance, drug toxicity, substance abuse, weak social support networks, sexually transmitted infections (Chhim et al., 2018; Das et al., 2010; Davey et al., 2018; Jobanputra et al., 2015; Lisa et al., 2014).

A study from DRC in Bunia province also showed similar findings where the likelihood of having non-suppression remained significantly higher among those who were at advanced stages of the disease, those with high baseline HIV viremia over 1000 copies/mL (Buju et al., 2022). This is also in agreement with another study conducted in Arba Minch hospital where a baseline viral load of <10,000 copies/ml and good adherence level to ART (AHR=2.648, CI: 1.202, 5.834) significantly predict the time to viral load suppression (Hussen et al., 2019).

4.4. Community-related factors associated with non-virological suppression among Adults living with HIV in Lira Regional Referral Hospital

The study found that community factors play a critical role in enhancing individuals to be either suppressed or non-suppressed. The regression analysis performed revealed that HIV-positive patients who belong to social network psycho-social support (COR = 0.195, p-value 0.031, 95%CI 0.04-0.86) were virologically suppressed as compared to those without a social network. The social network could help them to acquire more skills and knowledge making them confident enough to adhere. In addition to that, distance to the health facility (COR = 0.41, p-value 0.001, 95%CI), and availability of HIV-related services (COR = 1.19, p-value 0.001, 95%CI) were positively and significantly associated with non-virological suppression among Adults patients in Lira Regional Referral Hospital.

This study finding is in congruence with a study conducted in Uganda on factors associated with virological non-suppression among patients on antiretroviral therapy found that non-suppression associated with lack of follow-up poor monitoring of Adults living with HIV, lack of family support, stigma, and discrimination, age, and treatment failure (Bulage et al., 2017). In another study conducted in Uganda, the most commonly reported barriers among non-suppressing clients were lack of income, limited access to food, alcohol use or having experienced mental health challenges, having challenges with disclosure, or having experienced stigma (Kikaire et al., 2021).

Contribution of Authors

Conceptualization, JNN. Methodology, JNN, MSO, NO RB and CA.; Validation, JNN MSO, and C.A. Formal analysis, JNN MSO Investigation, JNN. and CA.; Resources, JNN. Data curation, JNN, MSO, writing original draft preparation, JNN.; Writing—review and editing, JNN NO RB CA.; visualization, JNN NO RB CA and.; Supervision, MSO.; Research administration, JNN.; Funding Source, JNN. All authors have read and agreed to the published version of the manuscript.

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