Prevalence, Associated Factors of Viral Load Suppression and Effect of Intensified Adherence Counselling among Adolescents on ART at Kisenyi, Kawala and Kitebi Health Centres. A Retrospective Chart Review.

David Kansiime[a,1], Violet Gwokyalya[a]

[a] School of Public Health, Makerere University.

Abstract

Background:
Viral Load Suppression (VLS) is a product of awareness of a positive HIV diagnosis and adherence to ART. Adolescents on ART should virally suppress within six months of ART to live longer, boost their immune system and reduce chances of transmitting the HIV yet literature shows that adolescents are not virally suppressing as adults. The purpose of this study is to therefore assess the prevalence, associated factors of viral load suppression, and effect of intensified adherence counselling among adolescents on ART at Kisenyi, Kawala, and Kitebi Health Centers

Methodology:
The study utilized a retrospective chart review design. The study population included individual records of adolescents who had been on ART for at least six months from 1st January 2017 to 31st December 2020. Data were analyzed using both univariate and bivariate analysis to be able to describe the data and establish the associations between independent and dependent Variables.

Results:
The mean age of the 196 study respondents was 15 (SD 3.4). More than half (53%, N=103) of the respondents were aged 15-19 years while 47% (N=93) were aged between 10-14 years.
The prevalence of viral load non-suppression after six months of ART was 36% (n-70), and sixty-nine percent (n-48) of the unsuppressed adolescents were females compared to males (31, n=22). Sixty-nine percent (47) of the unsuppressed adolescents were in primary school while 33% (n=23) of the Anglicans were virally unsuppressed.

Conclusion:
It is also evident that not all adolescents who enroll in IAC program benefit from it as shown by the 38% of the adolescents who did not suppress following IAC.

Recommendations:
Health facilities should offer resistance testing to all unsuppressed adolescents before enrolment into the IAC program, IAC should be considered primarily for those adolescents identified to have adherence challenges without resistant mutant strains.

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1 Background

Globally, by the end of 2018, 37.9 million people were living with HIV (PLHIV), of these, 79% [67-

92%] knew their status, 62% [47-74%] were accessing treatment and 53% [43-63%] were virally suppressed (Global HIV & AIDS statistics, 2019, UNAIDS,2018). Even though AIDS-related deaths fell by 35% globally from 2005 to 2013, deaths among adolescents living with HIV (ALWHIV) sharply increased, reaching 50%. Moreover, AIDS remains the second leading cause of death among adolescents worldwide and the leading cause of adolescent deaths in sub-Saharan Africa. This may be attributed to low viral load suppression rates (Idele P, 2014; WHO, 2014b)

East and Southern Africa is home to 6.2% of the world's population but over a half (54%) of the total population living with HIV in the world reside in this region (WHO, 2017). In 2016, 91% of adolescent deaths worldwide were reported in sub-Saharan Africa, and the rate of AIDS-related deaths among this age group has not reduced (Armstrong *et al.,* 2018; Organization & UNICEF, 2015).

In Uganda, the magnitude of the HIV/AIDS epidemic is still high. By the year 2018, 1000 new infections and 500 deaths from HIV/AIDS-related causes occurred every week (UNAIDS, 2018b). The country was home to 1.4 million people living with HIV (UNAIDS, 2018b); of these 84% knew their status and 72 % were accessing ART which was below the national target of 95% (UNAIDS, 2018a).

Comparing the 3 East African countries (Uganda, Kenya, and Rwanda), Uganda is second to Kenya with the highest number of people living with HIV. However, it has the lowest percentage of people living with HIV who know their status and is second (72%) to Rwanda (84%) among people living with HIV who are accessing ART.

The number of adolescents living with HIV reduced from a high of 110,000 in 2013 to a low of 90,000 in 2018. This shows a 10% reduction in the number of adolescents living with HIV but, this reduction is still lower than among adults where a 34% reduction was observed in the same period (UNAIDS, 2018a). According to Idele *et al* (2014), HIV prevalence in Uganda is highest (3.0%) among adolescent girls than in boys (1.7%) aged 15-19 years. In 2018, the percentage of young adolescents and children (0-14 years) who knew their HIV status was 66% (57-74) compared to 72% among adults (UNAIDS, 2018a) and this age group was not virally suppressing 39.3% as adults(UPHIA, 2016). Worse still, the viral load suppression is distinctively lower in younger adults (15-24) with 44.9% among females and 32.5% among males. Studies have pointed out factors associated with low viral load suppression among children and young adults that include failure to disclose the HIV status (Kacanek *et al.,* 2019), good management of the transition process from childhood to adulthood, access to appropriate adherence counseling and support, lack of awareness of HIV status, both internal and external stigma, poor compliance with VL testing guidelines, and keeping patients on failing regimen (Bernheimer *et al.*, 2015; Bienczak *et al.,* 2016).

Adolescents who achieve suppressed viral load live longer, have fewer complications, are less likely to transmit the virus, and are less likely to develop resistant mutations (Agolory *et al.,* 2018). In light of the above benefits, Uganda adopted the WHO guidelines that individuals on ART for six months should have a viral load test done (Organization, 2016). All individuals with HIV viral loads above 1000 copies would then receive IAC, which includes three sessions of monthly intensive adherence counselling, followed by a repeat HIV viral load test after one month to rule out virological failure. Those who re-suppress continue with first-line treatment after addressing issues affecting adherence while, those who do not are switched to second-line treatment (Organization, 2016).

The IAC strategy has been implemented in some health facilities including Kisenyi Health Centre IV, Kawala, and Kitebi Health Centre IIIs but, there is limited information about the effect of IAC on viral load suppression in this setting which receives patients from the slum area of Kisenyi. Establishing the contribution of IAC among adolescents on ART will aid the development of strategies that can promote the scale-up of IAC in ways that can effectively reach the adolescent population. Also, adolescent-specific data in Uganda is limited as adolescents in most studies are misclassified as either children 0-14 years or young people 15- 24 years. Therefore, there is limited adolescent-specific data about levels of viral load suppression and associated factors. This study established the prevalence, associated factors of VLS, and the effect of IAC on viral load suppression.

Methodology

Study setting

This study was conducted in 3 health centers of KCCA and these included Kisenyi, Kawala, and Kitebi Health Centre ART clinic. The three health centers are urban health facilities located in Kam-

pala and administered by Kampala Capital City Authority (KCCA). These are high volume health facilities with a wide range of health services including In-patient services, emergency care, and outpatient services like; integrated TB and HIV prevention, treatment, and care. The facilities serve people mainly from peri-urban areas of Kampala and the central business community as well as slum dwellers from the neighborhood.

The HIV prevalence in the population aged 15-24 in Uganda is 2.1% while the viral load suppression among the same age group is 42.5% (MoH, 2017). These health facilities are among the health Centres in Uganda implementing IAC. The IAC program started around the same time in 2016 at Kisenyi Health Centre IV, Kawala, and Kitebi Health III. Patients who fail to suppress at 6 months are recorded in the non-suppressed register. This register is monitored by the health workers on duty (Clinical officers and registered nurses) who work hand in hand with counselors to provide intensified adherence counselling to address ART adherence issues. Approximately 182 adolescents are served at Kisenyi Health Centre IV, 129 served at Kitebi Health Centre III, and 119 are served at Kawala Health III. Despite all these being in place, there is limited information about the effect of IAC on viral load suppression among adolescents on ART.

Study design

The researcher used a retrospective chart review design to establish the prevalence, factors associated with viral load suppression, and effect of IAC among adolescents on ART.

Study population

The target population was adolescents (10-19 years) who attended the ART clinic between 1st January 2017 - 31st December 2020 and received ART for at least six months with results of viral load after six months of ART on file.

Inclusion criteria

All documents of HIV-positive adolescents on ART for at least six months with viral load results in their files. Recruiting adolescents who have been on ART for at least 6 months ensures that they have at least one viral load result.

For objective three, adolescents with unsuppressed viral load after six months on ART and have results of a repeat viral load in their files were considered.

Exclusion criteria

All HIV-positive patients who transferred to a different facility or dropped out of treatment were not included in the study since their status could not be traced.

Sample size estimation

The researcher used the Kish Leslie formula for estimating the sample size of a cross-sectional study. Using the prevalence of 39% viral load suppression among adolescents in Uganda (UPHIA, 2016), the sample size was calculated as below.

n= 2

2

where

Z2= 1.96 (standard normal value at α=5% level of significance) P (0.39) = Estimated prevalence of the problem under study

Q = 100% - P

d = Maximum error the investigator is willing to allow n= 1.962 0.39*0.61

0.052

n= 366

sample size 366.

However, since the population is known, a finite formula for the known population was used. n = n0

1 + (n0 – 1)/N

Where:

n0 = calculated sample size (366) N = finite population (240)

n = corrected sample size n= 366

1 + (366 – 1)/240

n = 146

However, the researcher considered all the individual records (196 documents) of the HIV positive adolescents available during the time of data collection

Sampling Technique

The researcher used all the documents.

Variables

Dependent variables

The outcome variable was viral load suppression among HIV-positive adolescents. It was measured as a count and dichotomized as suppressed (viral load < 1000 copies of RNA/ml (plasma viral load) or not suppressed (viral load ≥ 1000 copies of RNA/ml (plasma viral load)

Independent variables

These included level of education, religion, perceived family support, the convenience of scheduled appointments, staying with a family member who is HIV positive, duration on ART,awareness of

HIV status, number of sex partners, disclosure status, source of social support, engagement in teen clubs, CD4 count at initiation, adherence status, WHO HIV stage, TB co-infection, and baseline BMI, and enrolment in the IAC program

awareness of HIV status, number of sex partners, disclosure status, source of social support, engagement in teen clubs, CD4 count at initiation, adherence status, WHO HIV stage, TB co-infection, and baseline BMI, and enrolment in the IAC program

Data collection method

Data were abstracted from individual records of the study subjects. It was collected from patient CD4 count registers, non-suppressed registers, IAC attendance registers, patients' files, and IAC attendance charts.

Data collection tool

Data extraction forms covering all the objectives of the study were used to collect data. Data on prevalence, associated factors, and the effect of intensified adherence counselling on viral load suppression were collected (appendix I, pp 42).

Training of research assistants

Three research assistants each from the three health centers were trained and assisted to abstract data

Pre-testing of the data extraction forms

The data abstraction forms were pretested from the Mengo ART clinic. Pretesting was done to improve the quality of data and also assess for ambiguous statements.

Data presentation and analysis

Data were sorted, cleaned, coded, and entered into STATA/MP 14.0 for analysis

Univariable data analysis was conducted; continuous variables that were normally distributed were analyzed and presented as mean (SD) or median (IQR) if the data was asymmetrical. Meanwhile, for all categorical variables, data were analyzed and presented as frequencies and percentages.

Bivariate analysis using odds ratios and their 95% confidence intervals to establish an association of the predictor and outcome variables was done.

Multivariable logistic regression was conducted to get unadjusted odds ratios, p-values, and corresponding 95% confidence intervals. Multicollinearity was checked for by conducting a Variance Inflation Factor (VIF) statistical test for the independent variables. Multicollinearity was checked and the VIF for all the variables was less than 10 with a mean VIF of 1.64

A multivariable regression model was constructed using the backward elimination model-building technique. All the independent variables with a p-value less than 0.25 were included in the model. Variables were removed step by step, starting with those with the least significance

based on the largest p-value. The Likelihood Ratio Test (LRT) was used to assess the goodness of fit of the multivariate regression model.

Ethical consideration

The researcher sought approval of the proposal from Makerere University School of Public Health and the Institutional Review Board (IRB) of the School of Public Health. Permission to conduct the study was sought from the office of the Director of Public Health at Kampala Capital City Authority who issued a letter directing the health facility incharge to avail the researcher with the necessary information to conduct the study.

To ensure the de-identification of data, the researcher was not involved in the extraction of data from the registers. To ensure confidentiality, the researcher used his passworded computer for data management and analysis.

Dissemination of the study findings

The study results were used to make a dissertation. The dissertation was disseminated to Makerere University College of Health Sciences-School of Public Health, KCCA, and Kisenyi, Kawala, and Kitebi HCs.

Results

Demographic Characteristics of HIV Positive Adolescents

The mean age of the 196 study respondents was 15 (SD 3.4). More than half (53%, N=103) of the respondents were aged 15-19 years while 47% (N=93) were aged between 10-14 years. The majority (76%, N=148) of the respondents were females, 91% (N=177) were single, and 9%

(19) had never been in a sexual relationship. Fifty-seven percent (N=112) of the respondents were in primary school, 36% (N=70) in secondary while 7% (N= 14) had no education at all.

The proportion of adolescents with unsuppressed viral loads after six months of ART is 36% (n-70), and sixty-nine percent (n-48) of the unsuppressed adolescents were females compared to males (31, n=22). Sixty-nine percent (47) of the unsuppressed adolescents were in primary school while 33% (n=23) of the Anglicans were virally unsuppressed. All adolescents (100%, n=68) who were

Table 1. Measurement of variables

Objectives	Variables	Measurement scale	Measure	Test statistic
Objective one	Viral load suppression	Dichotomous	Suppressed < 1000 Not suppressed≥ 1000	Chi square
	Age in complete years	Dichotomous	Young adolescents (10-14 years) Old adolescents (15-19 years)	Chi square
Objective 11				
	Weight in kg	Continuous	Mean	Logistic regression
	Height in Meters	Continuous	Mean	Logistic regression
	Education level	Ordinal	Primary Secondary Tertially	Logistic regression
	Marital status	Nominal	Married Single	logistic regression
	Duration on ART	Nominal	≤ 6 months >6months≤2 years >2 years	Logistic regression
	Presence of a family member on ART	Dichotomous	Yes No	Logistic regression
	Substance use	Dichotomous	Yes No	Logistic regression
	Disclosure of HIV status	Dichotomous	Yes No	Logistic regression
	Convenience of appointment	Dichotomous	Yes No	Logistic regression
	Baseline CD4 count	Continuous	Mean	Logistic regression
	WHO clinical stage	Ordinal	Stage I Stage II Stage III Stage IV	Logistic regression
	ART adherence	Ordinal	a. Good adherence: Drug adherence of 95% or ≤ 2 missed drug doses of 30	Logistic regression

virally unsuppressed also had good ART adherence levels and most adolescents aged 10-14 years during the time of the study had higher (66%, n=46) levels of unsuppressed viral load. There were 84% (166) adolescents in HIV clinical stage I and among these, 37% (62) were virally unsuppressed after six months of ART. The proportion of non-suppressed adolescents with a normal CD4 count (>500 cells/μl) was 37% (22) higher than those with a CD4 count between 200-500 cells/μl (34%, n=20).

Fifty-three percent (37) of the adolescents who had spent >6month ≤ 2 years

Years on ART had higher levels of non-suppressed viral loads compared to those who had been on ART for not more than six months (8%, n=11). Fifty-eight percent (40) of the unsuppressed adolescents were underweight which was higher than among the adolescents with normal weight (35%, n=24).

In the bivariate analysis, Males were less likely to be virally suppressed compared to their female counterparts (OR 0.53, 95% CI: 1.88-6.78) and the odds of viral load suppression for older adolescents (15-19) at the time of the study were 3.5 times higher than the younger adolescents.

Table 2. Measurement of variables

			doses or ≤ 3 missed drug doses of 60 doses. b. Fair Adherence: Drug adherence of 85–94% or 3– 5 missed drug doses of 30 doses or 3–9 missed drug doses of 60 doses. c. **Poor Adherence:** Drug adherence of < 85% or ≥ 6 doses of missed ART drug doses of 30 doses or > 9 doses missed ART drug doses of 60 doses	
	Baseline BMI	Ordinal categorical	Underweight <18.5 Normal weight 18.5-24.9 Overweight ≥ 25-29.9 Obese ≥30	Logistic regression
IAC	IAC	Dichotomous	Yes No	Chi square
	Number of IAC attendance	Continuous	3 times ≤ 2 times Never	Logistic regression

Factor	Viral load suppression		OR	CI	P-Value
	Suppressed N=126(64%)	Unsuppressed N=70 (36%)			
Sex					
Female	99 (80)	48(69)	1.00		
Male	24 (20)	22(31)	0.53	1.85-6.78	0.06
Marital status					
Single	107 (87)	67 (97)	1.00		
Married	5 (5)	1 (2)	3.13	0.35-27.75	0.28
Cohabiting	9 (8)	1(1)	5.64	0.68-6.63	0.07
Education					
Never attended	8 (7)	4 (6)	1.00		
Primary	64(54)	47 (69)	0.68	0.19-2.41	0.55
Secondary	47 (39)	17(25)	1.38	0.36-5.24	0.63
Religion					
Catholic	41 (33)	20 (29)	1.00		
Anglican	38 (30)	23 (33)	0.73	0.34-1.55	0.41
Moslem	38 (30)	21 (30)	0.78	0.36 -1.67	0.52
Born Again	7 (7)	6 (8)	0.54	0.16-1.86	0.32
ART adherence					
Good	113 (91)	68 (100)	0.00		0.06
Faire	5 (4)	0 (0)			
Poor	6(5)	0 (0)			
Age groups (years) in study					
10-14	47 (37)	46(66)	1.00		
15-19	79 (63)	24 (34)	3.54	1.85-6.78	0.00
WHO clinical stage					
Clinical Stage I	104 (83)	62 (88)	1.00	0.47-3.66	0.50
Clinical Stage II	14 (11)	6 (9)	1.31	0.42-10.66	0.35
Clinical Stage III	7 (5)	2 (3)	2.12		
CD4 Count					
< 200	15 (16)	17 (29)	1.00		
200-500	44 (47)	20 (34)	2.55	1.02-6.35	0.04
>500	35 (37)	22 (37)	1.80	0.74 - 4.39	0.37
Duration on ART					
≤ 6 months	72 (58)	8 (11)	1.00		
>6months≤2 years	35 (28)	37 (53)	0.10	0.04-0.27	0.00
>2 years	18 (17)	25 (36)	0.07	0.02-0.22	0.00
Awareness of the HIV status					
Yes	118(94)	64(95)	1.00		
No	6 (6)	4(5)	0.84	0.22-3.11	0.78

Figure 1. Socio-demographic and adolescent characteristicsrelated with viral load suppression at bivariate analysis.

BMI					
Underweight	56(46)	40 (58)	1.00		
Normal Weight	60 (49)	24 (35)	2.02	1.06 - 3.83	0.03
Overweight	7 (5)	5 (7)	1.08	0.26 - 3.27	0.90
Presence of other people in the house on ART					
No	40 (33)	18 (26)	1.00		
Yes	83 (67)	50 (74)	0.75	0.39-1.41	0.39
Alcohol and Drug use					
1 NO	121(98)	66 (97)	1.00		
2. Yes	2 (2)	2 (3)	0.56	0.08 - 4.09	0.56
Source of care					
None	13 (10)	3 (4)	1.00		
Brother/sister	39 (31)	25 (37)	0.32	0.22 - 5.4	0.09
Parents	67 (54)	37 (54)	0.43	0.11- 1.63	0.20
Friends	4 (3)	1(3)	0.23	0.05- 4.11	0.48
Alcohol and Drug use					
NO	121 (98)	66 (97)	1.000		
Yes	2 (2)	2(3)	0.747	0.39-1.41	0.388
Sexual partners					
None	80 (65)	55 (89)	1.000		
One	42 (34)	11 (16)	0.63	1.22-5.65	0.01
Two or more	2 (2)	2 (2)	0.71	0.10 - 5.20	0.73
Convenience of scheduled visits					
Yes	46 (40)	15 (25)	1.000		
No	68(60)	46 (75)	0.515	0.25-1.04	0.06

Figure 2. Socio-demographic and adolescent characteristicsrelated with viral load suppression at bivariate analysis.

(OR 3.54, 95%CI: 1.85-6.78). Also, adolescents who had been on ART between >6month ≤ 2 years (OR 0.1, 95% CI: 0.04-0.27) and more than 2 years (OR 0.07, 95% CI: 0.02-0.22) were less likely to be virally suppressed compared to those who had been on ART for 6 months & normal weight was significantly associated with viral load suppression and that the odds of viral load suppression among adolescents with normal weight were 2.55 (1.02-6.35) times among the underweight adolescents and that adolescents with only one sexual partner were less likely to virally suppressed compared to those with no sexual partner (OR 0.63, 95% CI: 1.22-5.65).

At the multivariate analysis, after adjusting for confounders, the only significant factor was duration on ART. Adolescents who had spent >6months ≤ 2 years

(OR 0.10, 95% CI: 0.04-0.26) and more than 2 years (0.10, 95%CI 0.04-0.27) were significantly less likely to virally suppress as compared to those who had spent at least 6 months on ART. Variables like being male (OR 0.53, CI 1.85-6.78, older adolescents (3.54 CI: 1.85-

6.78 and having one sexual partner (OR 0.63, CI 1.22-5.65) that were significant at the bivariate level were not significant at the multivariable analysis.

Effect of IAC on viral load suppression

Fifty-seven percent (n=40) of the unsuppressed adolescents were enrolled in IAC as opposed to 43% (n=30) who were not enrolled. Of those enrolled in IAC 65% (n=26) had retest viral load results in the file after the IAC session, of these 62% (n=16) had a re-suppressed viral load

Factor	Viral load suppression		OR unadjusted, (95% CI)	P-Value	Adjusted OR (95% CI)
	Suppressed (%)	Unsuppressed (%)			
Sex					
Female	99 (80)	48(69)	1.00		
Male	24 (20)	22(31)	0.53 (1.85-6.78)	0.06	
Marital status					
Single	107 (87)	67 (97)	1.00		
Married	5 (5)	1 (2)	3.13 (0.35-27.75)	0.28	
Cohabiting	9 (8)	1(1)	5.64 (0.68-6.63)	0.07	
Education level					
never attended	8 (7)	4 (6)	1.00		
Primary	64(54)	47 (69)	0.68 (0.19-2.41)	0.55	
Secondary	47 (39)	17(25)	1.38 (0.36-5.24)	0.63	
Religion					
Catholic	41 (33)	20 (29)	1.00		
Anglican	38 (30)	23 (33)	0.73 (0.34-1.55)	0.41	
Moslem	38 (30)	21 (30)	0.78(0.36 -1.67)	0.52	
Born Again	7 (7)	6 (8)	0.54 (0.16-1.86)	0.32	
ART adherence				0.06	
Good	113 (91)	68 (100)	0.00		
Faire	5 (4)	0 (0)			
Poor	6(5)	0 (0)			
Age groups (years) in study					
10-14	47 (37)	46(66)	1.00		
15-19	79 (63)	24 (34)	3.54 (1.85-6.78)	0.00	
WHO clinical stage					
Clinical Stage I	104 (83)	62 (88)	1.00		
Clinical Stage II	14 (11)	6 (9)	1.31 (0.47-3.66)	0.50	1.31(0.40- 4.32)
Clinical Stage III	7 (5)	2 (3)	2.12 (0.42-10.66)	0.35	0.96(0.15-6.11)
clinical stage IV	1 (1)				

Figure 3. multivariable analysis of the factors associated with viral load suppression among adolescentson ART at Kisenyi, Kawala and Kitebi Health Facilitie

2 Discussion of findings, conclusion and recommendations:

3 Discussion of Findings

Viral load suppression among adolescents is still a challenge in Uganda. Results indicate that the prevalence of viral load suppression is only 36%. The associated factors of viral load suppression in the bivariate analysis are age, sex, weight, and the number of sex partners. The multivariate analysis showed the duration of ART as the only factor associated with viral load suppression. 65% of the unsuppressed adolescents enrolled in the intensified adherence counselling had viral load results in the file after the IAC session.

The prevalence of viral load suppression:

Contrary to the expected high levels of viral load suppression in the country, this study reports 36% prevalence which is low compared to the 93.5% that is reported on the Uganda viral load dashboard as of 2021. This result is also lower than the prevalence of 85.7% reported in a study by Wakooko in 2020 (Wakooko *et al.,* 2020) the time the Ministry of Health viral load dashboard also showed the level of viral load suppression to be 74.6%.

The associated factors of viral load suppression:

Males were less likely to virally suppress than their female counterparts, this is probably because males may delay seeking treatment, tend to hide the infection from their caretakers, or even fail to adhere to ART regimens compared to their female counterparts. This study finding

Agree with a study conducted in Kenya by (Njuguna *et al.,* 2020) where it was found that males had lower odds of viral load suppression.

CD4 Count					
< 200	**15 (16)**	**17 (29)**	**1.00**		
200-500	**44 (47)**	**20 (34)**	**2.55 (1.02-6.35)**	**0.04**	
>500	**35 (37)**	**22 (37)**	**1.80 (0.74 - 4.39)**	**0.37**	
Duration on ART					
≤ 6 months	72 (58)	8 (11)	1.00		
>6 months ≤2 years	35 (28)	37 (53)	0.10 (0.04-0.27)	0.00	0.10 (0.04-0.26) ***
>2 years	18 (17)	25 (36)	0.07 (0.02-0.22)	0.00	0.10 (0.04-0.27) ***
Awareness of the HIV status					
Yes	118(94)	64(95)	1.00		
No	6 (6)	4(5)	0.84 (0.22-3.11)	0.78	
BMI					
Underweight	56(46)	40 (58)	1.00		
Normal Weight	60 (49)	24 (35)	2.02 (1.06 - 3.83)	0.03	
Overweight	7 (5)	5 (7)	1.08 (0.26 - 3.27)	0.90	
Presence of other people in the house on ART					
No	40 (33)	18 (26)	1.00		
Yes	83 (67)	50 (74)	0.75 (0.39-1.4)	0.39	
Alcohol and Drug use					
1 NO					
2. Yes	121(98)	66 (97)	1.00		
	2 (2)	2 (3)	0.56 (0.08 - 4.09)	0.56	
Source of care					
None	13 (10)	3 (4)	1.00		
Brother/sister	39 (31)	25 (37)	0.32 (0.22 - 5.4)	0.09	
Parents	67 (54)	37 (54)	0.43 (0.11- 1.63)	0.20	
Friends	4 (3)	1(3)	0.23 (0.05- 4.11)	0.48	
Alcohol and Drug use					
No	121 (98)	66 (97)	1.000		
Yes	2 (2)	2(3)	0.75 (0.39-1.41)	0.388	
Sexual partners					
None	80 (65)	55 (89)	1.000		
One	42 (34)	11 (16)	0.63 (1.22-5.65)	0.01	2.32 (0.93-5.81)
Two or more	2 (2)	2 (2)	0.71 (0.10- 5.20)	0.73	0.45 (0 .04- 4.82)
Convenience of scheduled visits					
Yes	46 (40)	15 (25)	1.000		
No	68(60)	46 (75)	0.52 (0.25-1.04)	0.06	

Figure 4. multivariable analysis of the factors associated with viral load suppression among adolescentson ART at Kisenyi, Kawala and Kitebi Health Facilitie

Age: A higher viral load suppression among the older adolescents as compared to the younger adolescents in this study was observed. This could be because older adolescents are more likely to take their ART regimen regularly without supervision and a better understanding of HIV status comes with time. The trend of this result is supported by other studies (Haland *et al.,* 2012; Mujugira et al., 2016; Joseph *et al.,* 2018). Other studies conducted in Kenya (Jobanputra et al., 2015; Meriki, 2014) and Swaziland (Kitchen et al., 2001) also are in agreement with this finding, where the likelihood of developing ART virological failure was higher among younger patients. This further confirms that proper orientation and early initiation of treatment are key to achieving high viral load suppression.

Duration of ART: This current study shows that viral load suppression is significantly lower among adolescents who spent more than one year on ART as compared to those who spent less than a year. This is probably because of treatment fatigue as some of these adolescents could have been perinatally infected, have spent quite long on ART, and have developed treatment fatigue. But they are also likely to develop mutations of the virus leading to an unsuppressed viral load. The findings in this study are similar to another study (Bayu *et al.,* 2017) which found that longer duration was consistent with non-viral load suppression. Given the higher chances of developing mutations and the likely virological failure among those that have been long on ART, it may be important that resistance testing is

done early enough to rule out any drug resistance. A study conducted (Bayu *et al.,* 2017) in Ethiopia found that the likelihood of virological failure was 3 and 7 times more among patients who took ART for 24–47 months and ≥48 months, respectively, compared to patients who took the treatment for 6–24 months (Bayu et al., 2017). This is in support of the findings of the current study.

Weight: This study suggests that normal weight is significantly associated with viral load suppression and that the odds of viral load suppression among adolescents with normal weight are 2.55 (1.02-6.35) times more than among the underweight adolescents. This result confirms the conclusion by (Mwamburi *et al.,* 2015) that Patients with HIV infection who are losing weight are likely not to virally suppress. Likewise, a study conducted in South-Western Ethiopia found that the odds of non-suppression were higher among those with low BMI (≤16- 18.5kg/m2)(Waju *et al.*, 2021). Similar studies conducted in Uganda and Tanzania also supported this current study since they reported that underweight HIV-positive adolescents were not virally suppressed compared to their counterparts with a normal weight {Council, 2011 #6}. Similarly, a study conducted in China also revealed that higher BMI at baseline predicted better virological response than sub-normal body mass index {Li, 2019 #7). This means that to achieve a high viral load suppression, maintaining a normal weight is key.

Several sex partners: This current study reports that adolescents with one sexual partner were less likely to be virally suppressed compared to those with no sexual partner (OR 0.63, 95% CI: 1.22-5.65). This study agrees with the previous studies. A study conducted in Kenya found that HIV-positive individuals with 2 or more sexual partners were likely to be virally unsuppressed compared to those with 1 or no sexual partners (Nakazea et al.,2020). Both findings agree that an adolescent having a sex partner when they are HIV positive increases the chances of not virally suppressing as compared to a single person. This means that the more sexual partners a person has the more likely they will not be able to achieve viral suppression. Therefore, having no sexual partner can improve viral suppression.

Effect of intensified adherence counselling among adolescents on ART:

Fifty-seven percent (n=40) of the unsuppressed adolescents were enrolled in IAC. Of those enrolled in IAC 65% (n=26) had retest viral load results in the file after the IAC session, and of these, 62% (n=16) had their viral load re-suppressed. These adolescents were suppressed probably because the adherence issues that initially affected them were corrected through adherence counselling. These findings agree with a study conducted at the infectious disease institute of Makerere University where 80% of the non-suppressing individuals enrolled on IAC re-suppressed (Baumann et al., 2019), a rate slightly higher than what is reported in this study. This difference is probably due to a smaller sample size used in this study.

On the other hand, some adolescents (38%) who were taken through the IAC program did not achieve viral load suppression. This speaks to the findings of some other studies that revealed that IAC had very little effect on viral load suppression, for instance, a study carried out in Zimbabwe by (Bvochora et al., 2019) indicated that only 32.2% of the adolescents who were enrolled on IAC achieved viral load suppression. The fact that not all adolescents enrolled on IAC achieved viral load suppression may suggest that their non-suppression may be caused by other factors other than poor adherence and these factors could include the presence of resistant mutant strains. Taking such adolescents through IAC only keeps them longer on failing regimens. Delaying adolescents with resistant strains on IAC without switching of regimen may not yield desired results and could expose them to more resistant mutations, increase their risk of transmission of resistant strains, predispose them to AIDS and hopeless feeling that the medication does not work, and probably cause them to drop out of the HIV care program. Assessing such adolescents before the initiation of IAC could be a better approach.

Further, forty-eight percent (n=30) of the adolescents were not enrolled in the IAC program, and in the majority, there was no evidence that they had any other assessment or support. This is a risky situation because such adolescents could be at increased risk of continued poor adherence, and drug resistance. This finding shows gaps in the HIV care services and the need to improve follow-up strategies to ensure no adolescent is lost.

Lastly, eleven (37%) of the adolescents not enrolled on IAC were directly switched to second-line

treatment. This contradicts the WHO recommendation for the management of unsuppressed adolescents and calls for further investigation into factors responsible for changing regimens without following the HIV management protocols among the adolescents.

In conclusion, this study provides crucial evidence that intensified adherence counselling is of high importance to adolescents on ART and can result in viral load suppression.

4 Conclusion:

The prevalence of viral load suppression is 36%. The associated factors of viral load suppression were age, sex, BMI, the number of sex partners, and duration of ART. IAC can still benefit most of the non-suppressing adolescents as evidenced by the fact that most (62%) adolescents are suppressed following enrollment into IAC. However, it is also evident that not all adolescents who enroll in IAC program benefit from it as shown by the 38% of the adolescents who did not suppress following IAC.

Recommendations

Based on the findings that the majority (62%) of those who were unsuppressed benefited from IAC, service providers must consider offering IAC primarily for those adolescents that still have adherence challenges without resistant mutant strains. However, even those that have resistant strains but have been discovered to have adherence challenges, should be enrolled in IAC to prevent them from messing up with the new regimen.

Some adolescents (38%) who were taken through the IAC program did not Achieve Viral Load Suppression. They could have benefited more if resistance testing had been done before enrollment into the IAC program. The service providers needed to do a thorough screening of the patients to determine if adherence was the only issue. In this case, they would sort out those who had adherence challenges and then take them through adherence sessions. Therefore, service providers should consider offering resistance testing to all unsuppressed adolescents before the initiation of IAC.

This study was limited by the incompleteness of data and this affected the analysis of the variables that the researcher intended to study, therefore KCCA should increase health worker supervision and continued sensitization to improve the quality of data entry.

Some adolescents (35%) had not received their retest results although samples had been taken two weeks earlier. This delay could result in delayed action and worsening adolescent health.

Given this, the Ministry of health should consider decentralizing viral load testing facilities to improve the turnaround time for viral load re-retest results.

Study Limitations

The procedure that was used in the execution of this study in a way posed some limitations to its findings. In the first place, small sample size was used. The study only looked at HIV-positive adolescents on ART within the three KCCA health centers. These health facilities are located in an urban area and for this reason, the generalization of the study findings to other areas especially rural ones may be limited due to the differences in their socio-economic settings. However, the utilization of secondary data minimized this limitation since through

Literature review important information was captured about the phenomenon under study in both rural and urban contexts.

Lockdown and the COVID 19 situation in the country affected data collection as the research assistants could not move. This affected delayed data collection

Since the study depended on secondary data, most records were missing information and this affected the results of the study for some variables.

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