



## Research Article

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# Virological Suppression among HIV Infected Adolescents and Youths Receiving ART in the National Teaching and Referral Hospital in Kenya

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## Abstract

**Background:** HIV virological suppression is poor among the adolescents and youths. This study aimed to determine the HIV virological response and the associated risk factors among adolescents and youths on ART.

**Methods:** We conducted a cross-sectional study among adolescents and youths aged 10 to 24-years in Kenyatta National Hospital who were on ART for at least six months. Patient characteristics were captured in a questionnaire. Viral suppression was presented as a proportion based on viral load less than 1000 copies per milliliter of plasma. Viral suppression rate was associated with categorical independent factors using chi square test and means were compared using independent T-test.

**Results:** The mean age was 17-years (SD 4.3-years) and 55.6% were females. A total of 227 (74.2%) HIV infected adolescents and youths were virologically suppressed. As compared to children 10-14 years-old who had 83.2% suppression rate, adolescents 15-19-years had poorer suppression rate at 69.6% [OR 0.5 (95% CI 0.2-0.9), P = 0.022]. Similarly youths 20-24 -years had a lower suppression rate at 70.8% compared to the children [OR 0.5 (95% CI 0.2-0.9), P = 0.022].

**Conclusion:** In conclusion, HIV viral suppression among adolescents and youths was low and even much lower among 15 to 24-year-olds.

## Keywords

HIV, Virological response, Adolescents, Youths

## Introduction

Adolescents and youths comprise a substantial portion of the population in many sub-Saharan African countries. An estimated 2.1 million adolescents (10-19-years of age) globally were living with HIV in 2012 [1] and youths (20-24-years of age) in 2011 accounted for 40% of all new global infections in adults [2]. However, coverage of ART is significantly lower (34%) in adolescents and youths [3]. The developmental stage for adolescents comes with challenges negatively affecting HIV management in the population. In spite of this, adolescents have not for a long time been considered a unique group in public health planning in sub-Saharan Africa, as their needs are typically overlooked or not fully recognized [4]. Currently, there is a global shift towards HIV programming for adolescents and youths as empirical evidence about this population became available.

Adolescents and youths are accompanied by rapid physical, psychological and physiological changes which influence health-related behavior and desire for autonomy hence separation from caregivers [5,6]. Other age-specific factors that

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may present a risk for HIV infection, or a challenge to its management, include immature judgment [7]. Adolescents frequently find consistent, long-term medication adherence difficult and HIV treatment is no exception [8]. Evidence from few studies done among adolescents and youths point to the possibility of poor viral suppression in this category of HIV patients. A study in South Africa reported viral suppression of 27.3% and 63.1% in adolescents and youths respectively [9]. Viral suppression is an outcome related to various interventions and more so to adherence to ART. Data from the Kenya Aids Indicator Survey (KAIS) in Kenya showed that viral suppression in patients who were non-adherent to ART was at 57.9% which was significantly lower than 78.5% in the adherent group [10].

The purpose of this study was to investigate the virological response rate and the risk factors associated with poor viral suppression among adolescents and youths on ART at the Kenyatta National Hospital (KNH). For this purpose we conducted a cross sectional study among the adolescents and the youths seeking care and treatment at KNH.

## Materials and Methods

### Study design and location

We conducted a cross sectional study among the adolescents and youths at the KNH Comprehensive Care Centre (CCC). KNH is situated in Nairobi's South-western zone approximately 5 km from the Nairobi City Centre.

### Study population

KNH has approximately 9,000 patients on HIV treatment, among which 1,050 patients are adolescents and youths. A total of 306 HIV infected adolescents and youths attending CCC were recruited in this study. Adolescents were defined as those aged between 10 to 19-years whereas youths were aged 20 to 24-years as per the World Health Organization [11]. All the enrolled participants had been on ART for at least six months at the time of enrollment. The services sought by the HIV infected adolescent and youths were compressive care and treatment of HIV and other sexually transmitted diseases (STDs). Adolescents who had not been disclosed to of their HIV status by their parents or guardians or were not accompanied by their parents or guardians were excluded. The adolescent and youth clinics are usually on different days with those of younger children. The adults HIV clinic is on routine basis though they are seen in different CCC settings from the adolescents and the youths. The HIV infected adolescents and youths can access the HIV CCC upon referral from other hospital departments after the first contact with the health care providers. However referral from other facilities are also received irrespective of the referral being routine or due to complex problems such as virological failure. Often a baseline viral load is done at the CCC before ART initiation, with a repeat viral load done after six months. If the viral load at six months after initiation of ART treatment is more than 1000 copies per ml plasma, a follow up viral load is done after three months. An annual viral load is normally done for those with less than 1000 copies of the virus per ml of plasma. The adolescents and youths are assessed routinely by psychoso-

cial support counselors to address their mental, emotional and social needs that could adversely affect their ART intake, clinic appointments and their health wellbeing. Enhanced adherence intervention services are available for those whose progress has been affected. In this case psychologists and peer mentors are tasked to ensure the right intervention has been met.

### Sampling procedures

Simple random sampling procedure was used to select participants. In this technique, all adolescents and youths meeting the recruitment criteria were approached by a HIV nurse counselor at the HIV care and treatment unit where they had the study explained to them. The HIV nurse counselor had basic training in nursing care, specialized training in HIV counseling, care and treatment and also adequate skills in human ethics in research. Upon ascertaining that an adolescent or a youth was eligible in the study, the research assistant also confirmed if they were willing and comfortable to participate in the study by taking them through the informed consent. Those who were less than eighteen years of age were accompanied by their parents or guardians who read and provided a written and signed consent to allow their children to participate in the study. The children also read an assent and expressed their will to participate. The participants who consented were enrolled into the study until the desired sample size was achieved. Data collection was done through a face to face interview using a structured questionnaire.

### Study Variables

#### HIV-1 RNA viral load suppression

WHO describes HIV-1 RNA viral load suppression as less than one thousand (< 1000) copies of the circulating HIV virus per milliliter (ml) of plasma [12]. However the UNAIDS 90-90-90 strategy recommends that an infected individuals attains undetectable copies of the circulating HIV virus per milliliter of plasma, as a key element of reducing new HIV transmissions to the exposed people [13]. The viral non suppression was described as a viral load of equal or more than 1000 copies/ml plasma. Plasma was the sample of choice for determination of HIV 1 RNA viral load which was analyzed using CobasAmpli Prep/CobasTaqman (CAP/CTM) (USA).

#### ART

ART is defined as taking a minimum of two nucleoside reverse transcriptase inhibitors (NRTIs) plus either one non-nucleoside reverse transcriptase inhibitor (NNRTI) or a boosted protease inhibitor (PI).

#### ART adherence, ART refill and clinic appointment

Adherence to ART can be assessed by requesting the patient to bring with them their pills during their visits. The number of remaining pills is calculated based on the previous prescription date and amount prescribed, and compared to the number of pills remaining at hand. Excess pills are assumed to be missed doses and the patient will be considered an ART defaulter. Drug pick up date can also be compared with the expected date of pick up (based on the number of

pills dispensed at last visit). If drug pick up date is later than expected, it is assumed the patient is missing doses equivalent to the number of late days [14].

### Virological criteria for determining treatment failure (recommended)

Virological failure is defined by a persistently high viral load greater or equal to 1000 copies/ml (two viral loads measured within a 3 month interval with adherence support between measurements) after at least 6 months of using ART [14].

### Statistical Analysis

Statistical analysis was conducted using SPSS version 21. The proportion of adolescents and youths achieving virological suppression after initiation of ART was presented with 95% CI. Risk factors associated with virological non suppression were determined using independent T-test for comparison of mean age and chi square test for association of categorical variables such as the age group, sex, education, ART intake, ART refill and clinic appointments. All statistical tests were interpreted at 5% level of significance (95% CI).

### Results

Three hundred and six (306) HIV infected adolescents (10-19-years) and youths (20-24-years) who were on ART for at least six months were enrolled in this study. As shown

in Table 1 below, the mean age was 17-years (SD 4.3-years) ranging between 10 to 24-years. Over a half (55.6%) were females. Majority had primary level of education (40.8%) and 9.8% had never attended any school. The baseline median CD4 count was 573 cells per micro liter of blood (IQR 344-1780). The median duration of ART was 86 months (IQR 31-114). Majority (86.3%) was in WHO stage 1 while 2% were in stage IV; 9.5% had ever been diagnosed with TB.

### Viral suppression rates

As shown in Table 2 below, a total of 227 (74.2%) HIV infected adolescents and youths were virologically suppressed with a viral load of less than 1000 copies per ml of blood as per the WHO guidelines. 52.6% had undetectable viral load.

### Factors associated with viral suppression

Table 3 below shows the factors associated with viral suppression among adolescents and youths. The age of the adolescents or the youths, default to take ARTs, default to turn up for a clinic or to honor a drug refill appointment were statistically associated with HIV-1 RNA viral non-suppression.

Those who suppressed were significantly younger (mean 16.8) compared to the unsuppressed (mean 17.9),  $P = 0.044$ . As compared to children 10-14-years old who had 83.2% suppression rate, adolescents 15-19-years had a poor suppression rate at 69.6% [OR 0.5 (95% CI 0.2-0.9),  $P = 0.022$ ]. Similarly youths 20-24-years had a lower suppression rate at 70.8% compared to the children [OR 0.5 (95% CI 0.2-0.9),  $P = 0.022$ ].

For those who defaulted ART the suppression rate was significantly lower (47.2%) compared to those who had never defaulted (97.6%), OR 0.22 (95% CI 0.01-0.06),  $p < 0.001$ . Similarly, those defaulting clinic appointments had significantly lower suppression rate (51.7%) compared to those who were adherent to their clinic visits (88.7%), OR 0.14 (95% CI 0.08-0.24),  $P < 0.001$ . At the same time, those who did not honor their ART refill appointment had a significantly lower suppression rate (50%) compared to those who did not miss their ART refill (90.7%), OR 0.10 (95% CI 0.06-0.19),  $P < 0.001$ .

### Discussion

Based on the WHO viral suppression cut off, this study showed a low virological suppression rate of 74.2% among adolescents and youths [11]. Viral suppression was varied in relation to the age of the participants where the younger age group between 10 and 14-years had higher suppression rate (83.2%) than 69.6% in 15-19-years and 70.8% in

Table 1: Demographic characteristics.

Variable	Frequency (%)
Mean age (SD)	17.1 (4.3)
<b>Gender</b>	
Male	136 (44.4)
Female	170 (55.6)
<b>Education level</b>	
Not in school	30 (9.8)
Primary	125 (40.8)
Secondary	76 (24.8)
Tertiary	75 (24.5)
<b>Pregnancy status</b>	
Pregnant	3 (1.0)
Not pregnant	302 (98.7)
Not sure	1 (0.3)
Duration of months on ART, median (IQR)	86 (31-114)
<b>Baseline CD4 cells/ micro liter blood</b>	
Median (IQR)	573 (344-780)
<b>Current WHO staging</b>	
I	255 (83.6)
II	22 (7.2)
III	22 (7.2)
IV	6 (2.0)
Ever confirmed TB	29 (9.5)

Table 2: Viral load suppression.

Variable	Median (IQR)/ Frequency (%)	95% CI
<b>Viral load suppression</b>		
Suppressed (< 1000)	227 (74.2)	69.3-79.1
Unsuppressed (> 1000)	79 (25.8)	20.9-30.7
<b>Detectable Viral load</b>		
Undetectable	172 (56.2)	51.0-61.8
Detectable	134 (43.8)	38.2-49.0

**Table 3:** Factors associated with viral suppression.

Variable	Suppressed	Unsuppressed	OR (95% CI)	P value
Mean age (SD)	16.8 (4.3)	17.9 (4.0)	-	0.044
<b>Categories, n (%)</b>				
10-14	79 (83.2%)	16 (16.8%)	1.0	
15-19	80 (69.6%)	35 (30.4%)	0.5 (0.2-0.9)	0.022
20-24	68 (70.8%)	28 (29.2%)	0.5 (0.2-1.0)	0.043
<b>Gender</b>				
Male	100 (73.5%)	36 (26.5%)	0.9 (0.6-1.6)	0.815
Female	127 (74.75%)	43 (25.3%)	1.0	
<b>Education level</b>				
Primary	94 (75.2%)	31 (24.8%)	0.6 (0.2-1.7)	0.343
Secondary	54 (71.1%)	22 (28.9%)	0.5 (0.2-1.4)	0.191
Tertiary	54 (72%)	21 (28.0%)	0.5 (0.2-1.5)	0.224
Not in school	25 (83.3%)	5 (16.7%)	1.0	
<b>Education</b>				
In school	202 (73.2%)	74 (26.8%)	0.5 (0.2-1.5)	0.228
Not in school	25 (83.3%)	5 (16.7%)	1.0	
Median months on ART (IQR)	86 (32-114)	75 (17-115)	-	0.495
<b>Defaulted ART</b>				
Yes	67 (47.2%)	75 (52.8%)	0.22 (0.01- 0.06)	< 0.001
No	160 (97.6%)	4 (2.4%)	1.0	
<b>Defaulted clinic appointments</b>				
Yes	62 (51.7%)	58 (48.3%)	0.14 (0.08-0.24)	< 0.001
No	165 (88.7%)	21 (11.3%)	1.0	
<b>Defaulted drug refill</b>				
Yes	62 (50%)	62 (50%)	0.10 (0.06- .19)	< 0.001
No	165 (90.7%)	17 (9.3%)	1.0	
<b>TB confirmed</b>				
Yes	23 (79.3)	6 (20.7)	1.4 (0.5-3.5)	0.501
No	203 (73.6)	73 (26.4)	1.0	

20-24-year-olds. The overall viral suppression rate in our study was comparable to the 75.4% reported in the general population found in a nationwide survey done in Kenya [10]. However, a study conducted in a general population of HIV infected individuals in western Kenya region reported higher viral suppression at 83% [15]. A study among adolescents aged 15-18-years done in Uganda reported a viral suppression rate of 63% which was slightly lower than the 69.6% for the 15-19-year-olds in our study [16]. Another study among adolescents less than 19-years-old in Rwanda found a lower viral suppression rate of 61% [17]. Though the viral suppression rates among adolescents were comparable within the region where our study was conducted, much lower suppression rates have been reported elsewhere. A study in Latin American that covered Argentina, Brazil and Mexico reported suppression rate of 37.5% among adolescents and youths aged 12-21-years [18]. Also, a study conducted in South Africa showed a dismal viral suppression rate of 27.3% among adolescents with the youths reporting 63.1% [9]. Our study showed

suppression rate of more than 70% among the youths aged 20-24-years.

High viral suppression rates in the younger age group could possibly be explained by different factors that may include close monitoring by their parents or caregivers. Thus, they rarely miss their ART intake and visits to the health facilities for routine reviews and intervention. In addition, this cohort has an improved nutritional support from their caregivers which plays a huge role in the ART intake and HIV management [19]. On the other hand, adolescents may suffer the effects of non-adherence to treatment. Evans, et al. in a study conducted in southern Africa reported that adolescents have the worst outcomes in terms of virological suppression, increased rates of virological failure, and adherence but similar rates of mortality and loss to follow-up compared to their adult counterparts [20]. In the United States, HIV positive adolescents and youths have been reported to have low tendency in starting treatment, achievement of viral suppression and staying on treatment compared to the HIV infected adults [21]. Adolescents and youths are accompanied by

rapid physical, psychological and physiological changes which influence health-related behavior. These leads to a desire for self-discovery and end up separating their relations with the care givers and the impact at long last results to unsuppressed viral outcome [5]. Therefore, transiting children to adolescents are at risk of discontinuation of, or irregular access to routine care.

In our study, 142 HIV infected adolescents and youths (46.4%) indicated to have missed their ARV intake for at least thrice in the last 30 days, 39.2% had missed at least one appointment to the clinic and 40.5% had failed to honor their ARTs refill appointment. Treatment for children and adolescents is influenced by the type of caretakers (such as parents versus guardians), schooling environment (for those in schools), and transition to adolescent care [22]. Missed clinic and ART refill appointments have a negative effect on viral suppression. Missing a clinic appointment translates to the patient missing their ART refill and consequently missing their prompt ART intake hence poor adherence. This study showed a high rate of non-suppression associated with missed clinic (48.3%) and ART refill (50%) appointments. Lower rates of long term suppression among adolescents can be explained by more rapid viral rebound resulting from poor ARV intake or ART resistance [23].

Studies have also shown that stigma, fear of disclosure, and stress may affect younger people more than their older counterparts [24]. In our study stigma was reported which included name calling by school mates and teachers and avoidance which led to depression. HIV stigmatization has been associated with loss to follow-up, poor adherence, failure to disclose status, decisions to drop out of school, avoidance of antenatal care and testing by pregnant female adolescents in sub-Saharan Africa [25]. It was reported in our study that some youths missed their ART as it was a reminder of a condition that makes them different from others as well as forgetfulness.

Defaulting ART is a major factor influencing suppression in adolescents and youths. In our study, ART defaulters had a lower suppression rate of 47.2% as compared to the 97.6% among those who adherent. A study conducted in Kenya among the HIV infected individuals reported a suppression rate of 57.9% among those non-adherent to ART [10]. Keeping young people in care by using social workers, peer supporters, and training on pediatric and adolescent disclosure among health workers contributes to improved ART adherence and hence better virological outcomes [26].

In conclusion, the HIV viral suppression among adolescents and youths was low at 74.2% with much lower suppression rate among 15-24-year-olds. Poor ART adherence and non-compliance to clinic appointments increased the risk of poor virological response. In addition, only 52.6% of the total study population had undetectable viral load. Thus far from reaching the UNAIDS target of 90% viral suppression among the HIV infected adolescents and youths on ART [4].

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## Declarations

### Ethical approval and consent to participate

The study protocol and the informed consent were reviewed and approved by the University of Nairobi/Kenyatta National Hospital Ethics and Review Committee (ERC no. P 736/10/2016).

### Conflict of interest

The authors declare that they have no conflict of interests.

### Author's contributions

JMK, KKM, JGK, PNM, MMN and OWG conceived and designed the study. JMK, JGK, MMN and SAM collected data in the field. KMM and JGK conducted data analysis. All authors contributed in the preparation of the manuscript, proof read and approved the final manuscript.

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