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Original Article

Prevalence and Determinants of Virological Non-Suppression Among HIV infected Adolescents on Antiretroviral Treatment at Kanyama General Hospital, Lusaka, Zambia.

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ABSTRACT

Background. Zambia continues to face challenges in addressing the HIV epidemic among adolescents. Despite implementing various interventions to improve viral suppression among adolescents, the proportion of adolescents achieving viral load (VL) suppression remains low compared to the adults, and below the Joint United Nations Programme on HIV/AIDS (UNAIDS) 95% target. Therefore, the study estimated the proportion and determined the factors associated with non-suppression among HIV infected adolescents on antiretroviral treatment at Kanyama General Hospital, Lusaka, Zambia. **Methods.** A cross-sectional study was conducted using routinely collected data from SmartCare on adolescents (10 – 19 years) receiving ART for the period 1st January 2020 to 30th September 2022. Demographic and clinic characteristics data was extracted. The study defined virological non-suppression as having VL count ≥1000 RNA copies/mL. The study used multivariable logistic regression to identify factors associated with virological non-suppression. Data analysis was conducted in Stata 14. **Results.** Of the 415 study participants, majority were 15-19 years (62.4%, 259/415) were female (56.6%, 235/415). The proportion of non-suppression was 5.8% (24/415, 95% CI=0.04-0.08). Age and sex showed no significant association with virological non-suppression, indicated by p-values of 0.089 and 0.310, respectively. Both treatment duration on ART and current treatment line were identified as determinants of virological non-suppression, with treatment duration on ART showing slightly decreased odds of (AOR=0.99, 95% CI=0.98-1.00) and being on the 2nd treatment line/regimen was associated with increased odds (AOR=8.09, 95% CI=2.71-24.17) of virological non-suppression. **Conclusion.** The study found a prevalence of 5.8% virological non-suppression among adolescents. Treatment duration on ART and 2nd treatment line/regimen were found as determinants of virological non-suppression. Need to continuously monitor adolescent's treatment duration on ART to avoid them moving 2nd treatment line/regimen.

Keywords: Virological non-suppression, adolescent, Zambia.

INTRODUCTION

Despite significant progress toward meeting the 2030 UNAIDS 95-95-95 targets, HIV/AIDS remains a major public health concern in Zambia. In 2020, People Living with HIV in Zambia were estimated to be 1.2 million, with a total of 1.1 million being on ART [1]. Zambia is one of the countries most affected by HIV globally, with over 1.3 million people living with HIV (PLHIV) in 2022 [2]. HIV is the leading cause of death in Zambia. The epidemic affects different groups in different ways, with women being more likely to have HIV than men, and young women (ages 15-24) being three times more likely

to get HIV than their male peers [3]. Several problems arise such as identified barriers at the intrapersonal level (e.g., poverty; lack of adequate nutrition; fear of stigma), interpersonal level (e.g., stigma; disrespectful treatment by providers), institutional/facility level (e.g., lack of adolescent specific services), and community level (e.g., lack of collaboration among organizations; social norms) [4, 5 6].

The country has scant HIV/AIDS data specifically for adolescents, primarily due to the prevailing age classification. Within most reports and/or literature, adolescents aged 10 to 14 years are classified as children (0-14 years), while adolescents aged 15 to 19 years are classified under young adults (15-24 years) or adults (25-59 years) [7]. Literature has shown that the proportion of adolescents achieving viral load (VL) suppression remains low compared to the adults, and below the Joint United Nations Programme on HIV/AIDS (UNAIDS) 95% target [7]. To the best of our knowledge, there is limited specific data regarding virological non-suppression among adolescents (10-19 years) in Zambia, particularly at Kanyama general hospital. Furthermore, little is known about the determinants of virological non-suppression among adolescents at the hospital. We undertook this study to assess the prevalence and identify determinants of virological non-suppression among adolescents living with HIV on ART.

METHODS

Study design

The study used a cross-sectional study design, using routinely collected data from the electronic database SmartCare on HIV-infected adolescents receiving ART for the period 1st January 2020 to 30th September 2022 from Kanyama General Hospital.

Study setting

The study was conducted at Kanyama General Hospital which is a high HIV priority health facility [with approximately 12,000 ART patients and approximately 430 adolescents on ART]. Kanyama General Hospital is in the Lusaka urban district, which is a densely populated area in Lusaka province and has the highest HIV prevalence of 16.1% (1).

Population, sample size and sampling methods

The study population constituted adolescents, aged 10-19 years, on ART for at least 6 months with at least one documented VL. The study employed the Cochrane (1963) formula to estimate a sample size of 328. A sampling frame was extracted from the electronic system SmartCare of the study facility. However, the study considered total enumeration of 459 study participants with 415 been eligible and analyzed.

Data collection

The study used secondary data. Routine clinic patient-level data was retrieved from SmartCare an electronic database. Based on the variables of the study, a data abstraction guide was developed. The study had initially planned to utilize physical clinic records to fill in the gaps in SmartCare, but this plan wasn't executed as the facility hard disposed of the hard copy records.

Statistical analysis

Data was analysed using STATA Statistical Software (Stata Corporation Version 14.0 College Station, Texas 77845, USA). Characteristics of study participants were summarized using descriptive statistics i.e., reporting proportions and percentages. Pearson chi-square test was used to test relationships between categorical variables. The cut-off point for statistical significance will be set at a p-value less than 0.05.

The association between virological non-suppression and demographic and clinic characteristics was investigated using logistic regression analysis. The univariable analysis was used to identify factors associated virological non-suppression. To

further explore these associations, the study used multivariable analysis while considering potential confounding variables to obtain a more comprehensive understanding of the variables associated with virological non-suppression, a statistical cut off point of 0.2 (20%) was used to select variables to include in the multivariable analysis.

Ethical considerations

Approval to conduct the study was obtained from University of Zambia Biomedical Research Ethics Committee (Reference No. 34782022) and the National Health Research Authority (Reference NHRA000010/19/01/2023). Furthermore, administrative permission was sought and granted by the Provincial Health Office and Kanyama General Hospital. Given that the study was cross-sectional, there was no need for consent or assent from the study participants. The data collected was only identified by codes, and that no patients' identifiers as such names were collected.

RESULTS

Participant demographic and clinical characteristics

A total of 415 adolescents participated in the study (table 1). The median age of the adolescents in the study was 16.0 years (Interquartile Range [IQR]=13.0–18.0). Majority of the adolescents in the study were aged 15–19 years (62.4%) and female (56.6%). The median duration on ART treatment was 95 months (IQR=50.0–131.0). Majority of the adolescents 93.3% (389/415), were receiving first (1st) treatment line/regimen, while a smaller proportion, 6.8% (28/415), were on second (2nd) treatment line/regimen.

Prevalence of virological non-suppression

Among adolescents the 415 study participants, the study revealed an overall proportion of virological non-suppression at 5.8% (24/415, 95% CI=0.04-0.08) (table 2). Particularly is the high prevalence among older adolescents aged 15-19 years (79.2%, p=0.081), females (66.7%, p=0.307), and those on 1st line treatment (75%, p=0.001).

Characteristics (factors) associated with virological non-suppression.

The univariable logistic regression analysis, as presented in Table 3, identified treatment duration on ART and current treatment line as potential factors associated with virological non-suppression among adolescents. Notably, adolescents aged 15-19 years, females and those on 2nd treatment line showed higher odds of virological non-suppression, with respective odds of 2.39 (95% CI=0.87-6.54, p=0.089), 1.57 (95% CI=0.66-3.76, p=0.310) and 5.59 (95% CI=2.02-15.49, p=0.001). On the other hand, treatment duration demonstrated lower odds of virological non-suppression, with an odds ratio of 0.99 (95% CI=0.98-1.00, p=0.010).

In the multivariable analysis (table 4), after controlling for confounding, treatment duration on ART and current line still emerged as factors associated with virological non-suppression. Notably, were higher odds of virological non-suppression among adolescents on 2nd treatment line (AOR=8.09, 95% CI=2.71-24.17, p=0.001) and older adolescents aged 15-19 years (AOR=2.74, 95% CI=0.96-7.78, p=0.059). Lower odds of virological non-suppression were observed regarding adolescents' treatment duration on ART (AOR=0.99, 95% CI=0.98-1.00, p=0.003).

Table 1: Characteristics of the adolescents 10-19 years on ART at Kanyama general hospital (N=415) between 1st January 2020 to 30th September 2022.

Study variables	Descriptive statistics	
Continuous	Median	Interquartile range
Treatment duration on ART (months)	95	(50.0, 131.0)
Categorical	Frequency (n)	Percentage (%)
Age group (in years)		
10-14	156	37.6
15-19	259	62.4
Sex		
Male	180	43.4
Female	235	56.6
Current treatment Regimen/line		
1st line	389	93.3
2nd line	28	6.8

Table 2: Virological non-suppression by demographic and clinical characteristics factors associated with virological non-suppression among adolescents aged 10 to 19 years on ART at Kanyama general hospital, Lusaka, Zambia between 1st January 2020 to 30th September 2022.

Characteristics	Total (N=415) *n* (%)	Viral load suppression status		*p*-value
		Unsuppressed (≥1000 RNA copies/mL) (n=24, 5.8%))	Suppressed (>1000 RNA copies/mL) (n=391, 94.2%)	
		n (%)	n (%)	
Age group (in years)				
10-14	156 (36.4)	5 (20.8)	151 (38.6)	
15-19	259 (62.4)	19 (79.2)	240 (61.4)	0.081[c]
Sex				
Male	180 (43.4)	8 (33.3)	172 (44.0)	
Female	235 (56.6)	16 (66.7)	219 (56.0)	0.307[c]
Current treatment line/regimen				
1st line	387 (93.3)	18 (75.0)	369 (94.4)	
2nd line	28 (6.7)	6 (25.0)	22 (5.6)	0.001[c*]

Abbreviations*: c*-Pearson's chi-squared test, *RNA*- Ribonucleic Acid, *mL*- millilitre, *-Significant p-value.

Table 3: Univariable logistic regression analysis of characteristics associated with virological non-suppression among adolescents on ART at Kanyama general hospital, Lusaka, Zambia between 1st January 2020 to 30th September 2022.

Characteristics	Unadjusted OR	95% CI	*p*-value
Age group (in years)			
10-14	Ref.		
15-19	2.39	0.87-6.54	0.089
Sex			
Male	Ref.		
Female	1.57	0.66-3.76	0.310
Treatment duration on ART (in months)	0.99	0.98-1.00	0.010*
Current treatment line/regimen			
1st line	Ref.		
2nd line	5.59	2.02-15.49	0.001*

Abbreviations: OR-Odds ratio, CI-Confidence Interval, Ref-Reference category/group *-Significant p-value

Table 4: Multivariable logistic regression analysis of characteristics associated with virological non-suppression among adolescents on ART at Kanyama general hospital, Lusaka, Zambia between 1st January 2020 to 30th September 2022.

Characteristics	Adjusted OR	95% CI	*p*-value
Age group (in years)			
10-14	Ref.	Ref.	Ref.
15-19	2.74	0.96-7.78	0.059
Treatment duration on ART (in months)	0.99	0.98-1.00	0.003*
Current treatment line/regimen			
1st line	Ref.	Ref.	Ref.
2nd line	8.09	2.71-24.17	0.001*

Abbreviations: OR-Odds ratio, CI-Confidence Interval, Ref-Reference category/group *-Significant p-value

DISCUSSION

In this cross-sectional study, we found a prevalence of 5.8% of virological non-suppression among adolescents on ART. Comparing our study's virological non-suppression prevalence of 5.8% to the broader national virological non-suppression rate of 3.7% (aged 15-59 years) reported by ZAMPHIA 2021 report, it appears that the national prevalence is relatively lower. However, it falls within the confidence interval our study's prevalence, which ranges from 4% to 8%.

However, our findings contrast with those of other studies. For instance, Mwangi and van Wyk reported a prevalence of approximately 20% in Kenya among adolescents aged 10-19 years [7]. Bulage *et al*., observed 10% prevalence among adolescents in a study in Uganda [8]. The noted variation in the prevalence of virological non-suppression among adolescents may be related to the difference in study settings.

Determinants of Virological Non-Suppression

Our study found no association between age group and virological non-suppression; however, older adolescents older adolescents (15-19 years) were more likely to experience virological non-suppression compared to young adolescents (10-14 years). This finding is consistent with the previous study by Van Wyk, Kriel, and Mukumbang, which attributed the trend to challenges in adherence during the transition from adolescences to adulthood. [9]

Although our study didn't find a significant association between sex and virological non-suppression, being female was associated with a higher likelihood of virological non-suppression. Similar findings were reported by Umar et al., and Van Wyk, Kriel, and Mukumbang [9] [10] (2,3), while Negash *et al*., observed a higher proportion virological non-suppression among males. [11]

In this study, treatment duration on ART emerged as a significant determinant of virological non-suppression. The study revealed a decrease in the odds of virological non-suppression with each additional month on ART, consistent with findings from Nglazi *et al*., in South Africa . This may suggest that longer treatment duration fosters better self-management and adherence to ART, thereby improving virological outcomes [12].

Our study identified ART treatment line/regimen as another significant determinant of virological suppression. We found adolescents on the 2nd line treatment to have higher odds of virological non-suppression compared to those on the 1st treatment line/regimen. This aligns with studies by Mwangi and van Wyk and Okonji *et al*.,[9]. These adolescents' prior failure to respond to a 1st regimen or treatment may have led to their inability to achieve virological suppression even after being placed on a rescue regimen (second therapy). It is important to closely monitor and provide adherence support

for these adolescents to diminish virological non-suppression [13].

The strength of our study was the total enumeration employed and the utilization of statistical techniques, such as multivariable analysis, to mitigate the effect of potential confounding variables and enhance the precision of the findings. However, our study had one important limitation: we encountered challenges in obtaining complete and comprehensive datasets from SmartCare database. Specifically, certain variables essential for the study such as area of residence, educational status, marital status, denomination and CD4 count at initiation were found to be with either missing data or unavailable in the database. This was attributed to the transition from SmartCare to SmartCare Plus and the introduction of E-First which introduced challenges related to data continuity. It was noted that some patient hard-copy files were discarded during this transition, resulting in a loss of valuable information that could be used for completing any missing data in SmartCare.

In conclusion, this study found a prevalence of 5.8% for virological non-suppression among the adolescents. Treatment duration on ART and treatment line/regimen were identified as determinants of virological non-suppression. Longer treatment duration on ART was associated with a slightly reduced likelihood of virological non-suppression, whereas being on 2nd treatment line/regimen was associated with increased likelihood of attaining virological non-suppression [14, 15]. It is important that the ministry of health (MOH) and the respective study facility develop, implement and strengthen adolescent support programmes, including counselling, and reminders to improve treatment adherence among adolescents on ART, while ensuring vigilant monitoring and support, particularly for those on the 2nd line treatment.

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