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*Shemmdolwa Naseeb & Switbert R. Kamazima*

*Muhimbili University of Health and Allied Sciences*

## ABSTRACT

**Background:** The burden of HIV infection is higher among the youth who also experience higher attrition rates compared to other age groups. Understanding the dynamics of their retention on HIV treatment and predictors of attrition is necessary for establishing streamlined interventions targeting this population.

**Objective:** This study examined the retention and predictors of attrition among HIV-infected youth enrolled on care and treatment in Rorya District Council (DC), Mara Region, Tanzania.

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# Predictors of Attrition among HIV-Infected Youth Initiated on Antiretroviral Treatment in Rorya District Council, Tanzania

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**Results:** A total of 253 client's records meeting the inclusion criteria were collected and analyzed. Overall the retention at 3, 6, and 12 months were 81.4%, 69.2%, and 59.3% respectively. Independent predictors of attrition among youth were being aged 20-24 years (AOR, 5.3, CI: 2.56-10.94), being a male (AOR, 6.61, CI: 2.46-17.74), being single or never married (AOR, 4.66, CI: 2.13-10.23), having a baseline WHO clinical stage 2 or 3 (AOR, 0.02, CI: 1.09-4.63),

and reporting having no treatment supporter (AOR, 9.22, CI: 2.38-35.79).

**Conclusion:** The overall retention of HIV-infected youth initiated on ART is still low and the independent predictors of attrition among youth are age, sex, WHO clinical stage 2 and 3, marital status, and having no treatment supporter. Urgent attention to retaining PLHIV youth initiated on treatment is required and should focus to target youths with high risks for attrition.

**Keywords:** Youth, HIV, ART, retention, attrition, Loss to follow up, Rorya, Tanzania.

**Author a:** Alumna, School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, P.O Box 65001, Dar-es-Salaam, Tanzania.

**a:** Behavioral Sciences Department, School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar-es-Salaam, Tanzania.

## I. INTRODUCTION

About 36% of new HIV infections occur among the youth every day in the world.[1] Currently, over 4 million youth are HIV-infected globally, and among them, more than 60% are living in Eastern and Southern Africa. In Tanzania, about 0.2 million youth are HIV-infected comprising 11% of all People Living with HIV (PLHIV) in the country.[2] Rorya district in the Mara region, Northwestern Tanzania, has an HIV prevalence of 4%.[2]

In order to control the HIV epidemic by 2030, the United Nations (UN) has set forth 90-90-90 and 95-95-95 targets, whereby 2020 and 2030, respectively, at least 90% and 95% of people living

with HIV be aware of their status, at least 90% and 95% of those with known status be on antiretroviral treatment (ART), and at least 90% and 95% of PLHIV on ART to achieve viral suppression.[3] Diagnosis of HIV infection is an entry point into the HIV treatment cascade and linkage to care and retention are vital in achieving viral suppression which is the ultimate goal of HIV treatment and public health measures.[4-5]

Retention on HIV care and treatment has benefits on optimal clinical outcomes, prevention of further HIV transmission of HIV, and reducing healthcare costs. Through attending clinic visits, PLHIV are continuously getting access to ART, health education and psychosocial support in coping with HIV and AIDS and monitoring their treatment response.[6] Attrition which is defined as a continuous process where clients default from HIV care and treatment services may result in treatment failures, increased chances of acquiring opportunistic infections as well as further HIV transmission.[7].

Research findings show relatively lower retention rates of HIV-infected youth on ART compared to other age populations.[8-9] Furthermore, there are substantial disparities on retention among HIV-infected youth on ART in different geographical settings.[10-12] The retention of youth has also been found to decline over time with a significant decline within the first year of HIV treatment.[13-14]

Tanzania being one of the HIV epidemic countries, has been implementing preventive, treatment, and support interventions to accelerate efforts towards ending the HIV epidemic by 2030. These interventions include initiatives to increase focused HIV testing services through optimized provider-initiated testing and counseling (PITC), community-based HIV testing services (CBHS), index testing, and HIV self-testing. In 2017, the country adopted the universal test and start strategy which allowed all individuals diagnosed with HIV infection to be linked to care and initiated on lifelong ART regardless of CD4 count or WHO clinical staging. Therefore, the number of youth who are diagnosed and initiated on ART has rapidly been increasing over time and, hence,

the increased demand for retaining them on HIV care and treatment services. However, there is limited knowledge on the specific dynamics of retention on ART and predictors of attrition among this age category. In this regard, interventions employed to retain PLHIV on care and treatment services may not be effective for this disproportionately affected population. In view of this, the current study reviewed the retention of HIV-infected youth over a 1-year period and examined socio-demographic and clinical characteristics associated with attrition inform programs and policy decisions for streamlining interventions to target their specific needs.

## II. MATERIALS AND METHODS

### 2.1 Study area and period

This study was conducted in Rorya DC, northwestern Tanzania in September 2020. Rorya Council has a population of 265,241 (Census of 2012, National Bureau of Statistics) and is dominantly inhabited by the *Wajaluo*, followed by the *Wakurya* and the *Wasimbiti*. It is a rural setting district with few towns, the largest being Shirati and the main economic activities in this council are farming, fishing and livestock keeping. It has the highest HIV prevalence in Mara Region and the common cultural practices fueling HIV transmission include female genital mutilation (FGM), early marriages, sexual cleansing, wife inheritance, and mourning by preparing a big feast as a sign of departure of their loved ones for a couple of weeks.

Rorya Council has 44 healthcare facilities and among them, 36 (82%) are providing HIV care and treatment services. There are 19 facilities with PLHIV-dedicated care and treatment clinics and the remaining 17 facilities have standalone reproductive and child health (RCH) clinics integrating HIV care and treatment to pregnant and breastfeeding women.

### 2.2 Design and participants

This study used a cross-sectional design. The study participants were the HIV-infected youth who were initiated on ART between October 1<sup>st</sup>,

2017 to Sept 30<sup>th</sup>, 2018 in all CTC and RCH clinics providing PMTC services, in Rorya DC, and whose clinical records were available on CTC2 files. The clients who were not in 15-24 years age category during the ART initiation and those who transferred to other facilities before 12 months since ART initiation were excluded. For each youth, data on socio-demographic and clinical characteristics during enrolment and follow-up clinic visit records for the period of 12 months after enrolment were collected.

### 2.3 Sample size

The sample size was calculated by using a single proportion formula ( $n = Z^2 p(100-p)/\epsilon^2$ ). The proportion of attrition among youth initiated on ART within a 1 year period ( $p$ ) was 19%.[9] The minimum sample size required was 237 clients with a margin error of 5%. To meet this sample size, all youth from 36 health facilities that were providing care and treatment services to PLHIV in Rorya DC, were listed to be included in the study. Out of 263 client's records retrieved, 253 met the inclusion criteria and were used in this study.

### 2.4 Study variables

The outcome variable was attrition throughout the 1 year period defined by the missing clinic for more than 90 days past the scheduled appointment date and not documented as a transfer out from the care and treatment clinic. Sociodemographic and clinical variables that were routinely collected during enrolment on HIV care and treatment were examined as predictors of attrition. The sociodemographic variables included age, sex, marital status, HIV status of the spouse and identification of treatment supporter. Clinical variables included the WHO clinical stage, TB co-infection, pregnancy/breastfeeding state during enrolment and the timing for ART initiation. In addition, the point for HIV diagnosis and the level and ownership of the facility delivering care and treatment services to the participants were included on the list of dependent variables.

### 2.5 Data collection

Data were collected from the participant's medical records in care and treatment facilities with the

help of two trained research assistants (Ras) using a pre-defined data excel sheet. The primary source of information was the individual CTC 2 files. The ART registers were used to complement or validate the information. Information gathered included sociodemographic and baseline clinical characteristics and attendance visits made within a period of 12 months after ART initiation. Data collected were compiled in an excel template and then imported to Stata statistical package version 14 for cleaning and analysis.

### 2.6 Ethical consideration and research clearance

Ethical clearance was obtained from the MUHAS Institutional Review Board (MUHAS IRB) and permission to access data was granted by the office of Mara Regional Administration, Rorya district authority, and management of the respective facilities. Participants were identified by using unique CTC numbers or facility's file numbers for confidentiality purposes.

### 2.7 Data analysis

We used frequency and proportions in the descriptive analysis. Mean and standard deviation was used to summarize continuous variables. Bivariate logistic regression was used to explore the association between baseline characteristics and attrition using the Chi-square test at a 0.1 significance level. Variable categories which were significantly associated with attrition in bivariate analysis at a  $p$ -value of  $<0.1$  were included in the single and multivariate analysis to determine those with the strongest independent association with attrition. The results are presented using the Crude and Adjusted Odds Ratios with their corresponding 95% confidence intervals.

## III. RESULTS

### 3.1 Description of the study participants

Records for a total of 253 eligible clients who met inclusion criteria were reviewed. Among them, 85% were females, 64.8% were aged 20-24 years and 33.6% were enrolled while pregnant or breastfeeding (Table 1). The clients with identified treatment supporters were 91.3% and 1.19% screened positive for TB Co-infection. Majority of

youth started ART within 7 days of confirmed diagnosis and only 8.3% started ART after 7 days of diagnosis.

*Table 1:* Characteristics during enrolment (n 253)

Characteristics	Categories	Frequency, n	%
Sex	Male	38	15.0
	Female	215	85.0
Age	15-19	89	35.2
	20-24	164	64.8
Marital status	Married/Cohabiting	170	67.2
	Single	12	4.7
	Divorced/Separated/Widowed	71	28.1
Testing modality	VCT(Self referral/CBHS)	100	39.5
	PITC	153	60.5
Level of facility	DISPENSARY	76	30.1
	HEALTH CENTRE	78	30.8
	HOSPITAL	99	39.1
Facility ownership	Gov	136	53.8
	FBO	95	37.5
	Private	22	8.7
WHO stage	Stage 1	72	28.5
	Stage 2	71	28.1
	Stage 3	102	40.3
	Stage 4	8	3.2
TB screening	Screen -ve	250	98.8
	screen +ve	3	1.2
Pregnancy	Pregnant/breastfeeding	85	33.6
	Non pregnant/breastfeeding	130	51.4
ART initiation	Within 7 days	232	91.7
	Beyond 7 days	21	8.3
Treatment supporter	Yes	231	91.3
	No	22	8.7
HIV status of the spouse	Known	20	7.9
	Unknown	162	64.0

### *3.2 Retention of HIV infected youth initiated on ART at 3, 6 and 12 months of enrolment*

Among the participants, the proportion of youth retained declined over time from 81.4%, 69.2%, and 59.3% at 3, 6 and 12 months of ART initiation respectively (Table 2).

**Table 2:** The proportion of HIV-infected youth retained in 3, 6 and 12 months

Months since ART initiation	n	%
3	206	81.4%
6	175	69.2%
12	150	59.3%

**3.3 Bivariate analysis of the predictors for attrition**

In bivariate analysis, it was found that sex, age, marital status, testing modality, level of the state, facility, facility ownership, WHO stage, pregnancy

and identification of treatment supporter variables were statistically significant with attrition. (Table 3)

**Table 3:** Bivariate analysis of baseline characteristics with attrition (Chi<sup>2</sup> ; p-value)

Characteristics	Categories	Attrition		Chi <sup>2</sup>	p-value
		n	%		
Sex	Female	102	47.4	17.525	0.000
	Male	32	84.2		
Age	15-19	33	37.1	13.908	0.000
	20-24	101	61.6		
Marital status	Single	53	74.7	19.614	0.000
	Married/Cohabiting	74	43.5		
	Divorced/Separated/Widowed	7	58.3		
Testing modality	VCT(Self referral/CBHS)	63	63.0	6.685	0.010
	PITC	71	46.4		
Level of facility	Dispensary	35	46.0	7.436	0.024
	Health centre	36	46.2		
	Hospital	63	63.6		
Facility ownership	FBO	62	65.3	10.106	0.006
	Gov	64	47.1		
	Private	8	36.4		
WHO stage	Stage 1	28	38.9	9.955	0.019
	Stage 2	37	52.1		
	Stage 3	64	62.8		
	Stage 4	5	62.5		
TB screening	Screen -ve	133	53.2	0.470	0.493
	screen +ve	1	33.3		
Pregnancy	Preg/b-feeding	30	35.3	25.852	0.000
	Non Preg/b-feeding	72	55.4		
ART initiation	Within 7 days	122	52.6	0.161	0.689
	Beyond 7 days	12	57.1		
Treatment supporter	Yes	117	50.7	5.715	0.017
	No	17	77.3		
HIV status of the spouse	Known	6	30.0	20.525	0.000
	Unknown	75	46.3		

### 3.4 Multivariate analysis on the predictors for attrition

Factors that were statistically significant were further analyzed by logistic regression and found that being male was associated with more than six times higher odds of attrition (AOR; 6.61, 95%CI:

2.5-17.7) compared to females. Also, being in the age group of 20-24 years was associated with five times higher odds (AOR; 5.3, 95%CI: 2.5-10.9) compared to those aged 15-19 years. More information is shown in the table below (Table 4).

*Table 4:* Univariate and Multivariate regression

Characteristics	Categories	LTF		Univariate regression			Multivariate regression		
		N	%	OR	p-value	95%CI	OR	p-value	95%CI
Sex	Female	102	47.4	1(ref)					
	Male	32	84.2	5.91	0.000	2.37-14.01	6.61	0.000	2.46-17.74
Age	15-19	33	37.1	1 (ref)					
	20.24	101	61.6	2.72	0.000	1.60-4.64	5.30	0.000	2.26-10.94
Marital status	Married/ Cohabiting	74	43.5	1(ref)					
	Single	53	74.7	3.80	0.000	2.07-.06	4.66	0.000	2.13-10.23
	Divorced/ Seperated/ Widowed	7	58.3	1.80	0.324	0.55-5.95	2.39	0.210	0.73-2.95
Testing modality	PITC	71	46.4	1 (ref)					
	VCT(Self referral/CBHS)	63	63.0	1.97	0.010	1.17-2.29	1.46	0.288	0.73-2.95
Level of facility	Dispensary	35	46.0	1 (ref)					
	Health centre	36	46.2	1.00	0.990	0.53-1.89	0.92	0.801	0.47-1.79
	Hospital	63	63.	2.05	0.021	1.11-3.77	2.35	0.179	0.68-8.14
Facility ownership	Private	8	36.4	1 (ref)					
	FBO	62	65.3	3.29	0.016	1.25-8.63	0.22	0.005	0.08-0.63
	Gov	64	47.1	1.56	0.353	0.61-3.94	1.13	0.824	0.39-3.27
WHO stage	Stage 1	28	38.9	1 (ref)					
	Stage 2	37	52.1	1.71	0.113	0.88-3.32	2.29	0.021	1.13-4.63
	Stage 3	64	62.8	2.65	0.002	1.42-4.92	2.14	0.025	1.09-4.17
	Stage 4	5	62.5	2.62	0.211	0.57-11.82	1.69	0.512	0.35-8.24
Pregnancy	Preg/b-feeding	30	35.3	1 (ref)					
	Non Preg/b-feeding	72	55.4	2.28	0.004	1.29-4.00	1.78	0.111	0.88-3.63
Treatment Supporter	Yes	117	50.7	1 (ref)					
	No	17	77.3	4.34	0.012	1.38-13.64	9.22	0.001	2.38-35.79

#### IV. DISCUSSION

In this study, the retention was found to decline over time whereby more than two-thirds of HIV infected youth were not retained on HIV treatment by the end of 12 months after ART initiation. Being aged 20-24 years, being a male, being single or never married, having a baseline WHO clinical stage 2 or 3, and reporting having no treatment supporters were independent predictors of attrition among HIV infected youth initiated on ART in Rorya DC.

A higher decline in retention was noted in the first three months after enrolment. These findings were also observed from the other studies in Sub Saharan Africa. [14-15] The decline could be due to the fact that the first three months are critical in coping up with the diagnosis and new experience with the ARTs.[16] Drug side effects, stigma, and perceived well-being have been cited as contributing factors to lower retention rates of youth on care and treatment services. [17-18]

The proportion of clients retained at 12 months in this study are much lower compared to that reported by Mee, *et al.*, in his study conducted in Tanzania which reviewed the patterns of retention on HIV treatment between 2008 and 2016.[19] This difference may be explained by differences in study population. While the study by Mee, *et al.*, included extracted data for all the HIV infected youths in the country, we only studied youths in one council. However, the results from this study are comparable to those from other studies in Sub-Saharan Africa settings. [14][18] Complex and dynamic factors have been identified to specifically affect the optimal retention of PLHIV youth on care and treatment services. These include HIV associated-stigma, socioeconomic stressors, poor risk perception of consequences of non-adherence, and depression. [16,20-21] Engagement of peers in the delivery of HIV care and treatment services has been used to address the factors affecting retention of youths on care. [22] Adopting this strategy may promote retention in the current study area setting.

Moreover, active tracing of clients immediately after missing the appointment has been identified

Moreover, active tracing of clients immediately after missing the appointment has been identified as one of the effective measures to improve the retention of clients prior to being categorized into attrition. [23,24] Further studies are needed to evaluate effective tracing mechanisms which will work better for the youth especially in the first three months of HIV treatment.

Attrition observed may have included a substantial proportion of clients self-transferred to another facility or died who could not be reached and reported. It is common for clients who find unfavourable service in one facility to silently transfer to another facility, retest for HIV, and get re-enrolled. The mobile clients may also be re-testing and get enrolled in multiple facilities due to unawareness of the procedures or when avoiding the procedures for collecting a transfer out letter each time they shift to another location. The current database can not capture clients already registered elsewhere unless the names are exactly the same. There is, therefore, a need to determine the true outcome of youth clients who are categorized as attrition. Innovations to deliver simplified and user-friendly ART services among mobile populations may reduce attrition and account for clients who will be refilled in the site other than the facility they were enrolled in.

In our study, we found that the males had higher attrition rates compared to the females. This is similar to other studies conducted in Sub-Saharan Africa. [25-26] The reasons could be due to their economic activity constraints and poor health-seeking behaviours. [9][28] A study in Kenya revealed that delivering care and treatment services near the youth males' residence or site of economic activity promotes the uptake of the services. [27] This may be attributed to the time and financial costs saved on increasing access to service. The analysis of the cost of accessing the ART services in 7 regions of Tanzania showed the males spent significantly higher travel costs than the females. [28] Furthermore, extending ART refill services to a community setting has been demonstrated to decrease the substantial risk for attrition among the males of 20 years and above. [29-30] Further studies are needed to

evaluate the impact of community ART refill services on reducing the risk of attrition for the male youths.

In this study, being aged 20-24 years was an independent predictor for attrition. Koech, *et al.*, reported similar findings among youths enrolled on HIV care in Kenya. [31] At this age interval, youth may have already been economically independent which may be associated with increased mobility. The 2019 Guideline on the Differentiated Service Delivery of Care and Treatment Services in Tanzania suggests the provision of special consideration to the mobile population by offering longer ART refills adapted to the client's travel plans. Successful implementation of this approach may significantly improve the retention of youth in this age category. Contrary, the findings from other studies indicate that youth aged 15-19 have higher attrition rates compared to 20-24. [12,32] The differences may be due to varied socio-economic contexts from the current study settings.

In this study, being single or never married was found to be the independent predictor of attrition among the HIV infected youth on care and treatment services. The finding in this study is consistent with the finding by Mecha, *et al.*, [33]. This might be because of a lack of social support in adherence to treatment and dealing with the stigma. In contrast, other studies found no association between marital status and attrition among youth on HIV treatment. [31,35] Further exploration on the role of partner support among youth on HIV treatment is needed to derive streamlined strategies in retaining these clients on care and treatment.

A number of studies have shown less attrition among PLHIV clients with treatment supporters compared to their counterparts. [27,36,37] Nakamanya, *et al.*, described the role of treatment supporters in providing psychological coping and reminding clients to take their medication and, therefore, encouraging adherence to ART services. [36] The current study affirms the significance of the role of the treatment supporter in the retention of HIV-infected youths on care and treatment services.

#### 4.1 Strength and limitation of the study

The strength of this study relies on the use of the national standardized data sources that facilitated capturing of consistent data. However, this study has some limitations that may have influenced the results. The study relied on the retrospective data collected from the routine care and service delivery which could be subjected to errors and data incompleteness. These were minimized by using multiple data sources to complement and validate the information. The study focused on only data that are routinely captured in a day to day care and treatment services. Other important information such as Key and Vulnerable Population (KVP) category, occupation and the level of education which were found predictors of attrition among PLHIV in literature could not be assessed as the records reviewed did not capture these data. Attrition may have included clients with unknown outcomes such as unascertained death, self transfers, and clients who were later re-engaged to care. However, the findings still provide an insight on the rate and its association with baseline characteristics.

## V. CONCLUSION

Retention of HIV-infected youth who are initiated on ART declines over time with a significant drop in the first 3 months of enrolment. Predictors of attrition include sex, age, marital status, WHO stage, and having no identified treatment supporter.

## RECOMMENDATIONS

This study revealed rates of retention decline over time among HIV-infected youth enrolled on care and treatment and highlighted significant predictors of attrition. Urgent implementation of the following recommendations by Rorya DC health management may improve the retention of youth on HIV care and treatment services: 1) Focusing on youth's retention specifically during the first three months on ART should be intensified. The adoption of youth PLHIV peers in navigating through care and treatment services and providing peer counselling may be needed to optimally address youth's specific barriers to retain on care. Youth with no identified treatment

supporters will also benefit from peer support; 2) The male youth and those who are in the 20-24 years age category have been found to be at risk of attrition and is attributed to their economic activity constraints and high mobility. Consideration of extending care and treatment services through community ART refills and offering longer hours for ART services will promote their retention.

In addition, further research to determine the outcomes of attrition among youth is recommended to account for clients who may have silently transferred to another facility or died. Moreover, there is an urgent need for qualitative analysis of the predictors for attrition to develop a deeper understanding and streamline relevant intervention measures.

#### Abbreviations

AIDS: Acquired Immune Deficiency Syndrome; ART: Anti-retroviral therapy; CBHS: Community Based HIV Services; CTC: Care and Treatment Clinic; HIV: Human Immunodeficiency Virus; KVP: Key and Vulnerable Population; PITC: Provider Initiated Testing and Counselling; PLHIV: People Living with HIV; VCT: Voluntary Counselling and Testing; WHO: World Health Organization.

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