Incidence and Determinants of Attrition among HIV Infected Patients Receiving Antiretroviral Therapy in Dessie Referral Hospital, Ethiopia: Retrospective Follow up Study

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Abstract

Background: Antiretroviral treatment (ART) scale-up has resulted in significant reductions in HIV-related morbidity and death. However, attrition from ART care remains a major public health concern, and it has been highlighted as one of the most important reportable factors in evaluating the success of ART programs. However, there are few researches in the subject region that indicate the incidence and predictors of it. As a result, the goal of this study was to determine the rate of attrition and predictors of attrition among adult HIV patients who started antiretroviral therapy (ART) at Dessie Referral Hospital.

Method: An Institution-based retrospective follow up study was conducted from January 2015 to October 2019. A sample of 565 patients was selected using simple random sampling and we were use data extraction checklist for extracting data from patient charts. The proportional hazard assumption was verified visually and using the Schoenfeld residual global test; a bi-variable cox regression analysis was performed. In the bivariable study, variables having a p-value of 0.2 were fitted to the multivariable cox regression analysis.

Result: A total of 565 adult HIV patients on ART were included in the analysis, The Incidence rate of over all attrition in this study was 14.2 per 100 person-year (95% CI; 12.2-16.6). Having ambulatory functional status, (aHR=2.08; 95% CI (1.29-3.33)), a patient who did not disclosed their HIV status (aHR=2.27; 95%CI; 1.39-3.69), presence of Comorbidity throughout the follow-up time 2.11 (aHR-2.11;95%CI (1.38-3.23)), patients who didn't take CPT prophylaxis 1.68 (aHR-1.68;95%CI (1.34-2.49)),fair and poor level of adherence 2.75 (aHR=2.75; 95%CI (1.75-4.30)) and 2.16 (aHR=2.16; 95%CI (1.39-3.36)) respectively were predictors of attrition.

Conclusion: In this study, the incidence of attrition was high. Patients on ART who did not disclose their HIV status, those who were in fair and poor level of adherence, those did not take CPT prophylaxis,, ambulatory functional status, patients who had co morbidity at enrollment, were at higher risk of Attrition. Therefore, intensive monitoring, reminders, surveillance, and tracking mechanisms aimed at this higher-risk population would reduce ART attrition.

Keywords: HIV /AIDS • Attrition • ART •. Ethiopia

Abbreviations: HAART: Highly Active Antiretro Viral Therapy • HIV: Human Immunodeficiency Virus • CD4: Cluster Differentiation Four • AIDS: Acquired Immune Deficiency Syndrome • cART: Combination Antiretroviral Therapy • PLWH: People Living with HIV • BMI: Body Mass Index • CIFs: Cumulative Incidence Functions • CPT: Cotrimoxazole Preventive Therapy • ETB: Ethiopian Birr; HIV: Human Immune Deficiency Virus; INH: Isoniazid Preventive Therapy • LTFU: Lost To Follow Up • OIs: Opportunistic Infections • PTB: Pulmonary Tuberculosis • TB: Tuberculosis • WHO: World Health Organization • FDC: Fixed Dose Combination • FMOH: Federal Ministry of Health • HAART: Highly Active Antiretroviral Therapy • HBV : Hepatitis B Virus • HCV: Hepatitis C Virus • HTS: HIV Testing Services • cHR: Crude Hazard Ratio • aHR: Adjusted hazard ratio • CI: Confidece interval

Introduction

The Human Immunodeficiency Virus (HIV/AIDS) continues to be a serious public health issue in Sub-Saharan Africa, claiming the lives of millions of people in their prime and leaving millions of children orphaned [1]. More than 74.9 million individuals have been infected with the Human Immunodeficiency Virus (HIV) since the epidemic began among those around 32.0 million people dying from HIV; At the end of 2018, 37.9 million people worldwide were living with HIV [1-4]. Antiretroviral treatment has dramatically decreased HIV-infected patients' mortality and extended their life expectancy, but its success still hinges on continuous patient follow-up [5-8]. Attrition among HIV-positive patients is linked to adherence to Antiretroviral Therapy (ART) and is becoming more of an issue in Sub-Saharan Africa as the ART program expands, resulting in a decrease in the health professional-to-patient ratio [9-12]. It also accounts for the bulk of all attrition, and the problem of attrition may be solved if the relevant causes are identified and patients are tracked properly [13,14].

Indeed, attrition has been highlighted by the World Health Organization (WHO) as one of the major factors in determining the effectiveness of an ART program [15]. Scaling up HIV management has been hampered by mortality and loss of follow-up in the ART program [3,16,17].Attrition rates in Asia and Sub-Saharan Africa have been reported to range from 6.2% to

35% [6,7,10,11,13,18-22]. In addition, the amount of attrition varies by area in Ethiopia ranging from 9.8% to 33% [5,8,14,20,23-29].

According to a systematic study done in low-resource settings, including Ethiopia, the major predictors of attrition were patients with advanced HIV-disease progression marked by Body Mass Index (BMI) <18 kg/m^2, baseline CD4counts<200 cells/mL [30,31], WHO stage - III and IV, non-disclosure of HIV serostatus [8,19,21,24,27], who had an opportunistic infection at base-line, who were not start CPT, reside in greater than 10 km far from health institution, poorer level of functionality, male sex [16,22,27,32-34] younger age and having lower levels of education [35-37]. Other research has found that people who begin ART with a higher baseline CD4, ambulatory functional status [28,29,38,39], working functional status, a secondary or higher level of education are more likely to drop out [31,35-37]. Despite the risk factors of attrition among people who are on ART were researched, some settings which provide HIV/AIDS care and treatment services for a high number of movable population like Dessie Hospital were not fully addressed. However, HIV/AIDS-related mortality and failure to follow up remain a major public health concern in the region. As a result, local data on risk factors for mortality among HIV/AIDS patients on ART is needed to offer evidence for organizations working on HIV/AIDS and ART at the national, regional, and district levels. Hence, this study aimed to determine the incidence and predictors of attrition among adult HIV/AIDS patients who were on ART at Dessie Hospital, Ethiopia.

Methods

Study design and setting

An institutional-based Retrospective follow-up study was conducted in Dessie referral hospital between January 1 2015 to December 30 2019 G.C among Adult HIV patients who were on ART. The hospital is found in Dessie town which is located 354 km from the capital of Ethiopia Addis Ababa. According to the city, administrative health office the total population of the town is 218,473. About 102,375 (46.86%) are males and 116,098 (53.14%) are females. The hospital is a leading referral hospital in northern central Ethiopia serving an estimated five million people. ART service is one of the services given by this hospital and a summary of medical records of the hospital shows that currently, there are 7,542 patients on ART follow up among these 6,279 are adults.

Sampling technique and data collection procedure

Adult HIV-positive patients who were on ART at Dessie referral Hospital ART clinic and who enrolled in treatment from January 1, 2015, to December 31, 2019, and Age ≥ 15years at least one follow-up visit were included in this study. However, a patient transferred in with incomplete baseline data and patients who are unknown initiation date of treatment has been excluded. Records of study participants were filtered first from the database according to their entry time to the follow-up, next patients were selected using age and eligibility criteria then we were given a unique number for the remaining records and select each record for our sample using computer-generated random number. The optimum sample size was 565 estimated by using the power cox command of Stata 14 software.

Variables and operational definitions of the study

Our primary outcome was attrition, which combines two mutually exclusive events LTFU and death (mortality).

LTFU was defined as patients who had missed the next clinic visit or pharmacy refill appointment to the same Health Facility at most 3 consecutive months after the last scheduled visit [20].

Death was defined as patients recorded as dead on the patient's exit form or whose outcome is recorded as death on the follow-up chart [20]. A patient was classified as censored if he/she had a formally recorded transfer to another health institution or still on follow up at this Dessie referral hospital at the end of the study period. The predictor variables assessed were baseline socio-demographic factors (age sex, marital status, occupational status, educational

status, residence, religions, and distance from health facility, disclosure status, and caregiver status). Clinical and treatment-related characteristics (baseline CD4 count, baseline WHO stage, INH prophylaxis, CPT prophylaxis, viral load, status of OI at enrollment, baseline functional status, BMI, baseline & recent adherence level, current TB status).according to WHO ART treatment guideline ART adherence level defined as Good (G): when a patient adherence level is ≥ 95% (of 30 doses ≤ 2 doses missed).Fair (F): when a patient adherence level 85-94% (of 30 doses 3-4 doses missed).Poor (P): when a patient adherence level is ≤ 84% (of 30 doses ≥ 6 doses missed).Disclosed was defined as disclosure of the status that is being HIV positive at least for one individual [17] Functional status was classified as Ambulatory: If the patient able to perform Activity of daily life but not able to work. Bedridden: Not able to perform Activities of daily life [40] The data were collected from the patient charts by one health officer and four clinical nurses by using a data extraction sheet which was designed based on study objectives. To assure the data quality, training was given for the data collectors and the supervisor about the ways of extracting the data based on the study objectives. The tool was also pretested and the data were checked for steadiness and completeness on daily basis by the principal investigator.

Data processing and analysis

Visual examination, performing frequencies and cross-tabulations, verifying missing values, and checking out of range values were used to clean the data before it was coded and put into Epi-data 3.1, which was subsequently exported to STATA 14. The characteristics of the study participants were described using descriptive statistics such as proportions, medians, tables, graphs, and charts. We used the Schoen field residual global test to fit the Cox regression model after confirming the proportional hazard assumption visually (Figure 1). The Kaplan-Meier test was used to estimate survival time, and the Log-rank test was performed to determine whether there was a significant difference in survival time across various categories of variables. To find variables correlated to attrition, a bi-variable cox regression analysis was used. In the bivariable analysis, factors having a p-value <0.2 were fitted to the multivariable Cox regression analysis once again (Figure 2). To determine the strength of the association, both crude and adjusted hazard ratios with the equivalent 95% Confidence Interval (CI) were computed. Variables with a P-value <0.05 were considered statistically significant in multivariable analysis.

Results

### Baseline socio-demographic characteristics of study participants

A total of 565 clients enrolled in ART care were included in the final analysis. Nearly half, 283 (50.09%) of the study participants were females. The

Survival Status
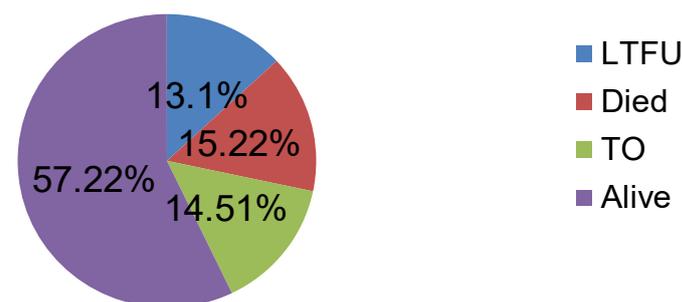
Figure 1. The proportion of survival status among adult HIV patients on ART in Dessie referal Hospital between January 1, 2015, and December 31, 2019.
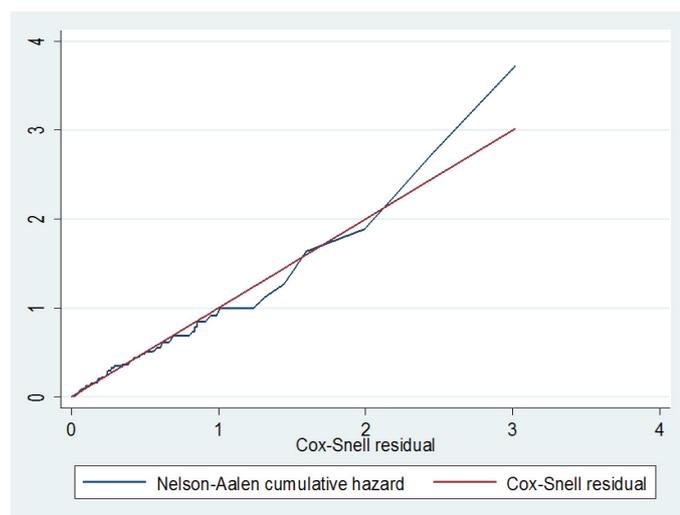
Figure 2. Cox Snell residual graph for checking model adequacy of Cox Model.

median age of 37 (IQR = ± 17) years. Of the total, 292 (51.68%) were married and the majority, 263 (46.55%) of study participants were

Muslim concerning educational status, 176 (31.15%) of participants had a primary level of education. Most of the study participants 443 (73.39%), disclosed their HIV status, and 449 (88.32%) of subjects had caregivers (Table 1).

Clinical and treatment-related characteristics

From a total of 565 study participants enrolled in ART care, about 240 (42.93%) were linked to care with a baseline CD4 count between 201-350cells/ml. The median CD4 count of the participants was 289 (IQR=213-397 cells/ml) and a total of 249 (44.07%) participants were at WHO stage II. More than four-fifth (82.49%) of the patients had been started on Cotrimoxazole prophylaxis therapy. The majority (95.8%) of patients was screened for TB, of which 19.7% were co-infected (Table 2).

Incidence of attrition

Of the 565 adults who initiated ART and followed for 5 years, 323 (57.2%) were retained and on active follow-up while 82 (14.51%) were formally transferred to other health facilities. Eighty-six (15.22%) were reported dead and 74 (13.10%) were LTFU (Figure 3). The overall attrition was 28.3% (95% CI: 24.64, 32.22). The 565 adults on ART contributed a total of 1,127 person-years of observation (Pyo).The incidence rate for LTFU, Dead, and overall attrition was 6.6 per 100 person-year (95%CI, 5.23-8.24), 7.6 per 100 person-year (95%CI 5.2-11.4), and 14.2 per 100 person-year (95%CI, 11.2-20.6) respectively. The attrition by 6 and 12 months were 37 (22.9% [95% CI, 18.0–24.1]) and 35 (21.6% [95% CI, 19.9 – 23.3]).

Predictors of attrition among adult HIV patients on ART

The survival experience of patients was analyzed non-parametrically using the Kaplan-Meir survival curve (Figure 4) against several categories of predictors and log-rank test was used to check the significant association (p-value<0.05) between each predictor variables along with the outcome variable (Figure 5).The log-rank test revealed a significant difference between BMI status, CPT, IPT, comorbidity status, sex, marital status, adherence level, baseline WHO stage, disclosure status, caregiver, educational status, residence, OI, and distance from the health facility. These variables were also crudely associated with HIV patient attrition at a 20% level of significance.

After fitting multivariable analysis, variables such as adherence level, ambulatory functional status, CPT, comorbidity, and disclosure status were found to be significant predictors for Attrition at a 5% level of significance. Among the significant predictors of Attrition being ambulatory functional status increased the risk of attrition by 2.08 (HR=2.08; 95%CI (1.29-3.33)) times compared with those were on working functional status. The hazard of attrition was higher among patients who did not disclose their HIV status by 2.27 (HR=2.27; 95%CI; 1.39-3.69) times compared with their counterparts.

The presence of Comorbidity throughout the follow-up time increases the hazard of Attrition by 2.11 (HR-2.11; 95% CI (1.38-3.23)) times as compared to their counterparts. The hazard of Attrition was increased on patients who didn't take CPT prophylaxis by 1.68 (HR-1.68; 95%CI (1.34-2.49)) times compared with the counterparts. Moreover, the hazards of Attrition among the fair and poor level of adherence were 2.75 (HR=2.75; 95%CI (1.75-4.30)) and 2.16 (HR=2.16; 95%CI (1.39-3.36)) times higher than those who have a good level of adherence respectively (Table 3).

Discussion

The incidence and determinants of attrition among adult HIV/AIDS patients on ART follow-up were investigated in this study. Several factors were included in this cox regression model to explain variance in HIV/AIDS patient attrition. The overall attrition rate was 14.2 per 100 person year in line with studies conducted in Kenya [11] (14.1/100 py) and Northern Ethiopia [14] (14.9/100py). This might be owing to the consistency in the quality of treatment provided to HIV/AIDS patients in these hospitals based on ART recommendations. However, the finding of this study is higher than other studies conducted in Swaziland [15], Zimbabwe [41], and other parts of Ethiopia [36,42-44]. This discrepancy might be due to the only ART center in the town which serves many patients, there may be overloading of patient flows resulting in difficulty in providing adequate health services and access, and ultimately, patient discontent. The other possible explanation could be variations in study design, patient follow-up periods, and definitions of LTFU and attrition might be another factor for the difference. LTFU is defined as a patient who has been missing for at least 90 days, while in studies in Sub-Saharan Africa [45], India [46], and

Table 1. Base line socio-demographic characteristics for adult HIV patients on ART in Dessie Referral Hospital between January 01, 2015 and December 31, 2019.

Variables	Category	Frequency	Percentage (%)
Sex	Male	282	49.91
	Female	283	50.09
Age	15-24	61	10.8
	25-34	156	27.61
	35-44	211	37.35
	≥ 45	137	24.25
Marital status	Single	93	16.46
	Married	292	51.68
	Divorced	101	17.88
	Widowed	79	13.98
Residence	Urban	345	61.06
	Rural	220	38.94
Distance from the health facility	Below 10 km	291	51.5
	10 km and above	274	48.5
Educational status	No education	130	23.01
	Primary	176	31.15
	Secondary	161	28.5
	Tertiary and above	98	17.35
Occupation	Unemployed	95	16.81
	Daily laborer	114	20.18
	Governmental-employee	108	19.12
	Self-employee	103	18.23
	Others*	145	25.66
Religious	Orthodox	212	37.52
	Muslim	263	46.55
	Others**	90	15.93
Disclosure status (n=558)	Disclosed	443	73.39
	Not disclosed	115	20.61
Care giver (n=564)	Yes	499	88.32
	No	65	11.5

Others*=house wife, students, drivers // others**= protestant, catholic

Table 2. Clinical and treatment-related characteristics of adult HIV patients on ART in Dessie referral hospital between January 01, 2015 and December 31, 2019.

| Variables	Categories	Frequency	Percentage (%)
Baseline CLD4 count	≤200	120	21.47
	201-350	240	42.93
	>350	199	35.6
Baseline WHO stage	Stage I	161	28.49
	Stage II	249	44.07
	Stage III/ IV	155	27.4
Last known WHO stage	Stage I	139	24.6
	Stage II	320	56.64
	Stage III/ IV	106	18.76
CPT prophylaxis	Yes	459	82.41
	No	98	17.59
INH prophylaxis	Yes	337	68.08
	No	158	31.92
OI at enrollment	Yes	237	42.25
	No	324	57.75
Types of OI at enrollment	TB	112	47.25
	Toxoplasmosis	13	5.48
	Skin infections	12	5.06
	Chronic diarrheal diseases	16	6.75
	Others**	84	35.44
TB screening status	Positive	111	19.68
	Negative	437	77.48
	On treatment	16	2.84
Current TB status/last known/	Positive	45	7.96
	Negative	520	92.04
Functional status	Working	431	76.28
	Ambulatory	106	18.76
	Bedridden	28	4.96
BMI	<18.5	158	27.96
	18.5-24.9	325	57.52
	≥25	82	14.52
last known adherence	Good	369	65.43
	Fair	128	22.7
	Poor	67	11.88
Hgb/Baseline/	<8	23	4.32
	8-10.9	158	29.7
	11-12.9	126	23.68
	≥13	225	42.29
Types of regimen at start	1c(AZT-3TC-NVP)	13	2.3
	1d (AZT-3TC-EFV)	15	2.65
	1e (TDF-3TC-EFV)	418	73.98
	1j (TDF-3TC-DTG)	31	5.49
	1f /1h/1g/(Others****)	88	15.58

WHO= World health organization, **CPT**= Cotrimoxazole preventive therapy, **IPT**= isoniazid preventive therapy, **BMI**= Body Max Index, **OI**= Opportunistic Infections. **Others****** (1f= TDF-3TC-NVP, 1h= ABC-3TC-NVP, 1g= ABC-3TC-EFV), others** = Cryptococcal meningitis, Herpes simplex, Cytomegalo virus, HIV associated Dementia (HAD), oral candidacies.

Ethiopia [36,43,44], LTFU is defined as a patient who has been missing for at least 180 days. The finding of this study is lower than other studies conducted in Latin America, South Africa, Southern Ethiopia [47-49]. The discrepancy might be due to variations in study design and the operationalization of terms, majority of the studies defined attrition as a combination of (LTFU, death, and transferred out) which could inflate the attrition rate.

In this study patients who were not taking CPT were more likely to be attritted in ART care similar with other studies performed in Myanmar, India, and Tepi [6,31,49].This might be because CPT, given for the prevention of bacterial infections [17,40,50], improves people's health by keeping them from becoming ill as often. In contrast, the patients who do not take CPT more susceptible to a variety of opportunistic infections and they may have such diseases and either develop drug toxicity due to drug-drug interaction or they may prefer to go to Traditional healers (Holly water) by discontinuing such burden of drugs and finally end up with Lost to follow up or Death leads to Attrition [16,39]. Patients who did not disclose their HIV/AIDS status were 2.27 times more likely to undergone Attrition from the treatment Program as compared to their counterparts, similar outcomes are published in sub-Saharan Africa, Tepi [49,51]. This might be due to the social support they receive after declaring their sexual orientation; it will decrease the likelihood of attrition because staying on treatment necessitates extensive support and care from many sectors of the community [52]. Patients in ambulatory functional status had a 2.08 higher risk of attrition than those in working functional status. The social, economic, and financial effects induced by their incapacity to work may be one reason why ambulatory patients are more prone to undergo attrition [42,47,53].

When compared to their contemporaries, patients with co-morbidities had a 2.11 times higher chance of attrition similar to a mixed model study done in
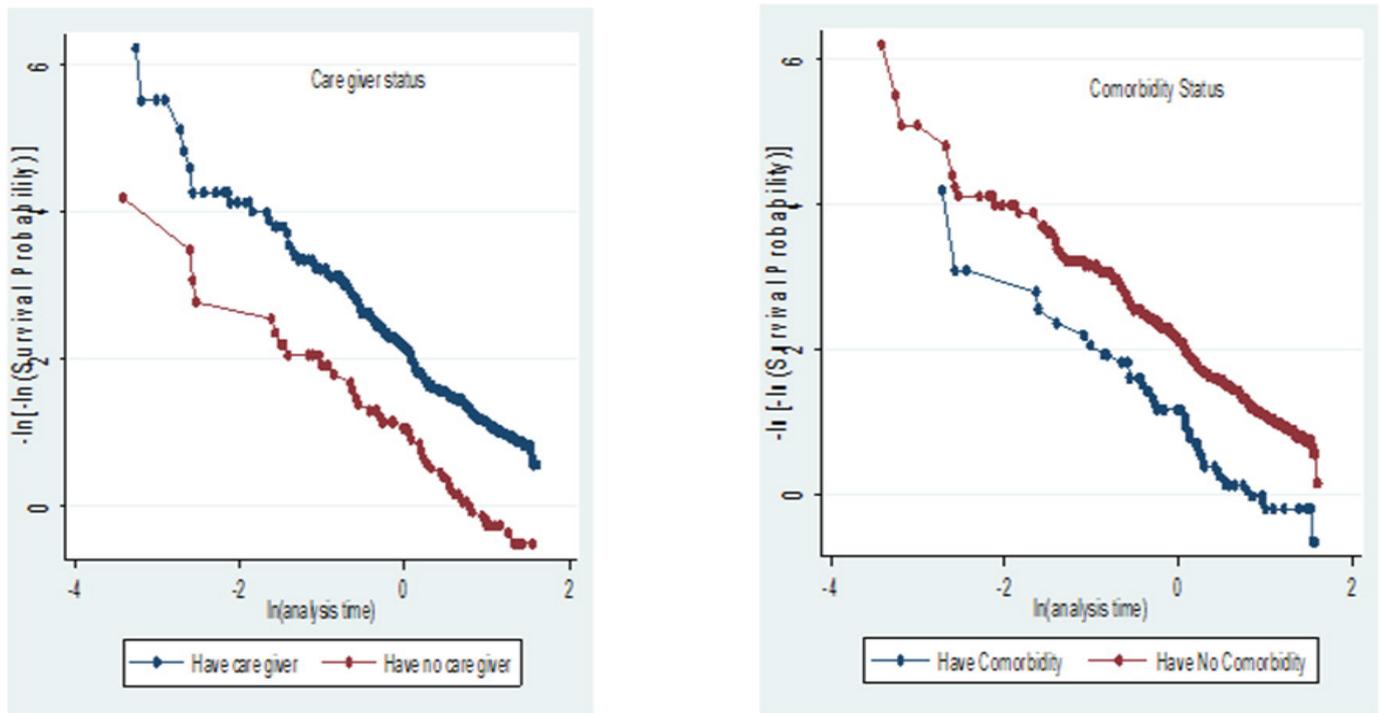
Figure 3. Plot of ln (-ln (survival probability)) versus ln (survival time) for assessing proportional hazard of Care giver status and Comorbidity status of patients at Dessie Referal Hospital, Ethiopia, from January 1, 2015 to December 31, 2019.
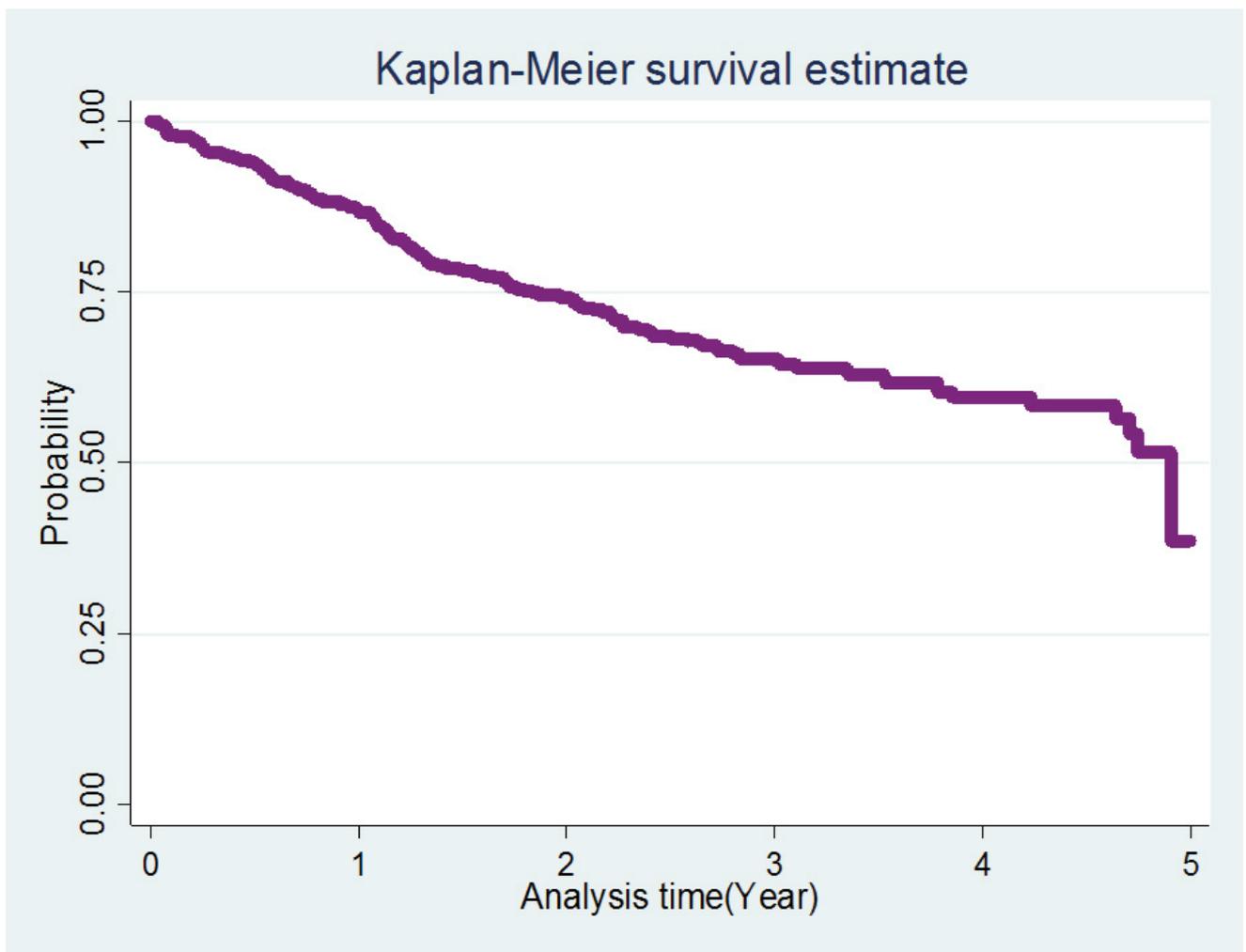
Figure 4. Cumulative survival probability of patients on ART in Dessie referral Hospital from January 01/2015 to December 31/2019.
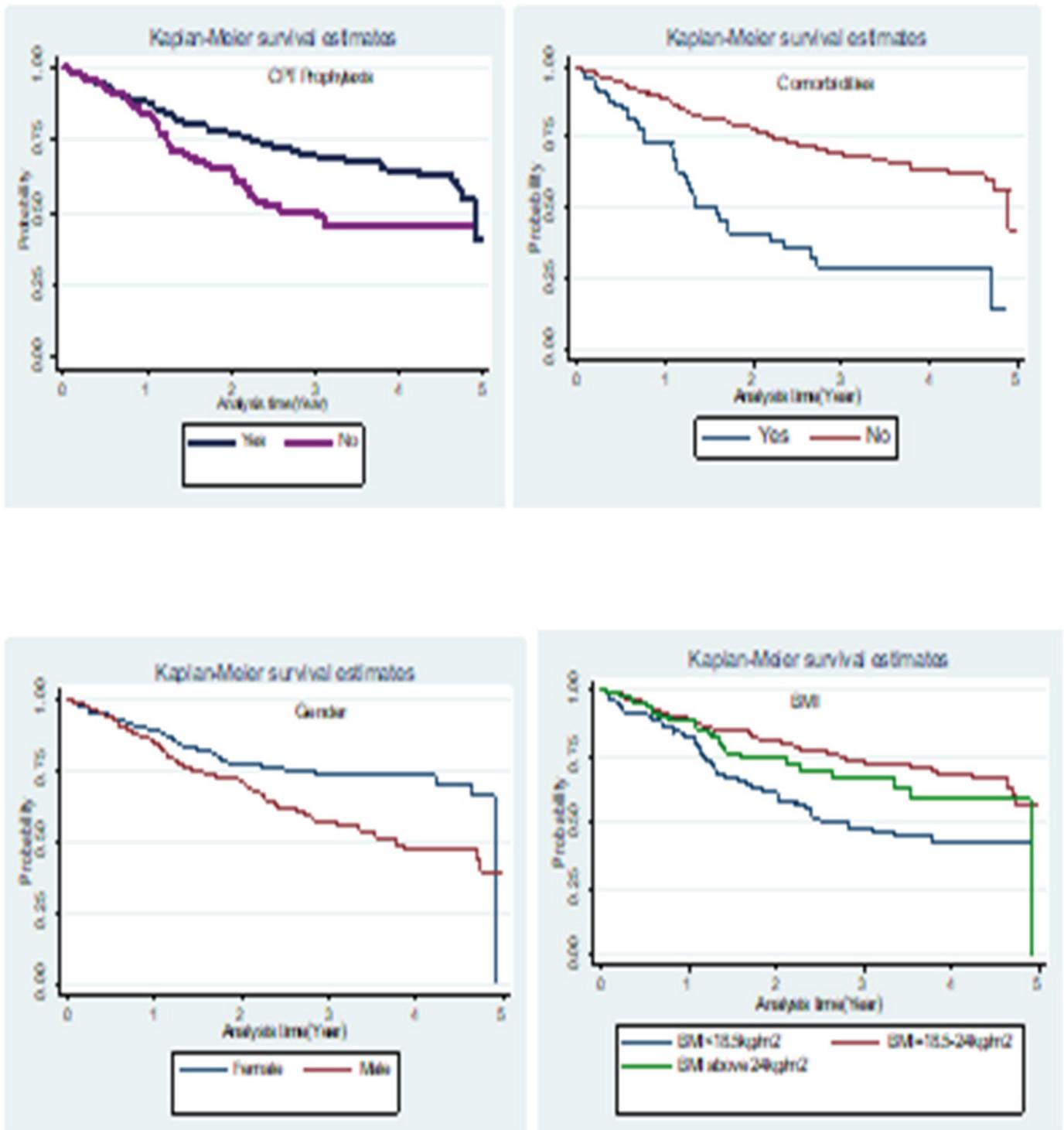
Figure 5. Survival curves (KM curves) for the follow-up of adults on ART according to their BMI level, CPT prophylaxis, sex & co-morbidities at starting of ART.

Table 3. Bivariable and multivariable cox regression analysis for predictors of attrition among adult HIV patients on ART at dessiereferal Hospital between January 1, 2015, and December 31, 2019.

Variables	Survival status			Over all Attrition	
	Censored(405)	LTFU(74)	Death(86)	cHR(95% CI	aHR(95%CI)
Sex					
Female	223	19	41	1	1
Male	182	55	45	1.73 (1.25-2.38)	1.30 (0.91-1.86)
Marital status					
Married	64	16	13	1	1
Single	232	23	27	1.53 (0.98-2.39)	0.73 (0.43-1.23)
Divorced	67	14	20	1.61 (1.05-2.45)	0.98 (0.61-1.55)

				cHR	aHR
Widowed	42	21	16	2.44 (1.62-3.68)	1.34 (0.82-2.18)
Educational status					
2nd & above	201	38	20	1	1
Primary	126	17	33	1.28 (0.88-1.87)	1.06 (0.68-1.68)
No education	78	19	33	2.12 (1.46-3.09)	0.89 (0.58-1.36)
Residence					
Urban	264	38	43	1	1
Rural	141	36	43	1.93 (1.42-2.64)	1.12 (0.74-1.72)
Disclosure status					
Disclosed	350	34	59	1	1
Not disclosed	55	40	27	3.51 (2.55-4.81)	2.27 (1.39-3.69)**
Care giver					
Have care giver	381	54	64	1	1
No care giver	24	20	22	3.52 (2.47-5.02)	1.01 (0.58-1.73)
Distance from HF					
Below 10 km	222	34	35	1	1
Above 10 km	183	40	51	1.53 (1.12-2.09)	0.89 (0.58- 1.34)
Baseline CD4 count (In cells/ml)					
>350	161	22	16	1	1
201-350	58	37	45	2.02 (1.37-2.97)	1.22 (0.73 - 2.05)
≤200	81	15	24	1.81 (1.16-2.83)	1.28 (0.83 - 1.98)
Adherence (last known)					
Good	308	33	28	1	1
Fair	66	30	32	4.36 (2.96-6.42)	2.75 (1.75-4.30)**
Poor	31	10	26	3.79 (2.57-5.59)	2.16 (1.39-3.36)**
TB screening status (at enrolment)					
Negative	332	52	53	1	1
Positive	65	20	26	1.99 (1.40-2.82)	1.18 (0.70-1.99)
On treatment	7	2	7	2.43 (1.23-4.80)	1.35 (0.58-3.14)
Body mass index (BMI) in kg/m^2					
≥25	94	19	45	1	1
18.5-24.9	252	37	36	0.75(0.47-1.19)	2.42(0.87-4.29)
<18.5	59	18	5	1.65(1.02-2.65)	1.44(0.67-1.95)
CPT prophylaxis					
No	72	28	16	1	1
Yes	330	42	69	1.74(1.22-2.47)	1.68(1.14-2.49)**
Functional status (Baseline)					
Working	363	33	35	1	1
Ambulatory	35	37	34	5.98 (4.27-8.37)	2.08 (1.29-3.33)**
Bedridden	7	4	17	6.96 (4.25-11.41)	1.96 (0.95-4.07)
WHO Stage (Baseline)					
Stage one	143	8	7	1	1
Stage two	202	23	24	1.68 (0.94-3.01)	1.45 (0.76-2.76)
Stage 3 or 4	60	43	55	11.19 (5.83-21.51)	2.70 (0.95-6.94)
Comorbidity status					
No	369	56	67	1	1
Yes	31	18	19	3.05 (2.11-4.41)	2.11 (1.38-3.23)**
OI (atenrollment)					
No	250	36	38	1	1
Yes	151	38	48	1.56 (1.14-2.12)	0.57 (0.35-1.87)

cHR = crude hazard ratio, aHR = adjusted hazard ratio, CI=confidence interval, *=pvalue<0.05, OI=opportunistic infection, WHO=world health organization, **=pvalue<0.01

Uganda and Kenya [54]. Comorbidities are additional chronic diseases that may jeopardize the health of HIV-positive people [3,29], these patients are forced to take more medicine, resulting in pill load and attrition from therapy. Individuals may be overburdened by these numerous illness conditions, and their HIV prognosis may deteriorate as a result, patients may be lost and/or die [40,50].When comparing patients with fair or poor adherence to those with strong adherence, the risk of attrition was more than twice as high. This finding is in agreement with studies conducted in Kembata Hadiya and Adama [55,56], suggesting that patients with poor adherence to ART medications are more likely to stop taking them [28,29,39],resulting in treatment failure and mortality [54].

The retrospective aspect of the investigation, which lacks completeness of certain potentially relevant variables such as drug use, might be a possible drawback of this study. There may be changes in these characteristics over time because the study utilized baseline socio-demographic and clinical data.

Conclusion

The rate of attrition was high in this study. Patients on ART who did not disclose their HIV status, poor level of adherence, those who did not take CPT prophylaxis, ambulatory functional status, and who had co-morbidity were at higher risk of Attrition. As a result, paying greater attention and closely following up on these high-risk populations in order to reduce attrition.

Declaration

Ethical approval and consent to participate

Ethical approval has been received from the Institutional Review Board (IRB) of the University of Gondar, College of Medicine and Health Science. Supportive letter was obtained from Dessie Refereral Hospital administration office to collect the data. All study participants are given written information about the research project, its benefits, and risks. They are informed that they have the choice to leave the study at any time. Prior to the intake information, written and verbal informed consent was received. Regarding ethical issues, this study protocol was conducted in accordance with the World Medical Association (WMA) Declaration of Helsinki.

Consent for Publication

Not applicable

Availability of Data and Materials

The data set analyzed for this study is not publicly available due to restriction in the IRB consent but may be available from the corresponding author based on reasonable request.

Authors Contributions

GSA: participated in conceptualization, data collection, data analysis, and original drafting of proposals; AAG, AGB, and TYB contributed on data analysis, original drafting, visualization, and validation for the manuscript. All authors reviewed and approved the final version of the manuscript.

Competing Interests

Authors declare that they have no conflict of interest

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References

1. Global AIDS Up Date UNAIDS. (2016).

2. Htet, KM, Soe KT, Oo MM, and Hone S, et al. "Early success with retention in care among people living with HIV at decentralized art satellite sites In Yangon, Myanmar, 2015–2016." *Front Public Health* 7 (2019).

3. National Department Of Health South Africa . "National Consolidated Guidelines For The Prevention Of Mother-to-Childtransmission of HIV (PMTCT) and the Management of HIV in Children, Adolescents and Adults." (2015).

4. WHO Global Health Statistics Observations (Gho) Data. (2018).

5. Ta, B. "Incidence rate and associated factors of loss to follow up among patients initiated antiretroviral therapy program in Hiwot Fana Specialized University Hospital, Harar." (2018).

6. Alvarez, Uria G, Naik Pk, Pakam R, and Midde M. "Factors associated with attrition, mortality, and loss to follow up After antiretroviral therapy initiation: Data from an HIV cohort study In India." *Glob Health Action* 6 (2013): 21682.

7. Balde, A, Lievre L, Maiga Ai, and Diallo F, et al. "Risk factors for loss to follow-up, transfer or death among people living with HIV on their first antiretroviral therapy regimen in mali." *HIV Med* 20 (2019): 47-53.

8. Bucciardini, R, Fragola V, Abegaz T, and Lucattini S, et al. "Retention in care of adult HIV patients initiating antiretroviral therapy in Tigray, Ethiopia: A prospective observational cohort study." *Plos One* 10 (2015): E0136117.

9. Abrha, Gesesew H, Asefa H, and Shaweno Adewo T. "Time to attrition and factors associated among adults enrolled in pre-anti- retroviral therapy care in tepi general hospital, Ethiopia." *Int J Health Med* 3 (2018): 6.

10. Asiimwe, SB, Kanyesigye M, Bwana B, and Okello S, et al. "Predictors of dropout from care among HIV-infected patients initiating antiretroviral therapy at a public sector HIV treatment clinic in Sub-Saharan Africa." *Bmc Infect Dis* 16 (2016).

11. Brown, LB, Getahun M, Ayieko J, and Kwarisiima D, et al. "Factors predictive of successful retention in care among HIV-infected men in a universal test-and-treat setting in Uganda and Kenya: A mixed methods analysis." *Plos One* 14 (2019): E0210126.

12. Elul, B, Saito S, Chung H, and Hoos D, et al. "Attrition from human immunodeficiency virus treatment programs in africa: A longitudinal ecological analysis using data from 307 144 patients initiating antiretroviral therapy between 2005 and 2010." *Clin Infect Dis* 64 (2017): 1309-1316.

13. Boeke, CE, Nabitaka V, Rowan A, and Guerra K, et al. "Assessing linkage to and retention in care among HIV patients in Uganda and identifying opportunities for health systems strengthening: A descriptive study." *Bmc Infect Dis* 18 (2018).

14. Bucciardini, R, Fragola V, Abegaz T, and Lucattini S, et al. "Predictors of attrition from care at 2 years in a prospective cohort of HIV-infected adults in Tigray, Ethiopia." *Bmj Glob Health*. 2017;2 (3):E000325.

15. Khumalo, Yjcacp PG. "Antiretroviral treatment attrition in Swaziland: A population-based study." (2016).

16. Raffaella, Bucciardini P, Paola Tatarelli, Esayas Haregot Hilawe, and Vincenzo Fragola Te. "Gender differences in death and loss to follow-up among HIV-positive patients on antiretroviral therapy in Tigray, Ethiopia." (2019).

17. WHO. WHO Antiretroviral Therapy (Art) coverage among all age groups. (2016).

18. Khumalo, PG, Chou Yj, and Pu C. "Antiretroviral treatment attrition in Swaziland: A population-based study." *Epidemiol Infect* 144 (2016): 3474-3482.

19. Makurumidze, Rm-A, Tsitsi Decroo, Tom Choto, and Regis C, et al. "Retention and predictors of attrition among patients who started antiretroviral therapy in Zimbabwe's national antiretroviral therapy programme between 2012 and 2015." (2019).

20. Mekuria, LA, Prins JM, Yalew AW, and Sprangers MA, et al. "Retention in HIV care and predictors of attrition from care among HIV-infected adults receiving combination anti-retroviral therapy in Addis Ababa." *Plos One* 10 (2015): E0130649.

21. Nsanzimana, S, Semakula M, Ndahindwa V, and Remera E, et al. "Retention in care and virological failure among adult HIV+ patients on second-line art in rwanda: A national representative study." *Bmc Infect Dis* 19 (2019).

22. Palladino, C, Briz V, Bellon JM, and Bartolo I, et al. "Predictors of attrition and immunological failure in HIV-1 patients on highly active antiretroviral therapy from different healthcare settings in Mozambique." *Plos One* 8 (2013): E82718.

23. Berheto, TM, Hinderaker SG, Senkoro M, and Tweya H, et al. "Body and mind: Retention in antiretroviral treatment care is improved by mental health training of care providers in Ethiopia." *Bmc Pub Health* 18 (2018): 896.

24. Endalkachew, Mekonnen E. "Predictors of mortality among adult patients enrolled on antiretroviral therapy in Hiwotfana Specialized University Hospital, Eastern Ethiopia: Retrospective cohort study." *J HIV Clin Sci Res* (2018): 7-11.

25. Lifson, AR, Demissie W, Tadesse A, and Ketema K, et al. Barriers to retention in care as perceived by persons living with HIV in rural Ethiopia." *J Int Assoc Prov AIDS Care* 12 (2012): 32-38.

26. Melaku, Z, Lamb MR, Wang C, and Lulseged S, et al. "Characteristics and outcomes of adult Ethiopian patients enrolled in HIV care and treatment: A multi-clinic observational study." *Bmc Publ Health* 15 (2015).

27. Gesesew, HA. "Time to attrition and associated factors among adults enrolled in pre-anti- retroviral therapy care in Tepigeneral Hospital, Ethiopia." (2018).

28. Tamrat, Endebu GA. "Attrition rate and predictors among adult patients receiving antiretroviraltherapy in Adama Hospital Medical College, Central Ethiopia: A retrospective cohort study design, 2006." (2019).

29. Wubshet, M, Berhane Y, Worku A, and Kebede Y, et al. "High loss to followup and early mortality create substantial reduction in patient retention at antiretroviral treatment program in North-West Ethiopia. *Isrn AIDS* (2012): 1-9.

30. Amin, Hassan S, Kennedy K Ndirangu, Eduard J Sanders, and Tobias F Rinke De et al. "Incidence and predictors of attrition from antiretroviral care among adults in a rural HIV clinic in Coastal Kenya: A retrospective cohortstudy. *Bmc Pub Health* (2015).

31. Kmh, KTS, Oo HN, and Mmo SH. "Early successwith retention in care among people livingwith HIV atdecentralized art satellite sites in Yangon, Myanmar, 2015–2016." (2019).

32. Carriquiry, G, Fink V, Koethe JR, Giganti MJ, et al. "Mortality and loss to follow-up among HIV-infected persons on long-term antiretroviral therapy in latin America and the Caribbean." *J Int AIDS Soc* 18 (2015): 20016.

33. Geng, Eh, Nash D, Kambugu A, and Zhang Y, et al. "Retention in care among HIV-infected patients in resource-limited settings: emerging insights and new directions." *Current HIV/AIDS Reports* 7 (2010): 234-244.

34. Kop MLV. "Retention during the first year of HIV care and the effect of an interactive text-messaging service on patient engagement in care." (2019).

35. FHAPCO. "HIV Prevention In Ethiopia National Road Map 2018 - 2020 Final_Final." (2018).

36. Legese, Mekuria, Jan M Prins, Alemayehu W Yalew, and Mirjam AG Sprangers, et al. "Retention in HIV care and predictors of attrition from care among HIV-infected adults receiving combination anti-retroviral therapy in Addis Ababa." *Plos One* (2015).

37. Aye, Thida, Sai Ko Zaw, Andrew A. Lover, and Philippe Cavailler, et al. "Retention and risk factors for attrition in a large public health art program in Myanmar: A retrospective cohort analysis." *Plos One* (2014).

38. Tadege M. "Predictors associated with HIV/AIDS patients dropout from antiretroviral therapy at Mettu Karl Hospital, Southwest Ethiopia." *Bmc Research Notes* 12 (2019).

39. Thida, A, Tun ST, Zaw SK, and Lover AA, et al. "Retention and risk factors for attrition in a large public health art program in myanmar: A retrospective cohort analysis." *Plos One* 9 (2014): E108615.

40. Zhu, H, Napravnik S, Eron J, and Cole S, et al. "Attrition among human immunodeficiency virus (HIV)- infected patients initiating antiretroviral therapy in China, 2003-2010." *Plos One* 7 (2012): E39414.

41. Tsitsi, Mutasa-Apollo, Kudakwashe C Takarinda, Janet Dzangare, and Owen Mugurungi et al. "Patient retention, clinical outcomes and attrition-associated factors of hiv-infected patients enrolled in zimbabwe's National Antiretroviral Therapy Programme, 2007–2011." *Plos One* (2018).

42. Mamowubshet, Alema Y, Yehuworku Y, and Ermiasdiro E. "High loss to followup and earlymortality create substantial reduction in patient retention at antiretroviral treatment program in North-West Ethiopia." *Int Schol Res Net* (2012).

43. Solomon, Odafe, Hadiza Khamofu, Obinna Ogbanufe, and Edward A. Oladele, et al. "The pattern of attrition from an antiretroviral treatment program in Nigeria." *Plos One* (2015).

44. Tadege M. "Predictors associated with HIV/AIDS patients dropout from antiretroviral therapy at Mettu Karl Hospital, Southwest Ethiopia." *Bmc J* (2019).

45. Stephen, Asiimwe B, Michael Kanyesigye, Bosco Bwana, and Samson Okello, et al. "Predictors of dropout from care among HIV-infected patients initiating antiretroviral therapy at a public sector HIV treatment clinic in Sub-Saharan Africa." Bmc *Infect Dis* (2016).

46. Gerardo, Alvarez-Uria P, Raghavakalyan Pakam, and Manoranjan Midde. "Factors associated with attrition, mortality, and loss to follow up after antiretroviral therapy initiation: Data from an HIV cohort study in India." 2013.

47. Gabriela, Carriquiry, Valeria Fink, John Robert Koethe, and Mark Joseph Giganti, et al. "Mortality and loss to follow-up among HIV-infected persons on long-term antiretroviral therapy in Latin America and the Caribbean." *J Int AIDS Soc* 18 (2015): 20016.

48. Phillips, TK, Clouse K, Zerbe A, and Orrell C, et al. "Linkage to care, mobility and retention of HIV-positive postpartum women in antiretroviral therapy services in South Africa." *J Int AIDS Soc* 21 (2018): E25114.

49. Tamrat, Shaweno AH, and Hailay Abrha Gesesew. "Time to attrition and factors associated among adults enrolled in pre-anti- retroviral therapy care in Tepi General Hospital, Ethiopia." *Int J Health Med* (2018).

50. Yotebieng, M, Rahmalia A, Price Mh, and Hartantri Y, et al. "Are there differences in HIV retention in care between female and male patients in indonesia? A multi-state analysis of a retrospective cohort study." *Plos One*. 14 (2019): E0218781.

51. Matthew, Lamb R, Wafaa M. El-Sadr, Elvin Geng, and Denis Nash. "Association of adherence support and outreach services with total attrition, loss to follow-up, and death among art patients in Sub-Saharan Africa." *Plos One* (2016).

52. Claudia, Palladino, Vero Nica Briz MA, Nuno Taveira and Cdpnmmabo F. "Predictors of attrition and immunological failure in HIV- 1 patients on highly active antiretroviral therapy from different healthcare settings in Mozambique." *Plos One (*2018).

53. Batya, Elul, Suzue Saito, Hannah Chung, and David Hoos,et al. "Attrition from human immunodeficiency virus treatment programs in africa: A longitudinal ecological analysis using data from 307 144 patients initiating antiretroviral terapy between 2005 and 2010." *Clin Infect Dis* (2017).

54. Lillian, Brownid B, Monica Getahunid, James Ayieko, and Dalsone Kwarisiima, et al. "Factors predictive of successful retention in care among HIV-infected men in a universal test-and-treat setting in Uganda and Kenya: A mixed methods analysis." *Plos One* (2018).

55. Wondimu, Ayele A, Alem Desta and Felicia A. Rabito. "Treatment Outcomes and their determinants in HIV patients On Anti-retroviral treatment program in selected health facilities of Kembata And Hadiya Zones, Southern Nations, Nationalities And Peoples Region, Ethiopia." *Biomed Cent* (2015).

56. Mekonnen, E. "Predictors of mortality among adult patients enrolled on antiretroviral therapy in Hiwotfana Specialized University Hospital, Eastern Ethiopia: Retrospective cohort study." (2018).