

Antiretroviral Therapy Adherence Among Patients Enrolled Before and After The Initiation of Universal Test and Treat Strategy: A Comparative Cross-Sectional Study

Yitayish Damtie^{1*}, Dabere Nigatu², Fentaw Tadese³, Melaku Yalew¹

¹Department of Reproductive and Family Health, School of Public Health, College of Medicine and Health Sciences, Wollo University, Ethiopia;

²Department of Reproductive Health and Population Studies, School of Public Health, College of Medicine and Health Sciences, Bahir Dar University, Ethiopia; ³Department of Epidemiology and Biostatistics, School of Public Health, College of Medicine and Health Sciences, Wollo University, Ethiopia

ABSTRACT

Background: Poor adherence becomes a critical problem in managing Human Immunodeficiency Virus (HIV)-infected patients receiving Antiretroviral Therapy (ART). Evidence of adherence to antiretroviral therapy after the initiation of Universal Test and Treat (UTT) strategy was limited in Ethiopia. Hence, this study aimed to compare adherence to antiretroviral therapy before and after the initiation of universal test and treat strategy and factors affecting adherence among HIV positive adults in Dessie town.

Methods: A comparative cross-sectional study was conducted on 594 HIV positive adults selected using systematic sampling. Interview and patient record review were used to collect data. The data were analyzed using SPSS version 23. Bi-variable and multivariable logistic regression models were used to identify factors associated with ART adherence. Adjusted Odds Ratio (AOR) with a 95% Confidence Interval (CI) was used as a measure of association. Statistical significance was declared at a P-value less than 0.05.

Result: The proportion of ART adherence among patients enrolled before and after the initiation of UTT strategy was 55.4% (95% CI: 49.9%, 60.6%) and 49.3% (95% CI: 43.5%, 54.8%) respectively. Absence of depression (AOR =3.87, 95% CI: 1.96, 7.64), eating three or more meals per day (AOR =2.65, 95% CI: 1.08, 6.49) and absence of concomitant illness (AOR =0.42, 95% CI: 0.23, 0.76) were factors associated with better ART adherence

Conclusion: ART adherence was not affected by the introduction of the UTT strategy in HIV treatment and care program. Depression, meal frequency and concomitant illness were factors associated with ART adherence. Efforts should be made to improve adherence through tailored interventions to overcome factors linked with poor adherence.

Keywords: ART adherence; Universal test; Treatment; CD₄ count; Ethiopia

List of Abbreviations: AIDS- Acquired Immune Deficiency Syndrome; AOR- Adjusted Odd Ratio; ART- Antiretroviral Therapy; CD₄- Cluster Differentiation4; CI- Confidence Interval; COR- Crude Odds Ratio; HIV- Human Immunodeficiency Virus; PHQ-9- Patient Health Questionnaire 9; SD- Standard Deviation; SSA- Sub Saharan Africa; UTT- Universal Test and Treat; WHO- World Health Organization.

BACKGROUND

HIV/AIDS becomes the major threat to the world population. Although significant progress was seen in expanding HIV prevention and care services worldwide, 36.7 million people were living with HIV, 1.8 million people were newly infected and 1 million were died due to AIDS in 2016. Sub-Saharan Africa (SSA)

shares 64% of new HIV infection [1]. According to 2017 HIV related estimate, 722, 248 people were living with HIV, 22,827 people were newly infected and 14,872 were died in Ethiopia [2].

The World Health Organization (WHO) recommends a greater than 95% adherence to get the best outcome of antiretroviral treatment [3]. But, suboptimal adherence became the major critical

Correspondence to: Yitayish Damtie, Department of Reproductive and Family Health, School of Public Health, College of Medicine and Health Sciences, Wollo University, Ethiopia, Telephone: +251943517982; E-mail: yitutile@gmail.com

Received: November 20, 2020; **Accepted:** November 27, 2020; **Published:** December 5, 2020

Citation: Damtie Y, Nigatu D, Tadese F, Yalew M (2021) Malaria as Public Health Problem and SWOT Analysis of Program Approach-“A Case Study from Baran District Rajasthan”. J Trop Dis 9:267. doi: 10.35248/2329-891X.2021.9.267

Copyright: ©2021 Damtie Y, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

problems in managing HIV-infected patients receiving ART. Results of a meta-analysis in SSA indicated that a pooled estimate of only 55% of the populations achieved adequate levels of adherence [4]. Evidence from a systematic review of adherence to ART in SSA also indicated that the average ART adherence score was 72.9% [5]. In Ethiopia adherence to ART ranged from 63.8%-95.5% [6-10], most of them were below the WHO recommendation.

Sub-optimal adherence imposed a significant impact on the patient's health. It resulted in the development of detectable viral loads, declining Cluster Differentiation4 (CD₄) counts and disease progression [11, 12]. For instance, the result of longitudinal study showed that 0%, 8% and 41% of patient with >90%, 51-90%, ≤50% adherence were progressed to AIDS over the 13 months follow-up period respectively [13]. A study also demonstrated that subjects with adherence levels of 0-79%, 80-99% and 100% had 53 cells/μL, 159 cells/μL and 179 cells/μL CD₄ increment from the baseline to 12 months respectively [14]. As studies have shown, socio-demographic factors [15] medication-related factors, health system factors [16] and psychosocial factors [5] affect adherence to ART medication.

Previously, in 2013, WHO strongly recommended initiating ART among all HIV positive individuals with a CD₄ count of 500 cells/mm³ or less by giving priority to those patients who had advanced HIV clinical disease (WHO clinical stage 3 or 4) or a CD₄ count of less than 350 cells/mm³ [17]. But in 2015, WHO launched a new UTT strategy that involves early identification of all HIV-infected individuals, followed by immediate ART initiation regardless of CD₄ count or Viral Load (VL). This will reduce the incidence of HIV infection and opportunistic infection, early disease progression, and the burden on the health service [18]. Ethiopian government adopted this approach in 2016 and began to implement it in ART clinics of Dessie Town since June 12th, 2016.

Even though adherence to ART before the initiation of universal test and treat strategy had been well investigated, limited evidence exists about adherence after the initiation of the UTT strategy. Thus, this study aimed to compare antiretroviral therapy adherence before and after the initiation of test and treat strategy and associated factors among HIV positive people attended ART clinics of Dessie town.

METHODS

Study area, study design and participants

A comparative cross-sectional study was conducted in ART clinics of Dessie town from April 15th, 2018 to June 5th, 2018. Dessie is the center of South Wollo zone located 401 kilometer away from Addis Ababa, the capital city of Ethiopia and 480 kilometer away from Bahir Dar, the capital city of Amhara region. According to the 2018 Dessie town Administrative Health Office report, two government hospitals and three health centers were providing ART service for 8,821 adult HIV patients enrolled before the initiation of UTT strategy and 926 adult HIV patients enrolled after the initiation of UTT strategy. The study population was systematically selected HIV positive adults who attended ART clinics of Dessie town. Those HIV positive people aged greater than or equal to 18 years and who were on ART for at least three months were included in the study.

Sample size and sampling procedure

The sample size was calculated using Epi Info version 7.1 with the assumption of 89.1% ART adherence among people who didn't

encounter opportunistic infection and 2.81 odds ratio taken from a study done in eastern Ethiopia [19], 1 to 1 ratio of exposed to unexposed, 80% power and 95% confidence level. Thus, adding 10% for non-response, the minimum required sample size was 594 (297 for patients who started ART before the initiation of UTT strategy and 297 for patients who started ART after the initiation of UTT strategy). The sample size was proportionately allocated to each health facility providing ART service based on the average number of client flow per month. Then, the study participants were selected by systematic sampling technique until reaching the sample size.

Data collection procedures and measurements

Data were collected by face to face interview using a structured and pretested Amharic version questionnaire. Careful design of questionnaires to avoid confusion and provision of adequate time for recall of long term memory was made to address the bias. Medical records were also reviewed to identify clinical markers like CD₄ count, viral load and WHO clinical staging. Five trained nurses have collected the data with supportive supervision of the principal investigator and one supervisor. The questionnaire composed of socio-demographic factors, medication-related factors, health care related factors, disease characteristics and psychosocial and behavioral factors that have taken from similar literatures [5, 15, 16].

Patient Health Questionnaire (PHQ-9) checklist was used to assess depression. As a result, patients who scored greater than or equal to the median value were classified as having depression and patients who scored less than the median value were classified as have no depression [7].

A set of ten yes or no response questions which were taken from previous works of literature were used to measure patients' knowledge of HIV/AIDS and its treatment. Then patients who scored greater than or equal to the median value were classified as having good knowledge whereas patients who scored less than the median value were classified as having poor knowledge of HIV/AIDS [20].

Similarly, ten questions with yes or no response options were used to measure patients' perceived stigma. Then patients who scored greater than or equal to the median value were classified as having perceived stigma whereas patients who scored less than the median value were classified as had no perceived stigma respectively [21].

Adherence to ART regimen was assessed by using eight questions designed to assess adherence to medication. Seven of the questions were with yes or no response options coded as 1 or 0 respectively. The 8th question was with five response options taking a score between 0 and 4 (0 always, 1 usually, 2 sometimes, 3 once a while and 4 never). Then, those patients who scored less than or equal to the median value were classified as poor adherence whereas those patients who scored greater than the median value were classified as good adherence [22].

The cronbach alpha of 0.87, 0.85, 0.93 and 0.91 was obtained for adherence, knowledge, stigma and depression checklists after pretesting thirty adult HIV infected patients enrolled before and after the initiation of the UTT strategy and meet the study inclusion criteria in Kombolcha health center which has similar characteristics with the study area.

Statistical analysis

Data were coded and entered to Epi Data Version 3.1 and exported to SPSS Version 23 statistical software for statistical analysis. Descriptive statistics such as frequency, proportion, mean with Standard Deviation (SD) and median with inter-quartile range were computed. The association between independent variables and adherence to ART was made using a binary logistic regression model. All independent variables having a p-value less than 0.2 were included in the multivariable logistic regression model. Multicollinearity was checked using the standard error. The p-value of the Hosmer and Lemeshow test of the model fitness was 0.4. Variables having adjusted odds ratio with 95% confidence interval not inclusive of one was considered as statistically significant predictors of ART adherence.

RESULTS

Socio-demographic characteristics

In this study, 289 HIV positive adult patients enrolled before and 292 HIV positive adult patients enrolled after the initiation of UTT strategy were involved and making a response rate of 97.8%. The mean age of patients enrolled before and after the initiation of UTT strategy was 36.2 with ± 9.8 SD and 36.7 with ± 8.6 SD respectively. One hundred seventy-one (59.2%) of patients enrolled before and 152 (52.1%) of patients enrolled after the initiation of UTT strategy were females. Two hundred thirty two (80.3%) patients enrolled before and 218 (74.7%) of patients enrolled after the initiation of UTT strategy were urban residents. In case of marital status, 155 (53.6%) and 178 (61.0%) of patients enrolled before and after the initiation of UTT strategy were married (Table 1).

Table 1: Socio-demographic characteristics of adult HIV patients attended Dessie town ART clinics, 2018.

Variables	Before UTT(n=289)	After UTT(n=292)
Sex		
Male	118 (40.8%)	140 (47.9%)
Female	171 (59.2%)	152 (52.1%)
Marital status		
Single	42 (14.5%)	45 (15.4%)
Married	155 (53.6%)	178 (61.0%)
Widowed	29 (10%)	13 (4.5%)
Divorced	63 (21.8%)	56 (19.2%)
Ethnicity		
Amhara	262 (90.7%)	275 (94.2%)
Others ^a	27 (9.3%)	17 (5.8%)
Religion		
Christian ^b	129 (44.6%)	102 (34.9%)
Muslim	160 (55.4%)	190 (65.1%)
Residence		
Urban	232 (80.3%)	218 (74.7%)
Rural	57 (19.7%)	74 (25.3%)
Level of education		
No formal education	67 (23.2%)	71 (24.3%)
Primary education	112 (38.8%)	116 (39.7%)
Secondary education	71 (24.6%)	78 (26.7%)
College and above	39 (13.5%)	27 (9.2%)
Occupation		
Government employee	39 (13.5%)	31 (10.6%)

Private employee	45 (15.6%)	36 (12.3%)
House wife	35 (12.1%)	52 (17.8%)
Merchant	54 (18.7%)	55 (18.8%)
Farmer	48 (16.6%)	62 (21.2%)
Daily laborer	49 (17%)	39 (13.4%)
Others ^c	19 (6.6%)	17 (5.8%)
Family size		
≤5	269 (93.1%)	277 (94.9%)
≥6	20 (6.9%)	15 (5.1%)
Frequency of meal/day		
<3meal/day	21 (7.3%)	8 (2.7%)
≥3meal/day	268 (92.7%)	284 (97.3%)
With whom patient live		
Family	113 (39.1%)	77 (26.4%)
Partner	140 (48.4%)	179 (61.3%)
Alone	36 (12.5%)	36 (12.3%)
Wealth quintile		
Lowest	59(20.4%)	50(17.0%)
Lower	72 (25.0%)	87 (29.8%)
Middle	26 (9.0%)	32 (11.0%)
Higher	87 (30.1%)	62 (21.2%)
Highest	45 (15.5%)	49 (21.0%)

a: Oromo and Tigray; b: protestant and orthodox tewahido; c: Student and jobless; UTT: Universal Test and Treat; ART: Antiretroviral Therapy.

Psychosocial and behavioral characteristics

Two hundred seventy eight (96.2%) HIV positive patients who started ART before and 285 (97.6%) of patients who started ART after the initiation of UTT strategy used reminders to take their ART medication. Two hundred ten (72.7%) patients who initiated ART before and 189 (64.7%) of patients who initiated ART after the UTT strategy had good knowledge to HIV/AIDS and its treatment. Two hundred sixty four (91.3%) and 270 (92.5%) of patients enrolled before and after the initiation of UTT strategy disclosed their HIV status to other individuals respectively. Fourteen (13.8%) patients who initiated ART before and 35 (12%) of patients who initiated ART after the initiation of UTT strategy experienced depression (Table 2).

Diseases related characteristics

A viral load test was done for all patients enrolled before the initiation of UTT strategy. As a result, 247 (85.5%) and 42 (14.5%) of patients had a viral load of less than 1000 copies/ml and greater than or equal to 1000 copies/ml respectively. One hundred ten (37.7%) patients who started ART after the initiation of UTT strategy had no viral load test result, 156 (53.4%) patients had a viral load of less than 1000 copies/ml and 26 (8.9%) patients had a viral load of greater than or equal to 1000 copies/ml respectively. One hundred fifty-six (54%) patients who started ART before and 21 (7.2%) patients who started ART after the initiation of UTT strategy had a baseline CD4 count of less than 200mm³. Forty-four (15.2%) patients enrolled before and 237 (81.2%) patients enrolled after the initiation of UTT strategy had a baseline WHO stage I. Ten (3.5%) patients who started ART before and 11 (3.8%) patients who started ART after the initiation of UTT strategy had experienced opportunistic infections (Table 3).

Table 2: Psychosocial and behavioral characteristics of adult HIV patients attended Dessie town ART clinics, 2018.

Variables	Before UTT(n=289)	After UTT(n=292)
Using reminders		
Yes	278 (96.2%)	285 (97.6%)
No	11 (3.8%)	7 (2.4%)
Feel comfort while taking medication in front of others		
Yes	230 (79.6%)	212 (72.6%)
No	59 (20.4%)	80 (27.4%)
Taking adherence counseling		
Yes	100(100%)	291 (99.7%)
No	0(0%)	1 (0.3%)
Disclosure status		
Yes	264 (91.3%)	270 (92.5%)
No	25 (8.7%)	22 (7.5%)
Getting support		
Yes	51 (17.6%)	21 (7.2%)
No	238 (82.4%)	271 (92.8%)
Taking alcohol		
Yes	69 (23.9%)	34 (11.6%)
No	220 (76.1%)	258 (88.4%)
Smoking cigarette		
Yes	8 (2.8%)	7 (2.4%)
No	281 (97.2%)	285 (97.6%)
Chewing chat		
Yes	19 (6.6%)	17 (5.8%)
No	270 (93.4%)	275 (94.2%)
Having multiple sexual partner		
Yes	29 (10%)	36 (12.3%)
No	260 (90%)	256 (87.7%)
Knowledge to ART		
Good	210 (72.7%)	189 (64.7%)
Poor	79 (27.3%)	103 (35.3%)
Stigma		
Yes	87 (30.1%)	84 (28.8%)
No	202 (69.9%)	208 (71.2%)
Depression		
Yes	40 (13.8%)	35 (12%)
No	249 (86.2%)	257 (88%)

UTT Universal Test and Treat; ART Antiretroviral Therapy

Proportion of ART adherence

The overall proportion of ART adherence was 52.3% (95% CI: (48.4%, 56.2%)). The proportion of ART adherence among patients enrolled before the initiation of UTT strategy was 55.4% (95% CI: (49.9%, 60.6%)) whereas the proportion of ART adherence among patients enrolled after the initiation of UTT strategy was 49.3% (95% CI: 43.5%, 54.8%).

Factors associated with ART adherence

In this study, both bi-variable and multivariable binary logistic regression analyses were done. The finding indicated that adult HIV patients who didn't experience depression were 3.9 times

Table 3: Disease related characteristics of adult HIV patients attended Dessie town ART clinics, 2018.

Variables	Before UTT(n=289)	After UTT(n=292)
Viral load result		
Not done	0(0%)	110 (37.7%)
< 1000 copies/ml	247 (85.5%)	156 (53.4%)
≥ 1000 copies/ml	42 (14.5%)	26 (8.9%)
Baseline CD₄ count		
<200	156 (54%)	21 (7.2%)
200-350	112 (38.7%)	54 (18.5%)
351-500	21 (7.3%)	76 (26%)
>500	0(0%)	141(48.3%)
Recent CD₄ count		
<200	22 (7.6%)	44 (15.1%)
200-350	67 (23.2%)	88 (30.1%)
351-500	84 (29.1%)	87 (29.8%)
>500	116 (40.1%)	73 (25%)
Baseline WHO stage		
I	44 (15.2%)	237 (81.2%)
II	47 (16.3%)	33 (11.3%)
III	135 (46.7%)	14 (4.8%)
IV	63 (21.8%)	8 (2.7%)
Current WHO stage		
T1	277 (95.8%)	279 (95.5%)
≥T2	12 (4.2%)	13 (4.5%)
Current viral load		
Not done	0(0.0%)	110 (37.7%)
<1000	247 (85.5%)	156 (53.4%)
≥1000	42 (14.5%)	26 (8.9%)
Concomitant diseases		
Yes	59 (20.4%)	34 (11.6%)
No	230 (79.6%)	258 (88.4%)
Opportunistic diseases		
Yes	10 (3.5%)	11 (3.8%)
No	279 (96.5%)	281 (96.2%)

UTT Universal test and Treat; ART Antiretroviral Therapy

more likely to have better adherence than patients who experienced depression (AOR=3.87, 95% CI: (1.96, 7.64)). Those adult HIV patients who had eaten three or more meals per day were 2.65 times more likely to have better adherence than patients who had eaten less than three meals per day (AOR=2.65, 95% CI: (1.08, 6.49)). Concomitant illness has also been significantly associated with ART adherence. Those patients without concomitant illness were 58% less likely to adhere their ART medication as compared to patients with concomitant illness (AOR=0.42, 95% CI: (0.23, 0.76)) (Table 4).

DISCUSSION

We found that the overall proportion of ART adherence was 52.3%. The proportion of ART adherence didn't vary between those patients who started ART before the introduction of UTT strategy and patients who started ART after the introduction of UTT strategy. Depression, meal frequency and concomitant illness were factors associated with ART adherence.

The overall proportion of ART adherence is lower than the

Table 4: Factors associated with ART adherence among HIV patients attended Dessie town ART clinics, 2018.

Variables	Adherence (n=581)		COR(95%CI)	AOR(95%CI)	
	Good	Poor			
Age	304 (52.3%)	277 (47.7%)	1.034(1.02, 1.05)***	1.01(0.98, 1.04)	
Marital status	Single	28 (9.2%)	59 (21.3%)	1	1
	Married	181 (59.5%)	152 (54.9%)	2.51 (1.52, 4.13)***	1.53 (0.78, 3.03)
	widowed	28 (9.2%)	14 (5.1%)	4.21 (1.93, 9.23)***	2.34 (0.82, 6.66)
	Divorced	67 (22%)	52 (18.8%)	2.72 (1.52, 4.84)***	2.02 (0.97, 4.19)
Frequency of meal/ day	< 3	11 (3.6%)	18 (6.5)	1	1
	≥ 3	293 (96.4%)	259(93.5%)	1.85 (0.86, 3.99)	2.65 (1.08, 6.49)*
Chewing chat	Yes	15 (4.9%)	21(7.6%)	1.58 (0.80, 3.13)	0.89 (0.37, 2.19)
	No	289 (95.1%)	256 (92.4%)	1	1
Taking alcohol	Yes	41 (13.5%)	62 (22.4%)	1	1
	No	267 (86.5%)	215 (77.6%)	1.85 (1.20, 2.85)**	1.44 (0.84, 2.48)
Multiple sexual partner	Yes	18 (5.9%)	47 (17%)	1	1
	No	286 (94.1%)	230 (83%)	3.25 (1.84, 5.74)***	1.56 (0.78, 3.10)
Depression	Yes	16 (5.3%)	59 (21.3%)	1	1
	No	288 (94.7%)	218 (78.7%)	4.87 (2.73, 8.70)***	3.87 (1.96, 7.64)***
Stigma	Yes	64 (21.1%)	107 (38.6%)	1	1
	No	240 (78.9%)	170 (61.4%)	2.36 (1.64, 3.41)***	1.31 (0.60, 2.89)
Follow appointment	Yes	223 (73.4%)	172 (62.1%)	1.68 (1.18, 2.39)**	0.66, (0.43, 2.93)
	No	81 (26.6%)	105 (37.9%)	1	1
Number of tablet/ day	1	159 (52.3%)	107 (38.6%)	1.91 (1.32, 2.78)***	3.19 (0.10, 104.62)
	2	58 (19.1%)	58 (20.9%)	1.29 (0.81, 2.04)	0.73 (0.12, 4.49)
	3	87 (28.6%)	112 (40.4%)	1	1
Frequency of dosage	Once	170 (55.9%)	122 (44%)	1.61 (1.16, 2.24)**	1.61 (0.24, 10.65)
	Twice	134 (44.1%)	155 (56%)	1	1
Enrollment status	AUTT	144 (47.4%)	148(53.4)	1	1
	BUTT	160 (52.6%)	129(46.6)	1.28 (0.92, 1.77)	1.49 (0.97, 2.29)
Current regimen	d	158 (52%)	108 (39%)	1	1
	e	50 (16.4%)	71 (25.6%)	0.48 (0.31,0.75)***	2.08 (0.16, 26.51)
	f	48 (15.8%)	42 (15.2%)	0.78(0.48, 1.26)	3.57 (0.24, 53.7)
	Others ^g	48 (15.8%)	56 (20.2%)	0.59 (0.37, 0.93)*	2.52 (0.20, 32.43)
Taking other medication	Yes	124 (40.8%)	151 (54.5%)	1	1
	No	180 (59.2%)	126 (45.5%)	1.74 (1.25, 2.42)***	1.31 (0.78, 2.20)
Concomitant disease	Yes	56 (18.4%)	37 (13.4%)	1	1
	No	248 (81.6%)	240 (86.6%)	0.68 (0.44, 1.07)	0.42 (0.23, 0.76)**

^d TDF-3TC-EFV; ^e TDF-3TC-NVP; ^f AZT-3TC-NVP; ^g AZT-3TC-EFV, TDF-3TC-ATVr, AZT-3TC-ATVr, ABC-3TCLPVr and AZT-3TC-LPVr; COR Crude Odds Ratio; AOR Adjusted Odds Ratio; AUTT After Universal Test and Treat; BUTT Before the Universal Test and Treat; ART Antiretroviral Therapy; *Significant at P<0.05; ** significant at P<0.01; *** significant at P ≤ 0.001 in the bi-variable and multivariable logistic regression analysis.

current recommended level of adherence by WHO[3] as well as the proportion of ART adherence reported by studies conducted in Adama Hospital (92.6%) and Debre Birhan Referral Hospital (95.5%) measured by seven and thirty-day recall respectively[8, 10]. The reason behind this difference could be seven and thirty-day recall overestimate adherence since both are highly affected by social desirability bias and measure adherence using single ‘yes’ or ‘no’ question unlike MMAS which measure adherence indirectly using a set of eight questions[23].

It is also lower than the proportion of ART adherence reported by a study conducted in Bale zone, Ethiopia (68.3%) [7]. The reason for this difference could be the four-item adherence scale had low sensitivity (81%) and specificity (44%) to detect ART adherence

and had low Cronbach’s alpha value (0.61), which is below the acceptable value of 0.7. Whereas the modified eight-item scale had high sensitivity (93%) and specificity (53%) with 0.83 Cronbach’s alpha value [24]. Our finding is also lower than the proportion of ART adherence reported by a study conducted in India (78%), measured with the same scale [25].

The result showed that the proportion of ART adherence is not varying between patients enrolled before the initiation of UTT strategy and patients enrolled after the initiation of UTT strategy. This might be due to the reason that those patients enrolled before the initiation of UTT strategy stay a long time on pre-ART which helped them to have good knowledge about adherence while those patients enrolled after the initiation of UTT strategy could also

be exposed to different media, educational materials and took an extensive adherence counseling that lead them to have similar ART adherence. This study also revealed comparable knowledge of HIV/AIDS and its treatment between those patients who initiated ART before (72.7%) and after (64.7%) the initiation of UTT strategy.

In this study, absence of depression was appeared to be positively associated with good ART adherence. Similarly, other literature showed that absence of depression had a positive association with good ART adherence [19, 25, 26]. The possible reason for this might be that those patients who were not depressed might not experience hopelessness and demoralization which could in-turn prevent them from skipping their regular treatment.

Meal frequency of three or more was also positively associated with good ART adherence. This finding is not in agreement with evidence obtained from Northern Ethiopia, in which daily eating pattern had no association with ART adherence[26]. Though the causal mechanism is not clear yet, the association between reduced meal frequency and ART non-adherence might be because of perceived fear or actual experiences with increased hunger on ART when people have to take ART on an empty stomach. It might be also because of fear or actual experiences with exacerbated side effects of ART in the absence of adequate nutritional intake [27].

The absence of concomitant illness has been negatively associated with good ART adherence. Similarly, a study conducted in Bale zone, Ethiopia also revealed the absence of concomitant illness has been negatively associated with good ART adherence [7]. This might be because of patients without concomitant illness reluctance to take their ART medication due to feeling well. On the other hand, patients with concomitant illness might adhere to their ART medication due to fear of death imposed by both HIV/AIDS and the concomitant illness. They might also stick to their ART medication because of having better information exposure about the importance of adhering ART medication as a result of double counseling service they might receive from different health care providers working for both HIV/AIDS and concomitant illness.

As a limitation, measuring adherence using Morisky scale might be affected by recall bias as patients were asked to answer the questions by considering their medication intake since they start ART medication. Being a facility-based study can underestimate non-adherence because it is prone to miss defaulters and delayed visitors of their appointment.

CONCLUSIONS

Starting ART before or after the initiation of UTT strategy had no effect on ART adherence. Depression, meal frequency and concomitant illness were factors significantly associated with ART adherence. Patient counseling on adherence should target those patients without concomitant illness since they might not adhere to their treatment due to feeling well. In order to improve ART adherence, health care providers should screen patients for depression and should provide appropriate and prompt medical as well as psychological treatment in collaboration with mental health professionals. Nutritional support with ART adherence counseling should be emphasized for those patients who are food in-secured.

DECLARATIONS

Ethical approval and consent to participate

Ethical clearance was obtained from the Ethical Review Committee

of Wollo University College of Medicine and Health Sciences. Letter of permission to conduct the study was obtained from Administrative Health Office of Dessie town and each health facility administration. After explaining the purpose of the study, an informed consent was obtained from participants before data collection. They were informed that participating in the study is voluntary and refusal to participate would not compromise the medical care they receive from the ART clinics. Privacy of the client and confidentiality of information they give was secured at all levels.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used for the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declared that there are no financial and non-financial competing interests.

Funding

Wollo University was funded the research. The funder had no role in the study design, data collection, analysis and interpretation, writing the manuscript and decision to publish.

Author's contribution

Yitayish Damtie: involved in conception and design, data collection, analysis and interpretation and write manuscript; Dabere Nigatu: enriched the research concept, critically review the proposal and manuscript. Fentaw Tadesse: participated in data collection, analysis and reviewing the manuscript; Melaku Yalew: involved in data collection and analysis; All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS

We would like to express our deepest gratitude to City Administrative Health Office and ART clinics of Dessie town for providing necessary information to conduct the study. We also would like to thank the study participants for their cooperation during the data collection process.

REFERENCES

1. Joint United Nations Programme on HIV/AIDS: UNAIDS data 2017. Geneva: UNAIDS. 2017.
2. Ethiopian Public Health Institute. HIV related estimates and projections for Ethiopia. Addis Ababa. FMOH. 2012:1-16.
3. World Health Organization, UNICEF. Towards universal access: Scaling up priority HIV/AIDS interventions in the health sector. 2009.
4. Mills EJ, Nachega JB, Buchan I, Orbinski J, Attaran A, Singh S, et al. Adherence to antiretroviral therapy in sub-Saharan Africa and North America: A meta-analysis. *Jama* 2006;296:679-690.
5. Heestermans T, Browne JL, Aitken SC, Vervoort SC, Klipstein-Grobusch K. Determinants of adherence to antiretroviral therapy among HIV-positive adults in sub-Saharan Africa: A systematic review. *BMJ Glob Health*. 2016;1:e000125.
6. Abera A, Fenti B, Tesfaye T, Balcha F. Factors influencing adherence to antiretroviral therapy among people living with HIV/AIDS at ART Clinic in Jimma University teaching hospital, Southwest Ethiopia. *J Pharma Reports*. 2015;1:1-6.

7. Beshir M, Tesfaye A. Factors affecting adherence to antiretroviral treatment among patients living with HIV/AIDS, in Bale zone, southeastern Ethiopia. *J AIDS HIV Res.* 2017;9:67-73.
8. Abayneh W, Obse N, Naba T. Factors associated with level of adherence to antiretroviral therapy in people living with HIV/AIDS at Adama hospital medical college ART clinic, Oromiya Regional State, Ethiopia. *Int J HIV AIDS Prevent Edu Behaviour Sci.* 2017;3:22-27.
9. Belayihun B, Negus R. Antiretroviral treatment adherence rate and associated factors among people living with HIV in Dubti Hospital, Afar Regional State, East Ethiopia. *Int Scholar Res Notices.* 2015;5:1-5.
10. Ketema AK, Weret ZS. Assessment of adherence to highly active antiretroviral therapy and associated factors among people living with HIV at Debrebrihan Referral Hospital and Health Center, Northeast Ethiopia: A cross-sectional study. *HIV AIDS (Auckl).* 2015;7:75-81.
11. Enriquez M, McKinsey DS. Strategies to improve HIV treatment adherence in developed countries: Clinical management at the individual level. *HIV AIDS (Auckl).* 2011;3:45-51.
12. Federal HIV/AIDS prevention and control office. Guidelines for management of opportunistic infections and antiretroviral treatment in adolescents and adults in Ethiopia. 2007.
13. Bangsberg DR, Perry S, Charlebois ED, Clark RA, Roberston M, Zolopa AR, et al. Non-adherence to highly active antiretroviral therapy predicts progression to AIDS. *AIDS.* 2001;15:1181-1183.
14. Mannheimer S, Friedland G, Matts J, Child C, Chesney M. The consistency of adherence to antiretroviral therapy predicts biologic outcomes for human immunodeficiency virus-infected persons in clinical trials. *Clin Infect Dis.* 2002;34:1115-1121.
15. Doyore F, Moges B. Adherence to antiretroviral treatment services and associated factors among clients attending ART clinics in Hosanna Town, Southern Ethiopia. *J AIDS Clin Res.* 2016;7:1-21.
16. Reda AA, Biadgilign S. Determinants of adherence to antiretroviral therapy among HIV-infected patients in Africa. *AIDS Res Treat.* 2012;12:574656.
17. World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: Recommendations for a public health approach. WHO. 2016.
18. World Health Organization. Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. WHO. 2015.
19. Letta S, Demissie A, Oljira L, Dessie Y. Factors associated with adherence to Antiretroviral Therapy (ART) among adult people living with HIV and attending their clinical care, Eastern Ethiopia. *BMC Int Health Hum Rights.* 2015;15:1-33.
20. Mthembu TG, Van WB. Patients' knowledge and beliefs about antiretroviral treatment and factors associated with adherence in Mpumalanga Province, South Africa. *Health SA Gesondheid.* 2014;19:1-7.
21. Fido NN, Aman M, Brihnu Z. HIV stigma and associated factors among antiretroviral treatment clients in Jimma town, Southwest Ethiopia. *HIV AIDS (Auckl).* 2016;8:183-193.
22. Gokarn A, Narkhede MG, Pardeshi GS, Doibale MK. Adherence to antiretroviral therapy. *JAPI.* 2012;60:1-17.
23. Shi L, Liu J, Fonseca V, Walker P, Kalsekar A, Pawaskar M. Correlation between adherence rates measured by MEMS and self-reported questionnaires: A meta-analysis. *Health Qual Life Outcomes.* 2010;8:90-99.
24. Tan X, Patel I, Chang J. Review of the four item medication adherence scale and eight item medication adherence scale. *Innovations Pharma.* 2014;5:1-5.
25. Alagaw A, Godana W, Taha M, Dejene T. Factors associated with antiretroviral treatment adherence among adult patients in Wolaita Soddo hospital, Wolaita zone, Southern Ethiopia. *Sci J Public Health.* 2014;2:69-77.
26. Gebrezgabher BB, Kebede Y, Kindie M, Tetemke D, Abay M, Gelaw YA. Determinants to antiretroviral treatment non-adherence among adult HIV/AIDS patients in Northern Ethiopia. *AIDS Res Ther.* 2017;14:1-16.
27. Young S, Wheeler AC, McCoy SI, Weiser SD. A review of the role of food insecurity in adherence to care and treatment among adult and pediatric populations living with HIV and AIDS. *AIDS Behavior.* 2014;18:505-515.