

Does Universal Test and Treat Strategy has an effect on Antiretroviral Therapy Adherence? A Comparative Cross-sectional Study

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Research article

Keywords: Antiretroviral therapy, Adherence, HIV/AIDS, Ethiopia

Posted Date: August 29th, 2019

DOI: <https://doi.org/10.21203/rs.2.13576/v1>

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Abstract

Background : Poor adherence is a critical problem in managing Human Immunodeficiency Virus (HIV) - infected patients receiving Antiretroviral Therapy (ART). Evidence of adherence to antiretroviral therapy after 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, including 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 consecutive 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 model were used to identify factors associated with ART adherence. Adjusted Odds Ratio (AOR) with 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 overall proportion of ART adherence using Morisky scale and self-reports were 52.3%, 95% CI: (48.4%, 56.2%) and 95%, 95% CI: (93.5%, 96.8%) 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 significantly associated with better ART adherence.

Conclusion: The overall proportion of ART adherence measured by Morisky scale was very low while the proportion of ART adherence measured by self-report was high and consistent with the current World Health Organization (WHO) recommendation. Adherence to ART 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. Key words: Antiretroviral therapy, Adherence, HIV/AIDS, Ethiopia

Introduction

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 WHO recommends a greater than 95% adherence to get the best outcome of antiretroviral treatment (3). But, suboptimal adherence became the major critical 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 Differentiation 4 (CD4) counts and disease progression (11,12). For instance, result of longitudinal study showed that 0%, 8% and 41% of patient with >90%, 51–90%, ≤50% adherence were progressed to AIDS over the 13months follow-up period respectively (13).A study also demonstrated that subjects with adherence levels of 0–79%, 80–99% and 100% had 53 cells/ μ L, 159 cells/ μ L and 179 cells/ μ L 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) were known to 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 < 350cells/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 had been well investigated before the initiation of universal test and treat strategy, only a little evidence exists about adherence after initiation of the UTT strategy. On the other hand, most of the studies used a single ART adherence measurement scale. So, the objective of this study was to compare antiretroviral therapy adherence before and after initiation of test and treat strategy and associated factors among HIV positive people who are attending ART clinics of Dessie town using multiple ART drug adherence measurements.

Methods

Study Area, Study Design and Participants

A comparative cross-sectional study was conducted in ART clinics of Dessie town from April15-June 5, 2018. Dessie is the center of South Wollo Zone located 401 km away from Addis Ababa, the capital city of Ethiopia and 480 km away from Bahir Dar. In Dessie town, two government hospitals and three health centers were providing ART service for 8,821 adult people enrolled before initiation of UTT strategy and 926 adult people enrolled after initiation of UTT strategy (19). The study population was consecutively selected HIV positive adults who were attending ART clinics indicia 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 (20), 1to1 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 who started before UTT strategy and 297 for who started after 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 in order of their arrival 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. 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. This checklist has nine questions with four response option taking a score between 0 and 3(0 = not at all, 1 = several days, 2 = more than half a day and 3 = nearly every day). Then, 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). Ten questions with yes or no option were used to measure patients' knowledge to ART. If the patient gets the right answer coded as 1 if not coded as 0. 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 (21). We had ten questions to assess patients' perceived stigma. The questions were with yes or no response options. The correct responses were coded 1 while the incorrect responses were coded 0. Then patients who scored above the median value were considered as they had perceived stigma whereas patients who scored less than or equal to the median value were taken as they had no perceived stigma (22). Adherence to ART regimen was assessed by using two medication adherence measurement approaches: a seven-day patient self-report and eight items Morisky Medication Adherence Scales (MMAS). In, a seven-day patient self-report method: a patient is asked a question "did you miss in taking your ART drug in the last seven days?" If a patient answered 'yes' to this question classified as good adherence otherwise taken as poor adherence (20). In, the MMAS approach: a patient is asked eight questions designed to assess adherence to medication. Seven of the questions were with yes or no response options coded each 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 score less than or

equal to the median value were classified as poor adherence whereas those patients who score greater than the median value were classified as good adherence (23).

Statistical Analysis

Data were coded and entered to Epi Data Version 3.1 and exported to the Statistical Package for Social Science (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 (IQR) 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 (SE). The p-value of the Hosmer and Lemeshow test of the model fitness was 0.87. 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 who were enrolled before and 292 HIV positive adult patients who were enrolled after initiation of UTT strategy were involved and making a response rate of 97.8%. The mean age of patients who were enrolled before and after initiation of UTT strategy was 36.2 with \pm 9.8 SD and 36.7 with \pm 8.6SD respectively. One hundred seventy-one (59.2%) of patients who were enrolled before and 152 (52.1%) of patients who were enrolled after initiation of UTT strategy were females. Two hundred thirty two (80.3%) patients who were enrolled before and 218 (74.7%) of patients who were enrolled after 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 initiation of UTT strategy were married (Table 1).

Psychosocial and Behavioral Characteristics

Two hundred seventy eight (96.2%) HIV positive patients who were started ART before and 285 (97.6%) of patients who were started ART after 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 UTT strategy had good knowledge to HIV/AIDS and its treatment. Two hundred eighty nine (100%) patients who initiated ART before and 291 (99.7%) of patients who initiated ART after initiation of UTT strategy took adherence counseling. Two hundred sixty four (91.3%) and 270 (92.5%) of patients enrolled before and after 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 initiation of UTT strategy experienced depression (Table 2).

Diseases related Characteristics

A viral load test was done for all patients who were enrolled before the initiation of UTT strategy. As a result, 247 (85.5%) and 42 (14.5%) patients had a viral load of <1000 copies/ml and \geq 1000 copies/ml respectively. One hundred ten (37.7%) patients who started ART after UTT strategy had no viral load test result, 156 (53.4%) patients had a viral load of < 1000 copies/ml and 26 (8.9%) patients had a viral load of \geq 1000 copies/ml respectively. One hundred fifty-six (54%) patients who started ART before and 65 (22.3%) patients who started ART after UTT strategy had a baseline CD4 count of <200mm³. Forty-four (15.2%) patients enrolled before-and 237 (81.2%) patients enrolled after- initiation of UTT strategy had baseline WHO stage I. Ten (3.5%) patients who started ART before and 11 (3.8%) patients who started ART after UTT strategy had experienced opportunistic infections (Table 3).

Proportion of ART Adherence

The overall proportion of ART adherence using Morisky scale and self-report was 52.3% (95% CI: (48.4%, 56.2%)) and 95% (95% CI: (93.5%, 96.8%)) respectively. The proportion of ART adherence among patients who were enrolled before the initiation of UTT strategy using Morisky scale and patient self-reports was 55.4% (95% CI: (49.9%, 60.6%)) and 94.1% (95%CI: (91%, 96.9%)) respectively. The proportion of ART adherence among patients who were enrolled after initiation of UTT strategy using Morisky scale and patient self-report was 49.3% (95% CI: (43.5%, 54.8%)) and 95.9% (95%CI: (93.2%, 98.2%)) respectively (Figure 1 and 2).

Factors Associated with ART Adherence

Adherence to ART measured by the Morisky scale was used to fit logistic regression model. 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 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 measured by using the Morisky scale (52.3%) was lower than adherence measured by self-report (95%). The proportion of adherence to ART 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. This study identified that depression, meal frequency and concomitant illness were factors associated with ART adherence.

This study revealed that the overall proportion of ART adherence measured by using the Morisky scale is lower than the proportion of ART adherence measured by using a seven-day patient self-report. The reason behind this difference could be self-report overestimate adherence since it is vulnerable to the dynamics of the provider-patient relationship and measurement biases like social desirability, recall and response bias (24). The overall proportion of ART adherence measured by using the Morisky scale is lower than the current recommended level of adherence by WHO (3). It is also lower than the proportion of ART adherence reported by a study conducted in Bale zone, Ethiopia(68.3%) which was measured by using four items MMAS) (7). The reason for this difference could be originally the four items Morisky medication adherence scale had low sensitivity (81%) and specificity (44%) to detect ART adherence and had 0.61 Cronbach's alpha value, which is below the acceptable value of 0.7. Whereas the modified eight-item MMAS had high sensitivity (93%) and specificity (53%) with 0.83 Cronbach's alpha value (25). Our finding is also lower than the proportion of ART adherence reported by a study conducted in India (78%), measured with the same scale (23).

The overall proportion of ART adherence measured by using seven-day patient self-report is consistent with the current WHO recommendation (3) as well as with a study conducted in Debre Birhan Referral Hospital(10).

Both Morisky scale and patient self-reports results showed that the proportion of ART adherence is not varying between patients who were enrolled before initiation of UTT strategy and patients who were enrolled after initiation of UTT strategy. This might be due to the reason that those patients who were enrolled before initiation of UTT strategy stay a long time on pre-ART which helped them to have good knowledge about adherence while those patients who were enrolled after 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 was positively associated with good ART adherence (20,26,27). 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 skip or forget 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(27). 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 (28).

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.

This study has strengths as well as limitations. As strengths, we used multiple ART adherence measurements. Adherence to ART was measured by patient self-report and the eight-item MMAS. In self-reported adherence, the last seven days ART adherence was used to minimize recall bias. As a limitation, adherence measured by the 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

In this study, the overall proportion of ART adherence measured using Morisky scale was low whereas the overall proportion of ART adherence measured using self-reports was consistent with the current WHO recommendation. Starting ART before or after initiation of the 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 on ART 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 insecure.

List Of Abbreviations

AIDS-Acquired Immune Deficiency Syndrome; AOR-Adjusted Odd Ratio; ART-Anti- Retroviral Therapy; BSc-Bachelor of Science; CD₄-Cluster Differentiation 4; CI-Confidence Interval; COR-Crude Odds Ratio; HIV-Human Immunodeficiency Virus; IQR- Inter Quartile Range; MMAS-Morisky Medication Adherence Scale; PHQ-9-Patient Health Questionnaire 9; SD-Standard Deviation; SE-Standard Error; SPSS-Statistical

Package for Social Science; SSA-Sub Saharan Africa; UTT-Universal Test and Treat; VL- Viral Load; WHO- World Health Organization.

Declarations

Ethical Approval and Consent to Participate

Ethical clearance was taken 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, a verbal 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 Material:

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

Competing interest:

The authors declare that they have no competing interests.

Financial Disclosure:

Wollo University was funded the research. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Author's contribution

YD: Initiated the research concept, wrote the research proposal, involved in the data collection processes, did data entry and analysis and wrote the manuscript. *DN*: enriched the research concept and proposal development process and critically reviewed the manuscript. *FT*: involved in reviewing the research paper. *MY*: involved in reviewing the research paper. All the authors read and approved the final manuscript.

Acknowledgement

We would like to express our deepest gratitude to Wollo University College of Medicine and Health Sciences Department of Public Health for providing financial and material support to conduct this research. We would like to acknowledge the City Administrative Health Office and ART clinics of Dessie town for providing necessary information to conduct the study. Finally, we would like to thank the study participants for their cooperation during the data collection process.

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Tables

Table1: Socio-demographic characteristics of before- and after-UTT ART initiators at Dessie town clinics, 2018.<.p>

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	27 (9.3%)	17 (5.8%)
Religion		
Christian**	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***	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 (17.0%)

* Oromo and Tigray, **; protestant and orthodox tewahido, *** student and jobless, UTT universal test and treat strategy, ART anti-retroviral therapy

Table2: Psychosocial and behavioral characteristics of before- and after-UTT ART initiators at Dessie town clinics, 2018.

Variables	Before	After
	UTT(n=289)	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 strategy, ART anti-retroviral therapy

Table 3: Disease related characteristics of before- and after-UTT ART initiators at Dessie town clinics, 2018.

Variables	Before UTT(n=289)	After UTT(n=292)
Baseline CD4 count		
<200	156 (54%)	65 (22.3%)
200-350	112 (38.8%)	92 (31.5%)
351-500	14 (4.8%)	84 (28.8%)
>500	7 (2.4%)	51 (17.5%)
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	92 (31.8%)	33 (11.3%)
III	123 (42.6%)	14 (4.8%)
IV	30 (10.4%)	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 strategy, ART anti-retroviral therapy

Table 4: Factors associated with ART adherence among before- and after-UTT ART initiators at Dessie town 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 Married widowed Divorced	28 (9.2%) 181 28 (9.2%) 67 (22%)	59 (21.3%) 152 14 (5.1%) 52 (18.8%)	1 2.51 (1.52, 4.13)*** 4.21 (1.93, 9.23)*** 2.72 (1.52, 4.84)***	1 1.53 (0.78, 3.03) 2.34 (0.82, 6.66) 2.02 (0.97, 4.19)
Frequency of meal /day	< 3 ≥ 3	11 (3.6%) 293	18 (6.5) 259(93.5%) (96.4%)	1 1.85 (0.86, 3.99)	1 2.65 (1.08, 6.49)*
Chewing chat	Yes No	15 (4.9%) 289	21(7.6%) 256 (92.4%)	1.58 (0.80, 3.13)	0.89 (0.37, 2.19)
Taking alcohol	Yes No	41 263	62 (22.4%) (13.5%) 215 (77.6%)	1 1.85 (1.20, 2.85)**	1 1.44 (0.84, 2.48)
Multiple sexual partner	Yes No	18 (5.9%) 286	47 (17%) 230 (83%) (94.1%)	1 3.25 (1.84, 5.74)***	1 1.56 (0.78, 3.10)
Depression	Yes No	16 (5.3%) 288	59 (21.3%) (94.7%) 218 (78.7%)	1 4.87 (2.73, 8.70)***	1 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	a	158 (52%)	108 (39%)	1	1
	b	50 (16.4%)	71 (25.6%)	0.48 (0.31, 0.75)***	2.08 (0.16, 26.51)
	c	48 (15.8%)	42 (15.2%)	0.78(0.48, 1.26)	3.57 (0.24, 53.7)
	Others [©]	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	126	1.74 (1.25, (59.2%) (45.5%) 2.42)***	1.31 (0.78, 2.20)
Recent CD4	<200	37	29 (10.5%)	1	1
			(12.2%)		
	200-350	61	94 (33.9%)	0.51 (0.28, (20.1%) 0.91)*	0.59 (0.30, 1.16)
	351-500	94	77 (27.8%)	0.96 (0.54, (30.9%) 1.70)	1.07 (0.51, 2.24)
	>500	112	77 (27.8%)	1.14 (0.65, (36.8%) 2.01)	1.13 (0.53, 2.44)
Concomitant disease	Yes	56	37 (13.4%)	1	1
			(18.4%)		
	No	248 (81. 6%)	240 (86.6%)	0.68 (0.44, 1.07)	0.42 (0.23, 0.76)**

COR Crude Odds Ratio; AOR Adjusted Odds Ratio; AUTT after universal test and treat strategy; BUTT before universal test and treat strategy; ART anti-retroviral 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; ©AZT-3TC-EFV, TDF-3TC-ATVr, AZT-3TC-ATVr, ABC-3TCLPVr and AZT-3TC-LPVr; a TDF-3TC-EFV; b TDF-3TC-NVP; c AZT-3TC-NVP

Figures

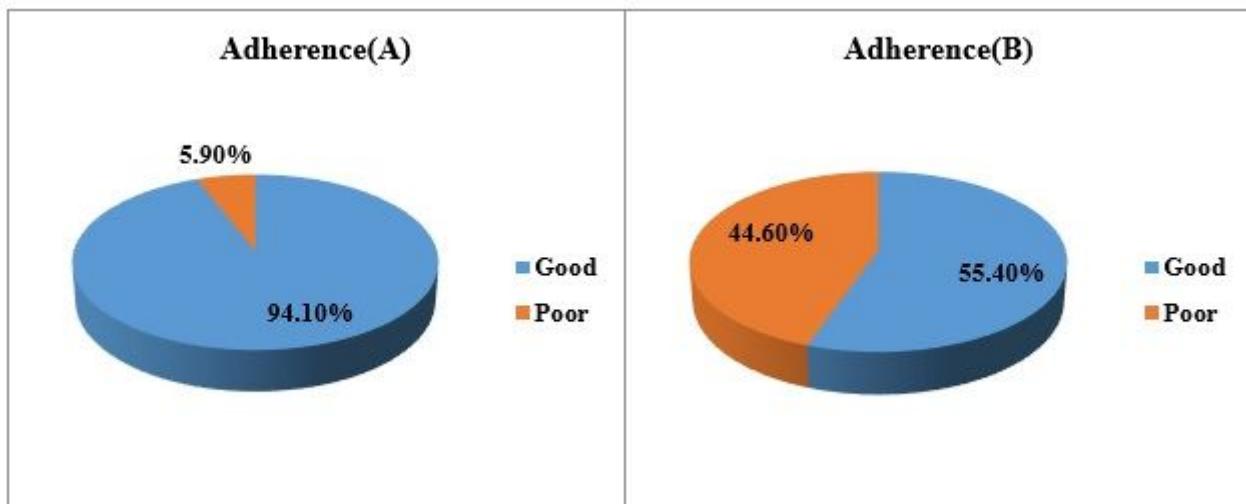
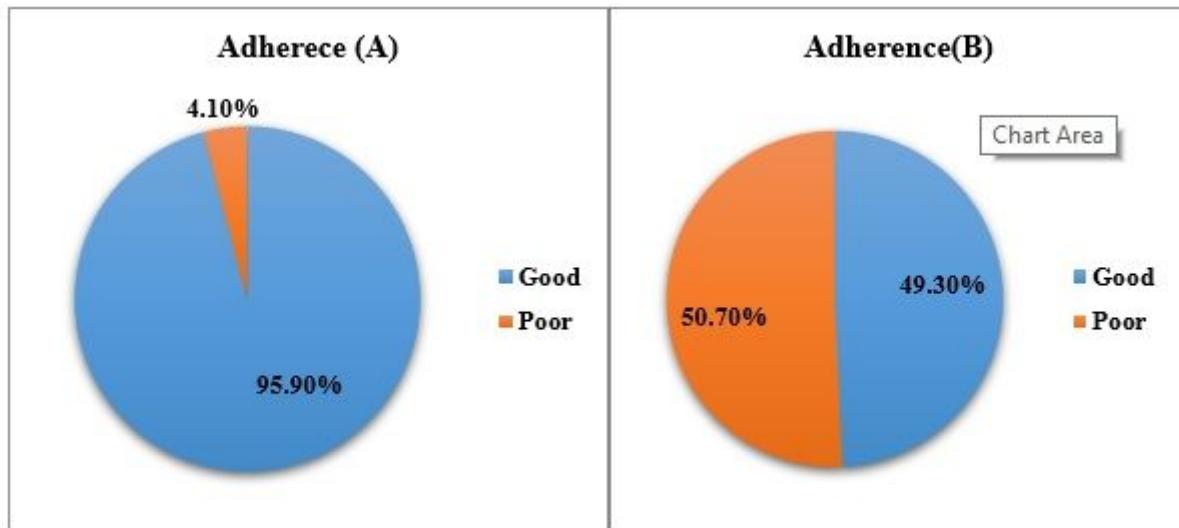


Figure 1

ART adherence using self-report (A) and Morisky scale(B) among before-UTT ART initiators at Dessie town clinics, 2018. Legend: Figure 1A, in the left side, indicates the proportion of ART adherence measured using patient self-report of last seven days adherence to ART medication while figure 1B, in the right side, indicates the proportion of ART adherence measured using the Morisky Medication Adherence Scale for Adult HIV positive patients who initiated the ART before the launch of universal test and treat (UTT) strategy.

**Figure 2**

ART adherence using self-report (A) and Morisky scale(B) among after-UTT ART initiators at Dessie town clinics, 2018. Legend: Figure 2A, in the left side, indicates the proportion of ART adherence measured using patient self-report of last seven days adherence to ART medication while figure 2B, in the right side, indicates the proportion of ART adherence measured using the Morisky Medication Adherence Scale for HIV positive adult patients who initiated the ART after the launch of universal test and treat (UTT) strategy.