Original Article

Adherence to Antiretroviral Treatment among Adult People Living with HIV/AIDS Attending Highly Active Antiretroviral Therapy at Adare Hospital, Southern Ethiopia

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Abstract

Background: Adherence to antiretroviral therapy (ART) has paramount advantages for programmatic success, including its good treatment outcomes and reduced risk of resistant viral strains transmission to the general population. There is limited evidence on the magnitude and associated factors of adherence to ART among adult PLWHA attending highly active ART (HAART) at Adare General Hospital, Southern Ethiopia.

Objective: This study aimed to determine the magnitude and associated factors of adherence to ART among adult PLWHA attending (HAART) at Adare General Hospital, Southern Ethiopia.

Methods: A hospital-based cross-sectional study was conducted from January 01/2018 to February 30/2018 at Adare Hospital. The participants were 370 adult people living with HIV/AIDS taking ART and who were selected by systematic random sampling technique. The data were collected by trained health professionals using a pre-tested interviewer-administered structured questionnaire. The data collected was entered into a computer and analysed using SPSS version 19. Descriptive statistics and multiple logistic regressions were applied. The significance level of association was considered at p-value <0.05.

Results: The magnitude of retrospectively self-reported combined adherence (measured by dose, schedule and dietary instructions) to ART in the past seven days before the interview was 80.3%. In multivariate analysis, Sidaamu Afoo language (AOR=0.5, 95%CI: 0.21-0.99), monthly income <1,000 Ethiopian Birr (AOR=0.08; 95%CI: 0.03-0.26), not disclosing HIV status to others (AOR=0.18; 95%CI: 0.07-0.50), taking ART pills comfortably while others looking (AOR=6.0; 95%CI: 2.54-13.91) and no utilisation of reminders (AOR=0.08; 95%CI: 0.03-0.21) were factors significantly associated with combined adherence. Forgetfulness and not wanting to take ART while others are looking were major reasons to miss pills.

Conclusion: Adherence to ART among adult PLWHA attending HAART at Adare Hospital was suboptimal, but still comparable with that of resource-limited settings. To maximise treatment success, considering emphasised translation to Sidaamu Afoo language, encouraging patients to be involved in any income-generating system and to reveal their HIV status for others is helpful. [*Ethiop. J. Health Dev.* 2020; 35(2):000-000]

Keywords: Adherence, Adults, ART, HIV/AIDS, Sidaama, Ethiopia

Introduction

Globally, over 36.7 million people of all ages were living with HIV/AIDS while 2.1 million persons were newly infected and 1.1 Million deaths were AIDS-related at the end of 2015 (1). The burden of the infection in Ethiopia is also a serious public health problem, which had accounted for 24,813 deaths related to HIV/AIDS in 2016 (2).

Antiretroviral Therapy (ART) program is the collaborative effort of World Health Organization (WHO) and Joint United Nations Program on HIV/AIDS (UNAIDS) to respond to HIV/AIDS epidemics countering needs in the poor and the middle-income countries (3). Free ART services started in Sub-Saharan Africa (SSA) in 2003 after WHO announced the "3 by 5" initiative to bring HIV treatment to scale (4). The program was first launched in Ethiopia in 2003 and became free in 2005 (5). The program has changed the fate of infected persons and that of the infection. For instance, it enabled to increase the life expectancy of a person living with HIV who is on treatment to equal to that of a person not infected by HIV. That is a success. However, ending the epidemics continued being a challenge globally due to inconsistent retention in care and poor treatment outcomes as a consequence of suboptimal adherence to ART. Adherence to ART is said to be optimal when the patient obeys ≥95% of the instructions ordered by clinicians (6).

Sub-optimal adherence to antiretroviral (ARV) treatment is a potential predictive factor for poor treatment outcomes and it results in unsuppressed viral load and complete discontinuation of clinical follow-up and treatment, increased risk of drug resistance, increased health care costs and clinical deterioration with increased risk of death (7, 8). Another worst consequence of sub-optimal adherence is that it can result in serious public health problem with the risk of resistant viral strains transmission to the general population (9).

Various adherence levels and associated factors were documented by previous studies conducted in different countries. For example, the ART adherence level was 55% in North America and 77% in resource-limited countries of SSA (10). Whereas, in Ethiopia, according to a systematic review of different studies, the adherence level varies from the lowest 34.8% to the highest 95.8% (11). Factors associated with adherence to HAART were patient-related variables, treatment-related factors, disease characteristics, patient-provider relationship and clinical setting (5,12, 13). Data on adherence is vital to strengthen and maintain effective ART outcome among

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patients with sound evidence and to initiate necessary interventions in the study area. Therefore, the aim of this study was to determine the magnitude and associated factors of adherence to ART among adult people living with HIV/AIDS and who were on HAART at Adare General Hospital, Southern Ethiopia.

Methods
Study setting and study design.
A hospital-based cross-sectional study was conducted between January 01/2018 and February 30/2018 among people living with HIV/AIDS (PLWHA) attending HAART at Adare General Hospital. The hospital is found in Hawassa city, the capital of Sidaama region, located about 275 km away from Addis Ababa. The hospital is one of the six health facilities providing ART services in Hawassa city. In the city, there were 359,358 annually estimated populations in 2017 and the hospital had been serving 2,854 PLWHA. Among them, 1,493 PLWHA were actively on HAART, of whom 1,409 were ≥15 years of age.

Inclusion and exclusion criteria
The source population constituted all PLWHA who were ever enrolled in chronic HIV care in the facility. The PLWHA who were on combined ARV treatment and those who fulfilled inclusion criteria like volunteer, ≥18 years old, and had follow up for at least three months were the study population. Severely ill and impairment neurocognitive patients were excluded.

Sample and sampling procedure
The minimum sample size was calculated by OpenEpi version-2 software. The proportion of adherence level (80%) was taken from the previous study (14). The 95% CI, precision (d) 4% and after 10% for contingency added, yielded a total sample size of 373.

Participants were recruited by a systematic random sampling technique from a sampling frame list of eligible adults that were taking HAART, traced using their unique ART registration number and through appointment. Using k-value 4, every four clients were taken among the daily appointees during exit. In case of refusal to give informed consent and information, the next volunteer participants were included.

Data collection instrument and procedure
Data were collected using a pre-tested structured interviewer-administered questionnaire. The questionnaire was prepared in English and translated in Amharic and again back to English. Most of the items were adapted from the widely used validated Adult AIDS Clinical Trial Group (AACTG) adherence questionnaire (15) with some modifications to fit the context of the study setting. A few of the items were developed from other literature. Content validity and face validity of the instrument were validated with experienced researchers.

The data were collected by four trained BSc degree health professionals working in the ART clinic of the hospital with close supervision by a MPH student. A room was secured for the data collectors to interview the participants in private using different local languages. Translators working in the adherence support group were recruited. Data collectors reviewed clinical data from the patient's folders.

Operational definitions
In this study, adherence was measured by seven days retrospective recall of HAART users self-report using three dimensions of measurement. The participants were asked whether they: i) missed a single dose of ART medicines (dose adherence), ii) followed time restriction (time adherence); and iii) obeyed dietary instructions with medication (food adherence). Those who had obeyed all instructions were considered as having achieved an optimal level (≥95%) of adherence.

Baseline CD4 and current CD4 were laboratory-measured values taken when the patient started HAART and during data collection, respectively. Baseline WHO Stages and Current WHO Stage were clinically determined stages of the HIV infection when the patient started treatment and during data collection, respectively.

Data quality assurance and analysis
The data were checked for completeness, accuracy, and clarity daily after collection. After coding, the data were entered into a computer programme and analysed by SPSS version 19. Descriptive statistics and multiple logistic regression were carried out for frequencies, proportion, and associations. All variables with p-value < 0.25 in the binary regression were entered into multivariable analysis. The goodness of fit model statistic was checked by Hosmer and Lemeshow test. At 95% confidence level, adjusted odds ratios were computed and variables whose p-value < 0.05 in the multivariable regression model were considered as significantly associated with adherence to ART.

Ethical consideration
Ethical clearance (reference N͟o: IRB/012/09) was obtained from Hawassa University, College of Medicine and Health Sciences, Institutional Review Board. The purposes and the advantages of the study were explained in the language each participant can understand and then written informed consent was secured from them. Only volunteers participated in this study and any personal identifier was excluded from the document.

Results
Socio-demographic characteristics
An overall 370 adult HAART users participated in this study, with response rate of 99.2%. Slightly less than two-thirds of the subjects (65.9%) were females. Their mean age was 36 years with SD (±9.6) and the range was 54 years, from 19 years to 73 years. Nearly a third (30%) of the respondents were above 39 years old.

Of the total participants, 55.4% were married. A little more than two-third of the participants, specifically 43%, were with educational status of between grade 1 and grade 8. More than a half (55.4%) spoke Amharic as their first language. About 28.6% of the participants reported that they had monthly income of 1000-1600

Ethiopian Birr (ETB). Almost all (99.5%) of the participants reported that they had good knowledge about HIV, ART, and adherence to ART. See Table 1.

Table 1: **Socio-demographic characteristics of adult HIV patients on HAART at Adare General Hospital ART centre, Southern Ethiopia, in 2018**

Variables	Frequency (out of N=370)	Per cent (%)
Sex		
Male	126	34.1
Female	244	65.9
Age in years (μ = 36, SD = ±9.6) ¶		
<25	24	6.5
25-29	59	15.9
30-34	85	23.0
35-39	91	24.6
>39	111	30.0
Marital status		
Never married/Single	35	9.5
Married/Living together	205	55.4
Separated/Divorced	72	19.5
Widowed	57	15.4
Others*	1	0.3
Education level		
Unable to read and write	37	10.0
Able to read and write	33	8.9
Grade 1-8	159	43.0
Grade 9-12	98	26.5
Tertiary/12+	43	11.6
First language		
Sidaamu Afoo	46	12.4
Amharic	205	55.4
Wolaitigna	58	15.7
Afaan Oromo	30	8.3
Others**	31	8.4
Monthly income quartile (in ETB)		
<1000	83	22.4
1000–1600	106	28.6
1601–2559	88	23.8
≥2560	93	25.1
Transport cost tertile		
Lowest (<4 ETB)	138	37.3
Middle (4–10 ETB)	103	27.8
Highest (>10 ETB)	129	34.9
Knowledge status of HAART users		
Had good knowledge	368	99.5
Had poor knowledge	2	0.5

¶ The mean (μ) and the standard deviation (SD) of the age of the participants
*Has sexual friend ** Hadiyigna, Gofa, Gurage, Gedio*** Private, Hotel waitress/employees, Guards, Housekeepers.

Medication characteristics
Close to three-fourths (72.4%) of the respondents took only a single dose per day; 88.4% of the subjects took only one pill per dose of their ART. A little more than three-fourths of the participants (viz. 76.5%) had been taking HAART for over two years. Although most (85.7%) of the subjects never changed their first ART regimen type, few 53 (14.3%) of them switched to other types for some reasons like drug side effects, failure of clinical outcome, availability of newly emerged drug type and others. Likewise, the majority (79.7%) of the respondents never felt ART-regimen-related side effects. For more details, please Refer Table 2.

Table 2. **Medication characteristics of ART among HAART users at Adare Hospital, Southern Ethiopia, in 2018**

Variable	Frequency	Percentage
Frequency of ART doses /day		
Once	268	72.4
Twice	102	27.6
ART pill number/dose		
One	327	88.4
Two and three	43	11.6
Duration since ART started		
3–6 months	19	5.1
7–12 months	27	7.3
1–2 years	41	11.1
>2 years	283	76.5
ART type change		
Yes	53	14.3
No	317	85.7
Reasons for ART change		
Side-effect	30	56.6
Clinical failure	14	26.4
New drug emerged	4	7.5
Other	5	9.4
Ever felt ART side-effect		
Yes	75	20.3
No	295	79.7

Disease characteristics

Slightly more than two-fifths (viz., 43.8%) of the subjects had a baseline CD4 count below 200 cell/mm^3. The current CD4 count was above 350 cell/mm^3 in a little more than two-thirds (67.7%) of the participants. At the start of HAART, close to a third (32.7%) of the respondents were at WHO Stage I of HIV infection. However, during data collection, a magnitude of stage I clients raised to nearly threefold (81.9%) of the previous baseline record. That was a good progress. During the start of ART, close to a tenth (9.2%) of the participants were at stage IV. However, at the data collection period, their number was significantly reduced to nearly a fifth (1.9%) of the previous. See Table 3.

Table 3: **Disease characteristics of HIV/AIDS among adults living with HIV/AIDS taking HAART at Adare Hospital ART Centre, Southern Ethiopia, in 2018**

Variable	Frequency	Percentage
Baseline CD4 count		
<200 cell/mm^3	162	43.8
200-350 cell/mm^3	112	30.3
>350 cell/mm^3	96	25.9
Current CD4 count		
<200 cell/mm^3	35	9.5
200-350 cell/mm^3	85	23.0
>350 cell/mm^3	250	67.6
Baseline WHO clinical stage		
Stage I	121	32.7
Stage II	109	29.5
Stage III	106	28.6
Stage IV	34	9.2
Current WHO clinical stage		
Stage I	303	81.9
Stage II	52	14.1
Stage III	8	2.2
Stage IV	7	1.9
Were you sick in the last 4 weeks?		
Yes	154	41.6
No	216	58.4

Patient-related psycho-social aspects, patient-provider relationships, and clinical settings

Most of the study participants (84.9%) disclosed their HIV status to anyone else. Among them, 43.0% said they told to their intimate persons, mainly wife or husband. Similarly, two-thirds (66.8%) of the participants indicated that they took their ART medicines comfortably in front of others. Most (84.3%) of the respondents said they had memory aids, mainly watch bells or mobile alarm (82.4%) to remember them to take their ART drugs. The overwhelming majority (viz. 96.2%) of the participants had a regular clinical follow-up. See Table 4 for further details.

Table 4: **Psycho-social, patient-provider relationship and clinical setting related factors.**

Variables	Frequency	Percentage
Have you disclosed your HIV status?		
Yes	314	84.9
No	56	15.1
To whom have you disclosed?		
Wife/husband	135	43.0
Family members	122	38.9
Friends	47	15.0
Others	10	3.2
Do you take ART comfortably in front of others		
Yes	247	66.8
No	123	33.2
Do you have your reminders?		
Yes	312	84.3
No	58	15.7
If 'yes' to the above, what types of reminders		
Pillboxes	14	4.5
Watch bell/Mobile alarm	257	82.4
Family members	22	7.1
Others	19	6.1
Have you ever used active substances like alcohol, *khat*...		
Yes	55	14.9
No	315	85.1
Did you ever miss ART clinic appointment?		
Yes	356	96.2
No	14	3.8

Magnitude of adherence to HAART

The combined adherence (dose, schedule and dietary) level was 80.3% at 95%CI (0.762-0.844) among the 370 participants. Among them, 86.5% took all the recommended doses; 81.4% followed their medication schedule and 85.4% obeyed treatment-related dietary instructions told by clinicians. Refer Table 5.

Table 5: **Self-reported adherence level on ART in adult PLWHA and attending HAART at Adare Hospital ART Centre, Southern Ethiopia, in 2018**

Adherence Category	Adherent		Non-Adherent		Total	
	Frequency	%	Frequency	%	Frequency	%
Dose adherence in previous day	342	92.4	28	7.6	370	100
Dose adherence in last 3 days	335	90.5	35	9.5	370	100
Dose adherence in last 7 days	320	86.5	50	13.5	370	100
Schedule adherence in last 7 days	301	81.4	69	18.6	370	100
Food adherence in last 7 days	316	85.4	54	14.6	370	100
Overall adherence in last 7 days	297	80.3	73	19.7	370	100

Respondents claimed major personal and situational reasons for missing any of HAART doses. As illustrated in Figure 1, the majority (86%) of non-adherents reported forgetfulness as a reason.
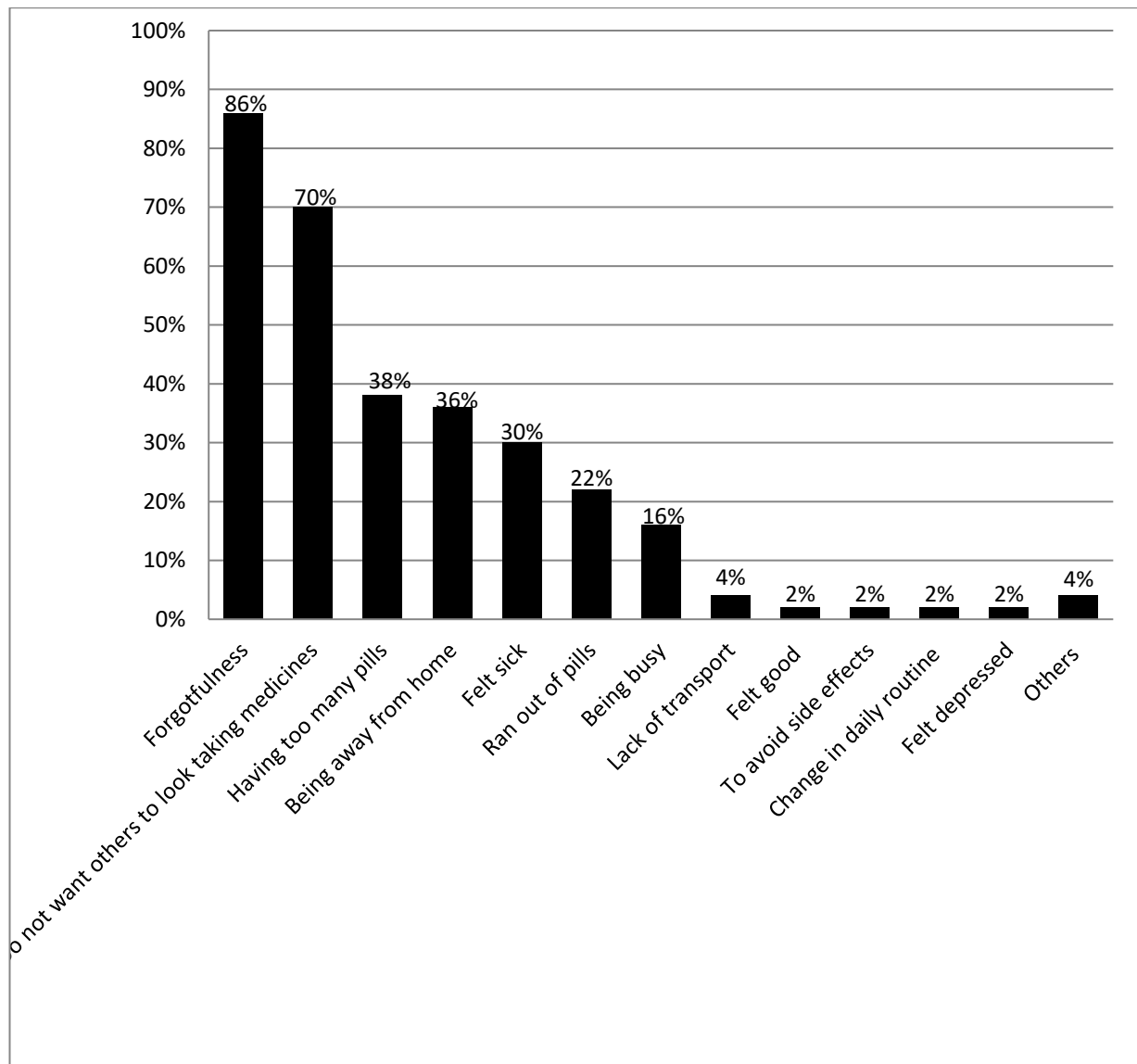
Figure 1. **Reasons for missing any of ART dose reported by study participants at Adare General Hospital, Southern Ethiopia, 2018**

Factors associated with combined adherence to HAART

In bivariable analysis, first language, monthly income, frequency of ARVs drug dose per day, number of pills per dose, absence of illness within four weeks, disclosure of one's HIV status, the person to whom HIV status was disclosed, taking ART comfortably while others looking, use of memory aids, and having regular follow up of clinical appointment were found associated with combined adherence to ART at p<0.25. Then, such variables were taken to multiple logistic regression for further analysis.

In multivariable analysis, first language, monthly income, the burden of ARVs pills number, disclosure of HIV status to others, feeling comfortable to take ART while others looking, and utilisation of memory aids were found significantly associated with an overall adherence at the p-value<0.05. Refer to Table 6.

Table 6. **Bivariable and multivariable analysis for factors associated with combined adherence to ART among adult PLWHA on HAART at Adare General Hospital, Southern Ethiopia, in 2018**

Variables	Adherent		COR (95%CI)	AOR (95%CI)
	No N(%)	Yes N(%)		
First Language				
Amharic	37 (18.0)	168 (82.0)	1.00	1.00
Sidaamu Afoo	17 (37.0)	29 (63.0)	0.38 (0.19-0.75)	0.5 (0.21-0.99)[*]
Others	19 (16.0)	100 (84.0)	1.16 (0.63-2.13)	1.56 (0.78-3.13)
Monthly income quartile				
<1000	50 (60.2)	33 (39.8)	0.06 (0.03-0.15)	0.08 (0.03-0.026)[***]
1000-1600	11 (10.4)	95 (89.6)	0.81 (0.31-2.12)	0.80 (0.23-2.77)
1601-2559	4 (4.5)	84 (95.5)	1.98 (0.57-6.81)	2.24 (0.50-10.03)
$\geq$2560	8 (8.6)	85 (91.4)	1.00	1.00
ART doses/day				
One	39 (14.6)	229(85.4)	1.00	1.00
Two	34 (33.3)	68(66.7)	0.34 (0.20-0.58)	1.92 (0.72-5.12)
ART pills per dose				
One	43 (13.1)	284(86.9)	1.00	1.00
Two and three	30 (69.8)	13 (30.2)	0.07 (0.03-0.14)	0.04 (0.012-0.114) [***]
Sick in last 4 weeks?				
No	34 (15.7)	182 (84.3)	1.00	1.00
Yes	39 (25.3)	115 (74.7)	0.55 (0.33-0.92)	0.45 (0.19-1.02)
Disclosed HIV+ status?				
No	39 (69.6)	17(30.4)	0.05 (0.03-0.10)	0.18 (0.07-0.50) [***]
Yes	34 (10.8)	280(89.2)	1.00	1.00
To whom HIV disclosed				
Wife/husband	5 (3.7)	130 (96.3)	1.00	1.00
Family members	17 (13.9)	105 (86.1)	0.24 (0.09-0.67)	0.22 (0.07-0.68) [**]
Others	12 (21.1)	45 (78.9)	0.14 (0.05-0.43)	0.11 (0.03-0.39) [**]
Take ART comfortable				
No	57 (46.3)	66 (53.7)	1.00	1.00
Yes	16 (6.5)	231 (93.5)	12.47 (6.72-23.14)	6.0 (2.54-13.91) [***]
Have you reminders?				
No	40 (69.0)	18 (31.0)	0.05 (0.03-0.10)	0.08 (0.03-0.21) [***]
Yes	33 (10.6)	279 (89.4)	1.00	1.00
Have regular follow up?				
No	6 (42.9)	8 (57.1)	0.31 (0.10-0.92)	1.28 (0.21-7.99)
Yes	67 (18.8)	289 (81.2)	1.00	1.00

*p<0.05, **p<0.01, ***p<0.001

Discussion

The magnitude of adherence to ART: The magnitude of combined adherence to ART in Adare Hospital was 80.3% among the representative sample of adult PLWHA on HAART. To attain successful HIV treatment outcomes, a strict and >95% of adherence level to HAART is required (16, 17). The finding of this study seems consistent with the result of a cross-sectional study conducted at two health facilities in Addis Ababa with a combined adherence rate of 80.0%, measured by asking three days recall (18). This finding was consistent with findings revealed by a systematic review of several studies whose pooled prevalence of ART adherence ranged from 34.8% to 95.8% (11). It conforms to, for example, findings of an institution-based survey done in Northern Ethiopia, Gondar University Hospital, with self-reported dose adherence of 80.9% (19) and HIV patients' self-reported dose adherence of $\geq$80.0% measured in southern Ethiopia, Hawassa University Hospital (14). The results agree also with a prospective study carried out in Canada which had also measured adherence levels between 80%

and 90% and a study conducted at Rome clinic, in Italy which revealed 80% adherence to ART (20).

However, our study revealed lower adherence levels than results of a prospective study conducted in France which reported >95% adherence level (21) and of a survey in Rural Uganda which found 95.7% adherence level (22). The adherence level revealed by the current study was lower also than the 88.6% adherence levels reported in Northwest Ethiopia (23), the 90.8% in Southeast Ethiopia (24), the 87% reported in Eastern Ethiopia (25), and the 88% reported in Akaki-Kaliti Sub-city of Addis Ababa (26). This might be because of the difference in study design, adherence measurement indicators used in the current study and others.

The finding of this study is higher than adherence levels found in Yirgalem Hospital (74.2%)(27), in Jimma Hospital (72.4%)(28), and Wolaita-Sodo Hospital (74.4%)(29) in Ethiopia. It is also higher than adherence levels documented by some studies in Nigeria (73.4%)(30), at Sokodė Hospital in Togo (78.4%)(31), a systematic review in sub-Saharan Africa (77.0%) and in

North America (55%)(10), and in Brazil (62.8%)(32). The differences in adherence levels reported by the different studies might again be due to differences in study design, adherence measurement indicators used, and patients' socio-demographic characteristics across studies.

Factors associated with combined adherence to HAART
Patient-related factors: This study revealed that language and monthly income were significantly associated with combined adherence to ART. Participants whose first language was Sidaamu Afoo were 50% less likely adherent to their HAART compared with participants whose first language was Amharic. No other studies showed consistency with this finding except a single abstract of the study conducted at Southern Ethiopia, Hawassa University referral Hospital. It found that participants who used Sidaamu Afoo as their first language were more likely non-adherent than other language users (14). This might be due to the communication barriers between patients and the adherence support group as well as clinicians during counselling.

Despite free access to ART drugs and care for PLWHA, this study revealed that lower monthly income was found negatively associated with optimal adherence. Those who earned <1000 ETB monthly income were less likely adherent than those who got ≥2,560 ETB. This finding agrees with results of a survey done in Northwest Ethiopia, which found that patients whose families' monthly income was ≤1200 ETB were 70% more likely non-adherent than those who earned above 1,200ETB (23). It also agrees with a qualitative study for Ethiopia at large (33). Patients whose families earn average middle-income and higher monthly incomes were more likely to have an optimal adherence than those that earned the lowest (28) income. This might be because HAART users with lower monthly income could not pay for transportation, could not afford adherence-enhancing reminders like a watch, mobile phones and medical-related services other than free ART drugs, not afford to pay for their food, and may have psychological stress that can confuse them about the schedule. Those problems may simply put them in sub-optimal adherence.

Other socio-demographic attributes, such as age category, sex, educational status, occupation, marital status, religion and duration of trip and transportation cost to reach ART clinic were not found associated with adherence in this study. This finding is in line with other studies which did not reveal significant relation with adherence (12, 18, 25). This suggests that some socio-demographic characteristics are problematic to categorise patients' adherence status.

Disclosure of one's HIV status to someone else was found as a predictor of optimal adherence in the current study. This result is in agreement with the findings of studies done in Addis Ababa (18), the review of adherence among African HIV patients (12) and the survey conducted in Togo (31). This might be because disclosing HIV status to supportive others unfolds great advantage to properly utilise health care services and appropriate treatments by confidence.

Taking ARV drugs comfortably in front of others was also an independent predictor for optimal adherence in our study. This is again in agreement with results of studies done at Gondar Hospital (19), at Debre Markos Hospital (23), in Addis Ababa city (18) and at Gobba Hospital (24). This may suggest that being non-fearful encourages adherence behaviour.

Even though many studies documented a significant association between social support and optimal adherence (11, 18, 28, 33), this study did not find any significant association. This might be because patients hide their real support from others seeking to get any additional support. Actually, PLWHA need any support from other people to achieve the treatment goal. Additionally, the current study did not identify a history of active substances use as a factor of adherence. This is in agreement with the result documented by the study done in Addis Ababa (18). The reason might be due to social desirability bias.

Medication characteristics: Study subjects were on both first and second-line HAART according to the national treatment standard. In our study, the pill burden was found negatively associated with optimal adherence. Those patients who took 2 and 3 pills once per any of ART dose were 96% less likely adherent to their treatment as compared to single pill users. This suggests that patients taking more than one pill are at greater risk of non-adherence. This result is consistent with results found by a study done in Rural Uganda (22) and a review of African patients' adherence behaviour(12). Patients may feel fatigued to take many pills once and for a long time; hence, they knowingly or unknowingly miss the recommended dose(s).

Dose frequency, duration of ART since started, drug type change and drug side effects were not associated with adherence. This also agrees with the findings of some other studies conducted in Addis Ababa and Gobba Hospitals (18,24). On the other hand, several other studies including a systematic-review that reported contrasting relationships (12, 23, 34, 35).

Disease characteristics: The current study did not find a significant association between adherence and HIV/AIDS disease characteristics-related factors like presence of illness within the past four weeks as well as both CD4 counts and WHO stages. This agrees with studies in Addis Ababa for CD4 count (18), at Jimma Hospital for WHO stages (28) and at Gobba Hospital (24). Conversely, other studies documented WHO stage as a factor of adherence (18, 28) and Tiyou et al. showed positive association among CD4 count and adherence (28).

Patient-provider relationships: Almost all of the participants responded that they were often satisfied with overall health care providers' support at clinic level. This might be due to "white coat positive

response" (36). However, other studies showed a significant association between adherence and the patient-provider relationship (18, 24). In reality, good patient-provider relationships have paramount importance for patients' confidence and trust in caregivers to consult about problems related to treatment, and these tend to improve adherence behaviour.

Clinical setting: Even though previous studies documented association between adherence and convenient clinical settings (12, 18, 33), almost all the participants in this study claimed positive response for the questions about ART clinic. The difference between the different studies with regard to results about the association between adherence and convenient clinical settings might be due to the patients' unwillingness to criticise the clinics in the presence of their caregivers since the interview was conducted at the health facility. Actually, convenient and pleasant clinical environment attracts patients to consistently follow appointments.

Reminder's utilisation: The current study revealed a significant association between schedule reminders and adherence. Patients who did not use reminders were 92% less likely adherent than those who did. This is consistent with the findings of studies done in Addis Ababa (18) and the qualitative study for Ethiopia at large (33). This suggests that reminders help HAART users to remember schedule of medications which is the central point for optimal adherence.

Reasons for missing ART pills: Antiretroviral users often claim many reasons for missing treatment pills. The current study identified major reasons stated by participants, such as forgetfulness (86%), do not want to be looked at by others while taking pills (70%), having too many pills to take (38%), being away from home (36%), feeling sick (30%), running out of pills (22%), being busy (16%) and lack of transport cost (4%). The finding agrees with the reasons documented in previous studies (18, 19, 26-28, 33). Here forgetfulness and fear of others are among great challenges for adherence. Treatment users who fear others simply fail to achieve optimal adherence.

Strengths and limitations
This study used three measurements (dose, schedule and dietary instructions) of adherence for seven days' retrospective recall and reviewed recorded data. A self-reported measurement costs low, is easily applicable in clinical practice, imposes a minimal burden on both participants and staff and paves the opportunity for data collectors to simply ask and identify reasons for missing ARVs doses. Recall bias and social desirability bias might have occurred in this study.

Conclusion and Recommendations
Despite the continued effort from the government to enhance ART adherence, the combined adherence level found in Adare Hospital, is suboptimal. This is yet still comparable to the findings of resource-limited settings like Ethiopia. Language barrier, lack of money, pill - burden, not disclosing HIV positive status e and non-use

of memory aids were factors influencing the patients' suboptimal adherence. On the other hand, ART users are vulnerable to forgetfulness as their treatment to be taken daily with routine personal activities.

PLWHA should disclose their status to others and use mechanical reminders to improve adherence. Additionally, the government should consider local language translator group at the facility level and health care providers should also give emphasise to translation for local and understandable language, encourage PLWHA to be engaged in any income-generating activity through ongoing counselling, and if feasible, reduce the number of pills per dose with consideration of ART regimen to optimise their adherence.

Educating patients continuously about drug side-effects and how they can cope with treatment through individualised counselling is advantageous. Clinicians have to identify HAART users who are in a clinically deteriorated condition which can alter adherence behaviour and offer relevant medical management and counselling to maximise treatment success.

Finally, longitudinal study should be considered using multiple adherence measurements like, bio-markers and others as adherence is a dynamic process.

Conflict of Interest Disclaimer
The authors declare that there is no conflict of interest in publishing this article in EJHD.

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