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Adherence to Antiretroviral Therapy (ART) Among People Living with HIV (PLHIV): A Cross-Sectional Survey to Measure in Selected Public Hospital of Addis Ababa

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Abstract: In Ethiopia, people with HIV receive free antiretroviral therapy (ART). Adherence to ART is very important for people with HIV, because if they don't take their medicines, they can spread HIV to other people. This study aimed to find out how many people living with HIV in Addis Ababa were adherent to their ART. A cross-sectional study was conducted in selected HIV positive adults receiving free ART from March to May2020 at Addis Ababa Public Hospitals. Three hundreds and eighty two People Living with HIV were interviewed using an anonymous questionnaire. The adherence rate estimates are based on the information provided by the HIV-infected people about medications they have taken in the previous four days. Data were analyzed using SPSS version 22 statistical software. Frequencies, ratios, mean and standard deviation were calculated and used to illustrate the studies. Data were presented in the form of tables and graph. To assess the relationship of independent variables with ART adherence, bivariate and data analysis were performed using chi square tests and univariate logistic regression for categorical independent variables were used for data analysis. The frequencies and distribution of each variable were calculated by conventional statistical methods. A p-value < 0.05 was considered to indicate statistical significance. The result showed that 86.9% of the participants showed optimal adherence and 13.1% showed sub optimal adherence. Our result showed that the respondents, age, marital status and average monthly income were associated with suboptimal adherence to ART. Other factors such as gender, duration on ART, and the use of adherence reminders were not associated with non-adherence to ART. Strategies should be developed based on findings to increase adherence to ART.

Keywords: Anti-Retroviral Treatment (ART), Adherence, AIDS, HIV and ART in Ethiopia

1. Introduction

Scientists identified the first case of human immunodeficiency virus (HIV) in 1981.

In 2018, approximately four out of five people living with HIV worldwide were aware of, and nearly two-thirds of all HIV- positive patients were on ART in 2018, and more than half had suppressed viral loads [1]. The HIV has infected people of all ages, genders, race and socio economic status, leading to poor health, poverty and death across the world [2].

ART has been recommended for all HIV patients worldwide regardless of CD4 count, WHO staging, or clinical status. The focus of patient management has shifted from early ARV related toxicity to detection and control to monitor and treatment strategies [3].

In Sub-Saharan Africa (SSA), the world's hardest hit, the number of people who are receiving treatment has more than doubled in the past 5 years. HIV/AIDS remains high in Ethiopia, despite a significant increase in the organize

HIV/AIDS interventions during the Millennium Development Goal (MDG) [4].

Resource limited countries were initially unable to pay for ART for their citizens, and the life expectancy of HIV-positive individuals continued to be low. There have been trial made to make it more rationally priced within low income and middle-income countries [5]. The number of health institutes which offer ART service is rising in trying to develop and decentralize ART services in Ethiopia, and the number of patients using ART services is increasing [6]. Patient adherence may be affected by various variables. The adherence of People living with HIV on antiretroviral therapy in Ethiopia is also influenced by several factors which include resources, cultural beliefs and practices, access to health facilities, stigmatization and support systems. Non-adherence to the proposed antiretroviral regimen is considered to be one of the greatest challenges to the response of a person to treatment and to the spread of resistant virus within the community [7].

The majority of HIV infected patients in Ethiopia does not achieve the optimal adherence. The primary reason for non-adherence to ART is patient –related factors, treatment - related factors, and health facilities related factors. Suboptimal adherence to ART is a common phenomenon in SSA member states, and nearly all these countries find it difficult to reach the WHO recommended 95% adherence rate [7]. HIV and AIDS in Ethiopia ranks among the top public health barriers. In Ethiopia an estimated 793,700 of the population are infected with HIV [8]. In Ethiopia, the HIV prevalence is generally heterogeneous in terms of sex, geographic regions and population groups. Combing women and men HIV occurrence is seven times higher in urban areas than in rural areas (2.9 percent versus 0.4 percent). The occurrence of HIV among women in towns and cities is 3.6% compared with 0.6% among women in the rural areas [9]. In Ethiopia, an adherence rate of 83% was reported in two hospitals of Oromia Regional State, 88.3% in Yirgalem Hospital and 81.2 percent in three hospitals in Addis Ababa which is below the target of 95% [10]. In Ethiopia, the HIV outbreak is getting worse in urban areas. The urban HIV occurrence of 2.9% is seven times greater than the occurrence in rural setting 0.4%. The Demography Health Survey 2016 data indicates an increased HIV occurrence rate in large towns including Addis Ababa and Gambella [11]. In Addis Ababa, the adult HIV - prevalence is approximately four times bigger as compared to the country-level average in the whole country, and may be related to labor migration and large scale construction projects [12]. In 2017, the number of HIV infections among adult Ethiopians was estimated at 722248 increasing by 3748 infections from 2016. The highest estimated HIV prevalence among adults in 2017 was 5 percent in Addis Ababa and Gambella 4 percent [13]. The reality is that the two regions (Gambella and Addis Ababa) have continued for a long time with a heavy load of HIV cases. The Gambella area is known for its lower exposure of male circumcision, which is one of the risk factors for HIV infection; this is because of its distinctive features. Addis

Ababa's high burden is connected with the tendency in distribution that the HIV epidemic in Ethiopia is mainly related with areas of urban concentration [13].

A research carried out on unsuccessful management of HIV/AIDS and related factors in Addis Ababa indicated that there is weak monitoring of the quality of interventions, insufficient connection of HIV positive patients, and loss of follow up, financial scarcity, inadequate manpower, and the gaps in the use of program data of HIV/AIDS treatment [14]. Literature on HIV condition in Addis Ababa showed that there is great prevalence of HIV in Addis Ababa motivated to examine the magnitude of HIV occurrence, why and who are infected, the access to and use of services and resources, and the gap and challenges to tackle the problem of HIV [11]. Attainment of best possible medication adherence, management of antiretroviral drug associated toxicities and patient retention are becoming the biggest obstacles in the management of HIV/AIDS in Ethiopia. Research has evaluated adherence to ART and its related factors/variables among the national HIV-positive patients. Nevertheless, this research reported varied adherence rate and determinants. Results from varied research differ depending on how adherence was calculated, the characteristics of the samples, and the remaining variables examined. In Ethiopia, many studies have also been conducted concerning ART adherence executions which are put in place regarding ART adherence, and these seem to be declining [15]. The level of adherence to ART among PLHIV and determinant factors has not been well studied in public hospitals of Addis Ababa. Therefore, this study intended to investigate the proportion of adherence to ART and identify possible factors related to non-adherence to ART among people living with HIV (PLHIV) in public hospitals of Addis Ababa.

2. Methodology

2.1. Study Design and Participants

This cross-sectional study was performed from March to May 2020 in Selected Public Hospital of Addis Ababa. Participants in the study were PLHIV receiving free ART provided by the HIV/AIDS donors. To be included participants had to be 18 years or over and willing to participate in the study. The clinical condition of the patient had to be suitable for ART based on the CD4 count and to be in the WHO clinical stage for at least six months. The PLHIV were responsible for how and when to take the medicine.

2.2. Sampling

Sampling is the process of selecting a proportion of the whole population to represent the entire population [16]. PLHIV receiving ART were selected consecutively from all study sites by using probability proportional to size, based on the number of PLHIV who were on ART. The participants were selected using simple random sampling. Participants. A solitary proportional formula was used to decide the number of participants who were incorporated in the quantitative stage of the research with the

hypothesis 95% confidence interval (CI), marginal error (d) of 0.05, and adherence level of (p) of 0.65 which was gathered from the earlier research in Dire Dawa, Eastern part of Ethiopia [10]. Then adding non-response rate 10%. The actual sample size for this study was determined by using the formula of single population proportion. Where n = Sample size, $Z\alpha/2$= Z value corresponding to a 95% level of significance = 1.96 p = expected proportion of optimal adherence to ART among adults living with HIV positive = 65% =0.65 q = (1 - p) = (1-0.65) = 0.35, d = absolute precision (5%), none response rate =10%. From the above assumptions and calculations, the final representative sample size was: 385. The study participants from each selected hospitals were calculated based on the proportional allocation formula. Systematically, sample interval was that every 5th unit was taken until the required sample size for study participants was reached and interviewed. However, we were able to enroll 382 participants. Of those 83 from Black Lion Specialized Hospital, 210 from Zewditu Memorial Hospital and 89 from Torhailoch Hospital. Three respondents declined to be interviewed as part of the study.

2.3. Measurement

Adherence measurement in this study was based on patient recall of their compliance of the prescribed doses in the four days prior to the interview. Adherence was calculated based on the number of pills reported to have been actually taken divided by the number of prescribed pills over in the past three days. Patients who reported an intake of $\geq$ 95% of the prescribed medication were considered good adherent, those with a reported intake of < 95% were classified as poor adherent.

2.4. Data Collection

A face-to-face interview with PLHIV by four trained interviewers at the HIV/AIDS center was conducted using a structured, self-report questionnaire developed by the Adult AIDS Clinical Trials Group (AACTG) [17]. The investigator gave training to supervisors and data collectors for two days. The training emphasized the objectives of the study, methods and process of data gathering. Respondents were requested to complete questionnaires which covered socio-demographic factors, adherence to ART, general health conditions and nature of social support. Each completed questionnaire was checked by the supervisor for completeness while the overall data collection process was overseen and managed by the researcher. The data collectors also signed a privacy pledge form. Information on the consent was read out to study respondents and verbal consent was secured from study respondents. In this study quantitative data were collected from HIV positive patients by using a structured self-administered questionnaire. Measurement.

2.5. Data Analysis

Quantitative investigators analyze their data through using statistics, which comprise simple techniques, for example, calculating the mea. In this study, data consistency and completeness were checked during the data collection, data

entry, and analysis. A code was given for each questionnaire using an identifier for each questioner and was entered into the computer using Epi. data version 3.1. Missing values and outliers confirmed by running frequencies and cross tabulation data. The entered data cleaned by anomalies prior for data analysis purpose. Erroneous data were cross checked with the hard copies of completed questionnaires. The number of omitted values for each important variable was checked and managed. The data after being ready for analysis were exported and analyzed using SPSS version 22 statistical software. Frequencies, proportion, mean, standard deviation, were calculated and used to describe the study. Data was presented by tables and graph. In order to assess the relationship of independent variables with ART adherence, bivariate and data analysis were conducted using chi square tests and univariate logistic regression for categorical independent variables. Additional assumption examination that was performed before the multivariate logistic regression analysis. Logistic regression models were employed to set up predictors of adherence and to guess the independent and multiple effect of selected factors or adherence. A p-value < 0.05 was considered to indicate statistical significance.

2.6. Ethical Considerations

Institutional Consent received from Addis Ababa Health Bureau was granted to each hospital study sites. During the data collection, the researcher assured every patient of privacy and non-disclosure of the details of the patient to some third party. This was accomplished by using a suitable place for each interview. Another way to protect the privacy of the respondents was that when the study report was written, the researcher did not identify respondents by their names, telephone number and place of residence. Through this, the respondents' privacy was respected. All concerned bodies were informed about the right to request and access the final report of this study. Each step of this study was agreed to maintain its ethical procedures. The interviewer explained the purpose of the study and procedures and gained written informed consent before commencing the interview. The participants were also informed that their participation was voluntary and that they could withdraw from the interview/discussion at any time without consequences.

3. Results

3.1. Socio Demographics

A total of 385 patients on ART were approached during this study, and data gathered from 382 respondents via face-to-face interviews with a structured questionnaire. The response rate was 99.2%, which keeps with the study's assumption of a 10% non-response rate. Most of respondents (84.8%) received ART services from Addis Ababa City because the hospital is found in Addis Ababa. More than half of the respondents (55.0%) attended their treatments in Zewditu Memorial Hospital which is part of the public hospital under the supervision of Addis Ababa Health Bureau (AAHB). One hundred and seventy –

one male patients (44.8%) took part in this study, and 211 (55.2%) were been females. This shows that there were more women living with HIV. The mean age of respondents was 43+ 10.3SD with the minimum age of18 years and also the maximum age of 81 years. The age distribution of the respondents indicates that 39.8 % (n=152) of the participants were in the age group of 38- 47 years, 34.8 % (n=133) were 47+ years age, 20.7 % (n=79) were between 28-37 years old and 4.7 % (n=18) were between 18-27 year old. The sample of the study included most of the participants (89.5%) who had some form of education so they were able to read and write completed their primary education. Regarding marital status 60.6% (n=231) had been married, 24.3% (n=93) hadn't been married, 9.9% (n=38) had been widowed, and 5.2% (n=20) have been divorced. Nearly two-third of the study participants has been married. Out of the whole number of study respondents, 43.5% (n=166), were private employed. over one third of the respondents (37.7%) had an average monthly income less than 1501 ETB which makes it difficult to survive within the context of Ethiopia. one –sixth of respondents lived alone (64out of 382). More than half of the respondents lived and shared meals with between one and three people within the same house (55.2%). Out of 382 respondents, 90.8 % (n=347) disclosed HIV status to their social and family support, and 9.2% (n=35) had not told their HIV status to social and family support (as shown in table 1).

Table 1. *Socio-demographic characteristic of respondents.*

Variable	Frequency	Percentage
HIV+ Pts take ART from		
Addis Ababa City	324	84.8
Outside of Addis Ababa City	58	15.2
Administration level of ART clinic (Public Hospitals)		
Black Lion Specialized Hospital (Federal)	83	21.7
Zewditu Memorial Hospital (Addis Ababa City Health Bureau)	210	55.0
TorHailoch Hospital (Armed Force)	89	23,3
Sex		
Male	171	44.8
Female	211	55.2
Age		
18-27	18	4.7
28-37	79	20.7
38-47	152	39.8
>47	133	34.8
Educational Status		
No formal education	40	10.5
Primary education	94	24.6
Secondary education	120	31.4
College diploma	72	18.8
University degree	46	12.0
Master degree	10	2.6
Marital Status		
Single	93	24.3
Married	231	60.6
Divorced	20	5.2
Widowed	38	9.9
Occupation status		
Private employee	166	43.2
Government employee	96	25.1
House wife	51	13.4
Pensioner	37	9.7
Jobless	23	6.0
Self employee	7	1.8
Non Government Organization	2	0.5
Monthly income (inBirr)		
<500	38	9.9
501-1500	106	27.8
1501-2600	80	21.0
2601-3700	57	14.9
3701-4800	13	3.4
>4801	88	23.0
Number of people living in the house and sharing meals		
0	64	16.8
1-3 People	211	52.2
> 3People	107	28.0
Disclosed HIV Status		
Yes	347	90.8
No	35	9.2

3.2. Treatment and Clinical Characteristics of Respondents

Table 2 presents treatment and clinical characteristics of the respondents. All respondents in the 3 out patient clinics were getting ART free of charge. There were 4 types of ARV in first-line ART regimens. Fifteen percent of the respondents were on regimen 1c that includes zidovudine, lamivudine, and nevirapine. Regimen1d includes zidovudine, lamivudine, and efavirenz and second most common therapy used in the three ART clinics. The highest frequently used regimens were 1e (that includes ten of ovirdisoproxil fumarate, lamivudine, and efavirenz) used by 44.2%.

***Table 2.** Treatment and respondents' clinical Characteristics (N=382).*

Treatment and Clinical Characteristics of respondents	Number of participants	Percentage of (%)
ART regimen		
1c (AZT-3TC-NVP)	58	15.2
1d (AZT-3TC-EFV)	80	21.0
1e (TDF-3TC-EFV)	169	44.2
2f (AZT-3TC-ATN/r)	10	2.6
2h (TDF-3TC-ATN/r)	65	17.0
CD4 count as baseline		
<200 cells/μL	27	7.1
201-499 cells/μL	162	42.4
>499 cells/μL	193	50.5
Cotrimoxazole prophylaxis use		
Current	56	14.7
In the past	313	81.9
Never	13	3.4
Tuberculosis treatment		
Yes	65	17.0
NO	317	83.0

Note: ATV/r: Atazanavir /ritonavir EFV: Efavirenz3TC: Lamivudine NVP: NevirapineTDF: Tenofovirdisoproxil fumarate AZT: Zidovudine.

3.3. WHO HIV / AIDS Clinical Stage

According to WHO guidelines, 29 (7.6%) were categorized as being in WHO's stage I; 76 (19.9%) in WHO's II; 130 (34.0%) in stage III and 147 (38.5%) in stage IV. There was a significant association between WHO/AIDS staging and adherence to ART (P=0.047). According to Figure 1 below, stage IV had the highest percentage of patients adhering to their ART (n=147; 38.5%), followed by WHO stage III (n=130; 34.0%).
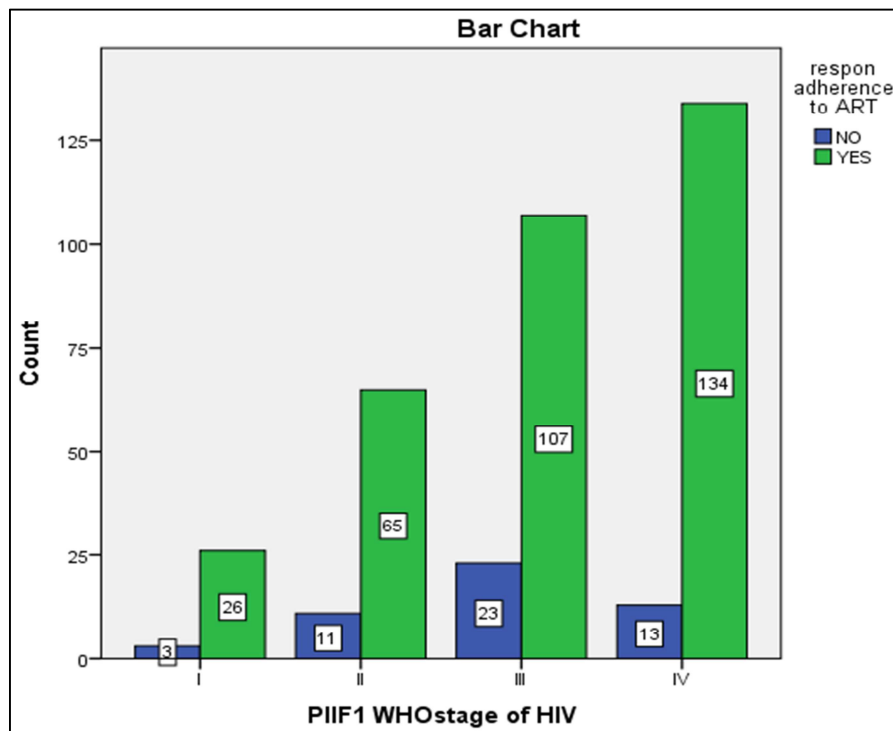
***Figure 1.** Respondents WHO stages of HIV (n=382).*

3.4. Other Characteristics of ART Adherence

Patients should show up for their scheduled appointments with medical professionals as another part of ART adherence. Only 19 of the 382 people surveyed (5.0%) missed an appointment in the previous three months. The most frequent excuses given by research participants for skipping appointments were "busy" (21.0%), "out of town" (73.7%), and "afraid of being victimized" (5.3%). As (shown in Table 3).

Table 3. Characteristics of ART adherence among Sample (N=382).

ART adherence characteristics	Number of respondents	Percentage of Sample (%)
Every missed appointment with Health care providers		
Yes	19	5.0
No	363	95.0
Most common reason for missing appointment		
Busy	4	21.0
Out of town	14	73.7
Afraid of being victimized	1	5.3

3.5. Reliability and Validity / Cronbach's α Adherence to ART

The internal consistency of the measures utilized in this study was developed using information gathered from 382 HIV/AIDS patients in three ART clinics. The Cronbach's alpha for each data was computed using SPSS for window22. "The typically agreed on lower limit for Cronbach's alpha is 0.70," according to the range of Cronbach's alpha. As predictors of sufficient internal consistency [18]. This result was 0.70. Total Cronbach's alpha for health status, health symptoms in the past month, reason for missed medications, Health Care Providers (HCPs) to patients and treatment characteristics to ART ranged from 0.798 to 0.950. This indicates that all items of these variables are contribute to overall reliability. Cronbach's alpha for internal reliability of family/social/friend support and depression were small (from 0.556 to 0.667) and below the standard requirement (as seen in table 4).

Table 4. AACTG questionnaires Scale reliability, Mean (SD) among respondents (N=382).

Scores	Number of items	Cronbach's α	Mean/SD
Total scores	63	0.823	125.30 (32.39)
Depression	10	0.667	20.60 (4.84)
Health Symptoms in the last month	10	0.837	19.75 (7.18)
Belief about health status/faith	4	0.798	11.36 (5.14)
Reason for missing dose	11	0.860	19.49 (5.55)
Health Care providers (HCPs) in formation to patients	4	0.845	16.50 (2.96)
Treatment characteristics to ART	6	0.950	10.70 (3.22)
Family/social/peer support	18	0.556	26.90 (3.50)

3.6. Characteristics of Drug Substance and Alcohol Use

Table 5 shows that, out of 382, 89.3 % (n=341) had never taken alcoholic beverage in the last month; while the remaining 10.7% (n=41) had had experience in drinking alcohol within the last month. When stratified these behaviors by sex, it's clearly that sex significantly influence these behaviors while eighteen percent of men drunk alcohol last month, only five percent women did. Regarding frequency of alcohol drunk last month, 15.2% (n=26) and 4.3% (n=9) men and women drunk 1-3 times /week respectively. Almost 98.2% had never used an illicit drug/substance in the last month; while 1.8% reported using illicit drugs within the prior month. Sex has no association with using illicit drugs (P=0.108).

Table 5. Alcohol and Drug/substance use (N=382).

Variables	Male	Female	Total	P-value
Alcohol use (last month)				
Yes	31 (18.1%)	10 (4.7%)	41 (10.7%)	0.001
No	140 (81.9%)	201 (95.3%)	341 (89.3%)	
Frequency of alcohol use (last month)				
1-4 times/wk	4 (2.3%)	0 (0.0%)	4 (1.0%)	
1-3 times/month	26 (15.2%)	9 (4.3%)	35 (9.2%)	0.001
Occasionally	1 (0.6%)	1 (0.5%)	2 (0.5%)	
Never	140 (81.9%)	211 (95.3%)	341 (89.3%)	
Every used illicit drugs (last month)				
Yes	5 (2.9%)	2 (0.94%)	7 (1.8%)	0.108
No	166 (97.1%)	209 (99.06%)	375 (98.2%)	

Variables	Male	Female	Total	P-value
Frequency of illicit drugs use (last month)				
Daily	5 (2.9%)	1 (0.5%)	6 (1.6%)	
1-4 times	0 (0.0%)	1 (0.5%)	1 (0.3%)	0.108
Never	166 (97.1%)	209 (99.0%)	375 (98.1%)	

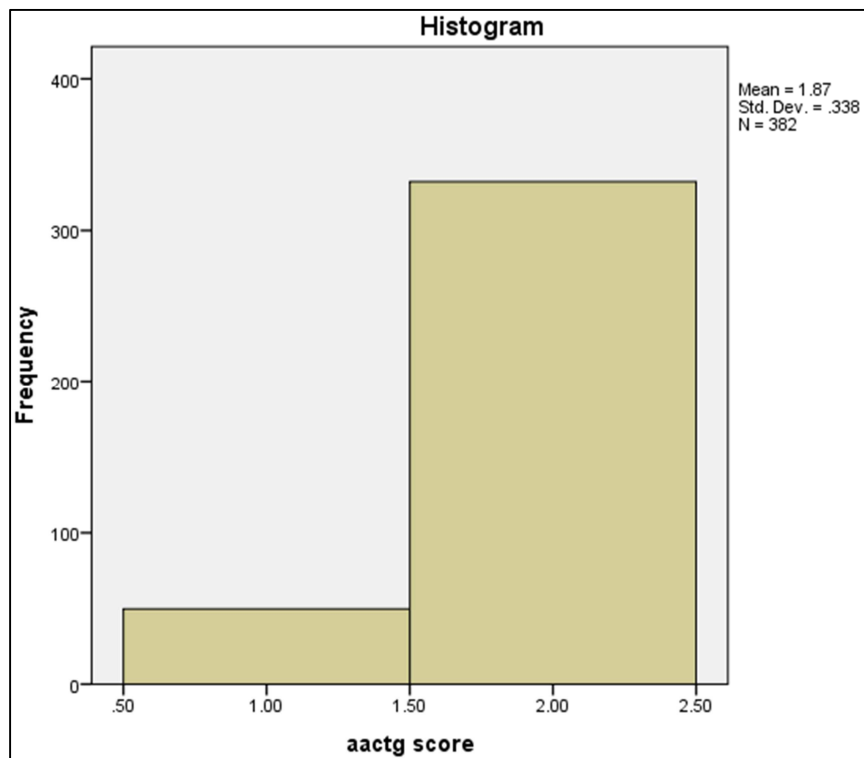### 3.7. Adult AIDS Clinical Trial Group Adherence Distribution of Respondents (AACTG)

Figure 2. Adult AIDS Clinical Trial GroupACTG Distribution of respondents.

The modified AACTG tool was used to count the number of doses which respondents did not take in the previous four days. Most of respondents were required to take ARVs twice a day with the time interval between two doses of twelve hours. Therefore, they were required to take a total eight dose during the past four hours. In this study, 86.9% (n=332) who had scores equal to or greater than 95% were categorized as good adherence, and 13.1% (n=50) of respondents who had adherence scores < 95%were classified as suboptimal adherence. The mean of adherence score was 1.87 (SD=0.338) as seen in Figure 2.

3.8. Determinants of Sub Optimal Adherence to ART

Table 6 provides an explanation of the association of socio- demographic factors related to ART adherence. Variables with P<0.30 in the bivariate analysis were included in the multivariate. Relative to the patient grouped aged from 18-27, the group of patients aged greater than 47 had 5.4 times odds of the time non-adherence (95%CI: 1.253, 23.795). Patients who had divorced [AOR: 0.207, 95%CI (0.057, 0.745)] slightly more likely to be non-adherence as compared to the counterpart. Study participants who had earned greater than 4800ETB per month [AOR=8.657, 95%CI (1.483, 50.536)] were 8.6 times more possible to non-adherence as compared to those who had earned less than 500ETB per month. In multivariate logistic regression analysis, five variables: sex, ethnicity, religion, education and occupation are factors not related with non-adherence to ART. The level of adherence was considerably influenced by age that patients in age group of 38-47 years old were more probable to be adherent than 18-27 years old.

Table 6. Binary and Multiple logistic regression presentation determinants of non-adherence to ART among three government hospitals of Addis Ababa, 2020 (N=382).

Variables	Poor adherence (%) n=50	Good adherence (%) n=332	COR 95%CI	AOR95%CI	P-value
Age					
18-27	7 (14.0)	11 (3.3)	1.0	1.0	
28-37	15 (30.0)	64 (19.3)	2.715 (0.902,8.172)	3.095 (0.749,12.790)	0.119
38-47	13 (26.0)	139 (41.9)	6.804 (2.254,20.544)**	8.225 (1.962,34.474)*	0.004
>47	15 (30.0)	118 (35.5)	5.004 (1.684,14.880)**	5.460 (1.253,23.795)*	0.024

Variables	Poor adherence (%) n=50	Good adherence (%) n=332	COR 95%CI	AOR95%CI	P-value
Sex					
Male	22 (44.0)	149 (44.9)	1.0	1.0	
Female	28 (56.0)	183 (55.1)	0.965 (0.530,1.756)	0.990 (0.428,2.290)	0.990
Marital Status					
Single	17 (34.0)	76 (22.9)	1.0	1.0	
Married	24 (48.0)	207 (62.3)	0.518 (0.264,1.018)	0.588 (0.234,1.476)	0.258
Divorced	6 (12.0)	14 (4.2)	0.271 (0.095,0.770)**	0.207 (0.057,0.745)**	0.016
Widowed	3 (6.0)	35 (10.5)	1.353 (0.387,4.733)	1.466 (0.364,5.901)	0.590
Ethnicity					
Amahara	20 (40.0)	177 (53.3)	1.0	1.0	
Oromo	20 (40.0)	83 (25.0)	0.469 (0.239,0.909)	0.455 (0.206,1.003)	0.051
Tigre	6 (12.0)	44 (13.3)	0.829 (0.314,2.186)	1.196 (0.395,3.623)	0.752
Gurage	3 (6.0)	22 (6.6)	0.829 (0.228,3.016)	0.887 (0.204,3.862)	0.874
Other	1 (2.0)	6 (1.8)	0.678 (0.078,5.919)	1.460 (0.115,18.459)	0.770
Religion					
Orthodox	39 (78.0)	274 (82.5)	1.0	1.0	
Muslim	4 (8.0)	20 (6.0)	0.712 (0.231,2.191)	1.102 (0.290,4.191)	0.887
Protestant	7 (14.0)	34 (10.2)	0.691 (0.287,1.667)	0.843 (0.295,2.411)	0.750
Catholic	0 (0.0)	1 (0.3)	---------- ---------	--- --- ---	

4. Discussions

In this study, we examined factors associated with ART adherence in Selected Public Hospital of Addis Ababa. According to Ethiopian Demographic Heath Survey (EDHS) the overall education status in Addis Ababa where only 36% of adults have received secondary education [19]. Many researches indicated that there's an association between education and adherence level [20-21]. In contrast, some studies reported that there's no association between adherence and educational status [22-23]. Our findings are consistent with the report of EDHS 2016.

Regarding living condition of respondents, our result finding is lower than the study done in Southern Ethiopia [24], 128 (40.0%) 141 respondents were lived alone. The difference of the result may be stigmatization and therefore the individual behavior of the patient preference to live alone. Family and community members can both play positive and negative roles in ART treatment commencement and adherence [25].

In many studies where HIV disclosure was low, they were established to have low ART adherence. Literature proposes that HIV disclosure facilitates ART adherence [26-27]. In a study done in Sokode, Togo compared to HIV status those who were reluctant to disclose their HIV status were more likely to be non-adherence to ART. PLHIV who did not disclose their HIV status were more likely to report frequent ART interruption and fear to be discriminated or stigmatized [26]. Regarding CD4 count the finding was lower than a study done in North eastern Ethiopia in which 236 (56.5%) of them had a base line CD4 count between 200-499 cells/mm3and (55.0%) had CD4 count of > or equal 500 cells/mm3 [28]. The discrepancy is our sample size lower than the study conducted in North eastern Ethiopia. A study undertaken in China indicated that patients initiating ART with high CD4cells count will likely adhere to the regimen as well as patients with lower CD4cell counts [29]. According to research conducted in SSA indicated that non-adherence in advanced HIV illness may be as a consequence of increased OIs [30].

In this study our result is lower than similar study conducted in Addis Ababa, 77.9% of the total respondents used mobile alarm as a kind of adherence aid [31]. The discrepancy might be the importance of memory aids in our study setting is not as such as provided by hospital ART staffs for patients regarding results of good education. This result is supported by a study done in Northern Ethiopia where 82.9% of the respondents used clock alarm that allowed for multiple daily reminders to receive ART drug [32]. Just about two-third of study participants (63.0%) found that these techniques helped them a lot in complying with their ARV. regimen. In this finding using of adherence aids or reminder has significant association with adherence to ART (P=0043). Also, a study conducted in southern east Nigeria indicated that for patients forgetting to carry their drug when going out, reminders and memory aids are expected to be helpful [33]. The whole alcohol users in our finding is below the study conducted in Northwest Ethiopia in which103 out of 647 (15.9%) accustomed drink alcohol [34]. On the other hand, alcohol drink in our result finding is consistent with the study conducted in Easter Ethiopia [35] in which the use of alcohol in the last month was significantly associated related to the risk of adherence. The difference may be the sample size of North West Ethiopia is above our sample size. The number of participants using substance/illicit drug during this finding is consistent with a study conducted in East Wollega, Ethiopia where only 5 (1.6%) respondents were illicit drug users [36]. These suggest that illicit drug use may contribute to non-adherence to ART. The association between illicit drug use and non-adherence were documented in Nepal, Latin America and Caribbean, Cambodia, Romania and Kenya [37-41]. At least 95% ART adherence is needed to suppress viral replication show clinical improvement and maintain treatment target [42]. If this adherence level is not maintained then it has public health implication and poor health outcomes like drug resistance, treatment failure and

increase OPIs [43]. Adherence was calculating using ART patients self report in this study for the previous 4 days. 158 In this finding, the rate of adherence to ART was obtained to be 86.9%. This is almost inline with those research conducted at China [44] and Gondar referral hospital [45], which indicated 85.5% and 88.2%, respectively. However, it is more than a research conducted in Nekemte Specialized Hospital, Oromia, Ethiopia (81.0%) (3), Addis Ababa (79.1%) [46], in Felege Hiwot and Gondar University Hospitals, northwest Ethiopia (75.6%) [47] and in SSA (72.9%) [48]. This variation might be due to differences in, adherence measurement tools self report 4 days, socio demographic characteristics, sample size and study designs/methods. In low income countries many researchers have been done among PLHIV on ART in order to measure their adherence to ART [26]. That adherence to ART was expected at 55.4% in Congo and 93% in Senegal. Adherence to ART among PLHIV is affected by many factors such as patient related, medication or treatment related and psychosocial and health facilities [26].

This result is comparable with that from a study conducted in Eastern Ethiopia showing significant relationship between age with ART adherence level [49]. The possible reason of this finding might be younger age groups might be feared stigma and discrimination compared to middle age grouped. A research conducted in Northern Tanzania also revealed that the relationship with age <25 years were more likely to report poor adherence [50]. The possible reason younger people were less likely to adhere to ART use was that younger people have a less stable social and economic situation, and have less interaction with health care system as compared with adult counterparts. This results showing adherence increase with age.

5. Conclusion

In conclusion, the result showed that 86.9% of the participants showed optimal adherence and 13.1% showed sub optimal adherence. Our result showed that the respondents, age, marital status and average monthly income were associated with suboptimal adherence to ART. Other factors such as gender, duration on ART, and the use of adherence reminders were not associated with non-adherence to ART. Strategies should be developed based on findings to increase adherence to ART competing Interests.

The scholars declare that they have no competing interests.

6. Limitations of Study

The findings of this study must be interpreted in the light of its limitations. The study was conducted at only three sites in the public Hospital of Addis Ababa and the findings may not be generalizable to other clinical settings. There is no gold standard for measuring adherence and our measurement of adherence is based on PLHIV self-reports of missed doses which may be subject to social desirability and recall biases.

Authors' Contributions

All authors participated in concept, design, literature search, data acquisition, and data analysis of the manuscript. Tefera Tezera prepared the manuscript and did revision tasks in addition to the above tasks. All authors approved manuscript submission.

Declaration

Tefera Tezera declare that my original work title is Adherence to Antiretroviral Therapy (ART) among People Living With HIV (PLHIV): a cross-sectional survey to measure in selected Public Hospital of Addis Ababa, Ethiopia and that all the sources I have used or cited have been indicated and accepted reference by complete reference and this work has not been previously submitted to any other journals to any other.

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