Original Research Article

Adherence to highly active antiretroviral therapy in a public hospital: an institution based cross-sectional study

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ABSTRACT

Background: The success of human immunodeficiency virus/ acquired immunodeficiency syndrome (HIV/AIDS) treatment relies heavily on patient adherence to antiretroviral therapy (ART). Poor adherence is a leading cause of increased morbidity and mortality among people living with HIV/AIDS (PLWHA). This study examined the factors influencing treatment adherence among PLWHA receiving highly active ART (HAART) at Yekatit 12 hospital in Addis Ababa, Ethiopia.
Methods: A cross-sectional institution-based study was conducted from January to February 2015, involving 200 participants selected through systematic random sampling. Data were collected using an interviewer-administered questionnaire, entered into spreadsheet software, and analyzed using IBM® SPSS® statistics version 25. Correlation analysis was used to evaluate participants' perceptions of the impact of ART category on adherence.
Results: The mean age of the respondents was 35.9±5.9 years. The overall proportion of adherent people was 74.4±1.2%. "Being busy" (19.5%), "forgetfulness" (17.5%), and "I did not want others to notice the medication use" (9%) were the most common reasons given by participants. The percentage of adherence to ART was correlated with ART acceptability and availability. ART acceptability correlation was statistically significant; [r (200)=-0.96, p=0.03]. However, the ART availability correlation was insignificant; [r (200)=-0.061, p=0.3].
Conclusions: In summary, according to the WHO ART adherence standard, the average adherence level in this study was classified as poor. Enhancing adherence to ART necessitates implementing targeted adherence strategies, fostering strong patient–provider relationships, and promoting the use of memory aids.

Keywords: Adherence, Highly active antiretroviral therapy, HIV/AIDS, PLWHA, Ethiopia

INTRODUCTION

The human immunodeficiency virus (HIV) was initially found 40 years ago. Since then, an acquired immunodeficiency syndrome (AIDS) has killed millions of people worldwide.[1] In 2021, the United Nations (UN) AIDS estimated that 37.7 million (30.2 million-45.1 million) people were living with HIV/AIDS (PLWHA) and 28.2 million people had access to antiretroviral therapy (ART).[2] The 2020/2021 national HIV estimates report of Ethiopia, a country in Sub-Saharan Africa, showed that 622 326/617 921 people of all ages were living with HIV and 11 715/10 943 were newly infected with HIV.[3]

The discovery and introduction of antiretroviral drugs (ARVs) for the treatment of HIV are the most significant advances in medicine. These drugs, ART, lower viral load to undetectable levels and dramatically reduce morbidity and mortality. The reduction of serum viral load by ARV drugs also reduces the rate of transmission from mother to child.[4] Taking full advantage of ART is a complex individual behavioral process that is determined by many other factors, including patient characteristics and healthcare systems. Human behaviors and beliefs are also critical: inadequate knowledge and negative attitudes toward ART, medication side effects, financial constraints, service-related factors, stigma, discrimination, inability to disclose HIV status, and various sociocultural issues can discourage patients from seeking or maintaining treatment.[5]

HIV medication nonadherence is a key factor in treatment failure, drug resistance, and increased costs. It is associated with frequent hospitalizations and prolonged hospital stays. Adherence can be defined as the patient's ability to follow a physician's advice or treatment plan by taking prescribed medications as directed and adhering to food and other medication restrictions.[10,11] Adoption and maintenance of treatment adherence is a difficult undertaking for people with any chronic disease. HIV/AIDS often requires multiple medications, frequent dosing, and a prolonged course with significant side effects. With the advent of ARV drugs, anything short of near-perfect adherence to treatment regimens can lead to declining drug efficacy and the subsequent development of drug-resistant strains of the virus.[12]

According to guidelines from the panel of the International AIDS society and the United States of America, "less than excellent adherence can lead to viral breakthrough and the emergence of drug-resistant strains. The consequences of poor adherence include not only reduced benefit to the patient, but also the threat to public health from the emergence of multidrug-resistant viruses, as these resistant strains can then be transmitted from a patient to his or her contacts.[13] Low adherence results in ARVs not working effectively and is associated with an increase in viral load, a decrease in cluster of differentiation 4 (CD_4) levels, and an increased risk of disease progression at AIDS.[14,15]

Therefore, the aim of this study was to determine the level of adherence to HAART and its determinants in a representative sample of patients attending the Yekatit 12 hospital ART clinic (Y12H-AC) in Addis Ababa, Ethiopia.

METHODS

Study framework, design, and period

A cross-sectional study was conducted at Y12H-AC, Addis Ababa, Ethiopia from January to February 2015. During the study period, Y12H was one of the six public hospitals in Addis Ababa that provided ART services to 1162 PLWHA in the follow-up of 2595 registered PLWHA. The selection of the study setting relied on convenience sampling, taking into account that Y12 is a pioneer in providing ART services to PLWHA.

Inclusion and exclusion criteria

Inclusion criteria included: PLWHA who had been treated for at least one month at ART and were willing to participate in the study, and patients who were in regular follow-up but had not started ART. Patients with critical medical and mental health conditions were excluded.

Sample size and sampling techniques

The sample size for the study was determined by using the single population proportion formula. Since there is no previous study, the proportion was taken as 50%, and accordingly, the sample size was calculated to be 384.

$$n = \frac{(Za_{/2})^2 \ p(1-p)}{d^2}$$
$$n = \frac{(1.96)^2 \ (0.5)(1-0.5)}{(0.05)^2} = \frac{0.9604}{0.0025} = 384.16 \sim 384$$

Since the sample size n>0.05 N, where N was the population size (i.e. 509), the final sample size calculation involved the finite population correction factor (FPC), which was

$$FPC = \sqrt{(N-n)/(N-1)}$$
$$FPC = \sqrt{(509-384)/(509-1)}$$
$$FPC = \sqrt{(125)/(508)}$$
$$FPC = \sqrt{0.25}$$
$$FPC = 0.49$$

n*, the new sample size was calculated by multiplying the FPC factor with the previous sample size, n, which was

$$n* = n \times FPC$$
$$n* = 384 \times 0.49$$
$$n* = 190.5$$

Considering a 10% non-response rate, the final sample size was calculated to be

$$n* = 190.5 + 19.05 \sim 209.5$$

Where;

n: sample size (infinite population); n*: sample size (finite population); p: proportion of adherent patients on HAART; d: margin of error.

The sampling frame included patients receiving care in the treatment and care clinics of ART. Individuals who met the inclusion criteria were selected using the patient

registry as sampling frame. The appropriate sample size was determined using systematic random sampling until the required sample size was achieved. The first case was selected by lottery, and every 3rd case was selected as study participant. For absent and non-respondents, next closest person was selected as an alternate.

Data collection procedures and tool

Data collection from the study population was done using a pre-tested structured questionnaire (5%; 10 study participants) validated through face-to-face interviews in the local language, Amharic. A total of 200 questionnaires were used to collect data from eligible respondents. The questionnaire was translated into Amharic, the national language of Ethiopia by translators, as the data collection was done in Addis Ababa and back-translated to English for its consistency. A pretest was conducted on 5% of the samples at TASH hospital.

A final year pharmacy student, who is one of the principal investigators, collected data directly from each study participant. Respondents were guided in answering the questionnaire according to the instructions in each section of the questionnaire. The data collection instrument included a section on demographic characteristics and ART adherence. The section on demographic characteristics included age, sex, education level, occupation, marital status, and disclosure of HIV status. The ART section on treatment adherence used the national standard to designate ART treatment adherence as "Good," "Moderate," and "Poor"; individuals who had missed ≤2 doses, 3-5 doses, and ≥6 doses were classified as "Good" (≥95% treatment adherence), "Moderate" (85-94% treatment adherence), and "Poor" (<85% treatment adherence), respectively.

Study variables

The independent variables were: Age, gender, marital status, disclosure of HIV status, socioeconomic status, drug and alcohol use, and patients' views on accessibility, affordability, acceptability, and availability of ART services. The dependent variable was the degree of patient adherence to ART.

Data quality management

To ensure data quality, a carefully designed and pre-tested questionnaire used. Respondents were personally guided during data collection. Unclear questions were also corrected on spot to ensure data quality.

Operational definitions

Adherence: It defined as not missing a single ART dose during the 30-day period prior to filling out the self-report. Adherence was measured by self-reports by the patients.

ART accessibility: A measure of the patient's views on the appropriateness of physical location of the ART clinic, waiting time, ease of access to healthcare workers and convenience of the facility to the patient. ART accessibility refers to the appropriateness of the location, waiting time, accessibility of medical staff, and convenience of the facility for the patient.

ART affordability: A measure of the ability of patients to pay for ART related services that they utilize at the facility. Acceptability of ART refers to patients' views on professional competence, attitude of medical staff, quality of health education in the Y12H-AC and benefits or adverse effects of ART treatment.

ART availability: A measure of the patients' views on the availability of all the range of medical services that a HIV-infected patient may require including outpatient and inpatient services. Availability of ART is the patients' perception of the various medical services provided at the hospital, some of which they needed due to their HIV infection. For example: counseling for adherence to ART, inpatient care for PLWHA, prevention of mother-to-child transmission (PMCT) of HIV, psychiatric services, and ear, nose, and throat (ENT) services.

The monthly income of the household included the summed total income of the house and was categorized as No income, <500 ETB, 500-2000 ETB, and >2000 ETB.

Statistical analysis

Questionnaires were checked for completeness, numbered consecutively, and open-ended questions were coded for entry. IBM® SPSS® Statistics version 25 software was used to analyze the data. A correlational analysis was performed to assess participants' views on the availability, accessibility, and acceptability of ART and to assess the impact of each category on adherence.

Ethical considerations

Ethical approval was obtained from the Y12H, medical sciences institutional research and ethical review committee. The ethical standards set forth in the declaration of Helsinki for research with human subjects were followed by this study. Data were collected after study participants were informed of the purpose of the study and the confidentiality of their personal information, and written informed consent was obtained.

RESULTS

Sociodemographic information

The study included 200 respondents, achieving a response rate of 95.5%. The average age of the respondents was 35.9 years. The age range of the sample spanned from 18 to 72 years, with the youngest and oldest individuals in the sample being 18 and 72 years

old, respectively. The median age of the respondents was 33.0 years, and the modal age was 39.0 years.

Approximately 50% of respondents held only a primary school diploma, while just 7% had education levels beyond secondary school. There was no statistically significant difference in educational attainment observed between male and female patients in the survey. A notable finding was a higher proportion of widowed and unmarried women compared to men. Conversely, more men were divorced than women, although this gender difference did not reach statistical significance.

In the study, nearly half of the participants, 83 (41.5%), were identified as unemployed. Gender disparities were evident in occupational distributions, with a significant majority of females, 48 (57.8%), and males, 35 (42.2%), falling into the unemployed category. Moreover, a substantial majority of females, 59 (80.8%), reported being self-employed, compared to only 14 (19.2%) of males.

In the scientific paper, the income range among men varied from 700 Ethiopian Birr (ETB) as the lowest to 10,000 ETB as the highest. Comparatively, women reported a range from 300 ETB as the lowest to 5,000 ETB as the highest.

HIV disclosure status

The majority of male and female respondents, 177 (88.5%), had disclosed their HIV status to family, friends, or relatives. The number of patients who had not disclosed their HIV status was 23 (11.5%).

In this study, no association was found between adherence to ART and patient disclosure of HIV status to others ($p>0.05$). Most of the respondents, 154 (88.8%), had disclosed their status to at least one person (Table 1).

Proportion of adherent people to HAART

The mean proportion of adherence for all patients was 74.4±1.2%. A more detailed analysis of the data shows that the number of patients who adhered optimally (more than 95%) to ART was only 124, representing 62% of the total participating patients. About 61 (30.5%) patients adhered to ART more than 86% of the time. Only 15 (7.5%) of patients in the sample adhered less than 75% to ART.

There was a statistically significant difference in adherence among respondents when categorized by occupation. Employed patients showed notably lower adherence compared to other groups, with only 41 (13.9%) demonstrating adherence (Table 2).

The proportion of adherent people in younger patients (<50 years) was 37.9%, which was significantly different from the adherence of older patients aged 50 years and older (29.9%). Optimal adherence in patients younger than 50 years compared with those older than 50 years was 95% CI (1.112-1.167). Approximately 52 (29.9%) of elderly patients did not adhere to ART compared with younger patients.

The percentile of optimal adherence comparing primary with secondary and higher levels of education was 36.8% (95% CI, (0.505-0.524), $p>0.1$). There were no differences in adherence between categories of different marital statuses. The percent adherence of a nonmarried patient compared with a married, separated, or divorced patient was 27 (14.4%) [95% CI, (0.335-0.350), $p>0.1$].

Reasons for nonadherence

Respondents were asked to indicate the factors that influenced their adherence to ART treatment. About 39 (19.5%) of the participants reported "being busy," 35 (17.5%) indicated "forgetfulness," and 18 (9%) answered "I did not want others to notice my ART medications." Additionally, 18 (9%) of the patients indicated "I was not at home" as the reason for nonadherence. About 45 (22.5%) of the participants provided a variety of other reasons: "I had to take too many pills" (12/6%), "I had a change in my daily routine" (13 or 6.5%), "I felt sick" (9/4.5%) and "I had nausea" (11 5.5%) as main reasons for nonadherence. Remaining 45 (22.5%) gave no reason for not taking their pills.

ART availability, accessibility, and acceptability

In our study, patient perceived availability of ART was correlated with percent adherence to ART, although the correlation was not statistically significant; [$r(200=-0.061$, $p=0.3$].

In our study, 22% of the respondents arrived to the Y12H-AC in under an hour, while 50.5% arrived after an hour. This indicates that the overall accessibility of the Y12H-AC is considered low. Fifty (25%) respondents rated the waiting time as poor, while 54 (27%) respondents rated the waiting time as excellent. Patient perceived accessibility of ART correlated with percentage of adherence. However, the correlation was not statistically significant; [$r(200)=-0.029$, $p=0.062$] (Table 3).

In our study, almost all participants (93%) rated the competence of healthcare staff in terms of health education as poor. The quality of privacy during consultation in the hospital was rated as excellent or good by 132 (88%) and 23 (76.7%) respondents, respectively. The 112 (59.6%) of the participants rated the communication and information they received at the hospital as excellent. Patients' mean scores correlated with percent compliance with ART, and the correlation was significant; [$r(200)=-0.96$, $p=0.03$]. It was found that patients with a high level of confidence in the competence of healthcare staff and quality of hospital's services generally had higher compliance with ART.

Table 1: HIV disclosure status of respondents based on sex and adherence status to ART at Y12H, Addis Ababa, Ethiopia, 2015.

Variables		HIV disclosure status, N (%)		Total, N (%)
		Yes	No	
Sex	Male	58 (29.0)	9 (4.5)	67 (33.5)
	Female	119 (59.5)	14 (7.0)	133 (66.5)
	Total	177 (88.5)	23 (11.5)	200 (100.0)
Adherence status	Yes	154 (77.0)	20 (10.0)	174 (87.0)
	No	23 (11.5)	3 (1.5)	26 (13.0)
	Total	177 (88.5)	23 (11.5)	200 (100.0)

Table 2: Proportion of adherent people by sociodemographic characteristics of study participants at Y12H, Addis Ababa, Ethiopia, 2015.

Sociodemographic variables		Adherence status, N (%)		Total, N (%)
		Yes	No	
Age (in years)	18-25	10 (5.0)	3 (1.5)	13 (6.5)
	26-35	56 (28.0)	12 (6.0)	68 (34.0)
	36-45	56 (28.0)	5 (2.5)	61 (30.5)
	>45	52 (26.0)	6 (3.0)	58 (29.0)
	Total	174 (87.0)	26 (13.0)	200 (100)
Marital status	Married (Monogamous)	73 (36.5)	10 (5.0)	83 (41.5)
	Married (Polygamous)	43 (21.5)	8 (4.0)	51 (25.5)
	Single	25 (12.5)	6 (3.0)	31 (15.5)
	Divorced	04 (2.0)	----	04 (2.0)
	Widowed	29 (14.5)	2 (1.0)	31 (15.5)
	Total	174 (87.0)	26 (13.0)	200 (100)
Educational level	Unable to read and write	12 (6.0)	03 (1.5)	15 (7.5)
	Primary (1-4)	17 (8.5)	03 (1.5)	20 (10.0)
	Primary (5-8)	47 (23.5)	09 (4.5)	56 (28.0)
	Secondary (9-12)	15 (7.5)	02 (1.0)	17 (8.5)
	Diploma	69 (34.5)	09 (4.5)	78 (39.0)
	Degree and above	14 (7.0)	----	14 (7.0)
	Total	174 (87.0)	26 (13.0)	200 (100)
Occupation	Student	10 (5.0)	03 (1.5)	13 (6.5)
	Unemployed	72 (36.0)	11 (5.5)	83 (41.5)
	Paid employee	28 (14.0)	03 (1.5)	31 (15.5)
	Self-employed	70 (35.0)	03 (1.5)	73 (36.5)
	Total	180 (90)	20 (10)	200 (100)

Table 3: Percentage adherence of the study participants at Y12H, Addis Ababa, Ethiopia, 2015.

ART services	Percentage adherence	
	ρ	P value
Availability	-0.061	0.3
Accessibility	-0.029	0.062
Acceptability	-0.96	0.03

N.B. ρ: Spearman correlation coefficient, p: p value

DISCUSSION

In the study, the proportion of adherent individuals under the age of 50 was 37.9%. In contrast, the proportion of adherent individuals aged 50 years or older was significantly higher at the 67.8%, indicating difference of 29.9%. Another study utilizing a medication event monitoring system (MEMS) to assess the impact of patient age on adherence found that the overall adherence rate for the entire cohort was 80.7%. Notably, older patients (those over 50 years old) demonstrated significantly higher adherence rates compared to younger patients, with adherence rates of 87.5% and 78.3%, respectively.[16] Another study found that younger patients were less likely to adhere to their medication regimen compared to older patients. Specifically, older patients were three times more likely to be classified as good

adherents, defined as having 95% adherence, although this difference was not statistically significant (p=0.4).[17]

Gender was not found to be a predictor of adherence to ART, as there was no significant difference in adherence between male and female patients. In a study examining adherence to ART by the number of tablets, gender was similarly not a significant predictor of adherence (p=0.7).[18] In Aksum, Ethiopia, a case-control study revealed that women adhered to ART at a higher rate than men. The study found that female participants who were housewives or self-employed had better adherence, which contributed to the observed discrepancy compared to other studies.[19]

In this study, marital status was not found to be a factor influencing participants' adherence to ART. However, a study conducted at three treatment clinics in Kampala, Uganda, indicated that married individuals were significantly more likely to adhere to ART (OR=2.93, 95% CI [1.32-6.50]).[20] The findings of the Ugandan study may be explained by the fact that married couples living together can encourage each other to adhere to their treatment plans. Therefore, in contrast to our results, marital status could be a positive predictor of adherence to ART in some populations.

In this study, occupation emerged as a significant factor, with employed patients adhering to treatment less consistently than self-employed and unemployed patients. The hectic schedules and long commutes of employed patients may explain this finding. Conversely, self-employed individuals, who often worked in private settings, were better able to adhere to ART. In contrast, a multicenter cohort study focusing exclusively on gay and bisexual men found no correlation between adherence and employment status (p=0.96).[21]

The study found no association between patient disclosure of their HIV status and adherence to ART (p=0.215). However, a study conducted in Harari, Ethiopia, showed that participants who disclosed their HIV status were more likely to adhere to their treatment (87.2%) compared to those who did not disclose their status (66.3%). Those who did not disclose their status were more likely to experience frequent treatment interruptions, as they needed to conceal their medication and avoid taking it in front of others.[22–24]

Another study examined the relationship between disclosing one's HIV status and adherence to ART. It found that participants who disclosed their HIV status tended to have higher adherence to their treatment regimen.[25] According to a study conducted in Tanzania, disclosing one's HIV serostatus to individuals outside of medical professionals in the infectious disease clinic was associated with reduced likelihood of poor adherence to ART (p=0.048).[26] One possible explanation for the findings in this study is that the proportion of adherence impacted by disclosure was limited to only 18 participants (9.6%). This limited sample size may have reduced the study's statistical power to detect differences in adherence between the two groups.

Other studies on ART adherence have also identified common reasons given by participants for skipping their medication, such as "being busy," "forgetfulness," and "concerns about being observed taking medications." In a study conducted in Arba Minch, Southern Ethiopia, the primary barriers to adherence were reported as stigma, stress, anxiety, and depression.[27] In a study conducted in eastern Ethiopia, similar findings identified busy schedules, travel commitments, and forgetfulness as primary contributors to poor adherence to ART.[24]

The ART adherence measure used in our study relied on self-report of lifetime adherence and 30-day recall among non-adherent PLWHA, which has inherent limitations. A Thai study highlighted the need for caution when interpreting adherence rates due to potential biases associated with self-reporting.[28] However, the survey assumes that it provides a measure of strict adherence, as the lifetime adherence measure includes data from patients who have ever forgotten to take their ART drugs. There is no perfect benchmark for assessing adherence. Therefore, the study relied on participants' self-reports of missed doses to determine the proportion of adherent individuals, which may introduce recall bias.

The study evaluated three dimensions of ART services; accessibility, acceptability, and availability in relation to patients' perceptions and adherence to ART treatment. Optimal adherence to ART is significantly influenced by patients' perceptions of service accessibility, including factors such as travel time from home to the hospital. However, this study did not find an association between patients' perceptions of ART accessibility and adherence.[29] In contrast, a Tanzanian study examining determinants of partial adherence among PLWHA on ART found that increasing walking distance from home to the hospital was associated with higher odds of adherence (OR per 10-minute increase=1.2; p=0.05).[26]

Similar research conducted in Uganda aimed to investigate the factors contributing to ART non-adherence, focusing on both causes and timing. Long wait times at clinics, which resulted in lost wages for workers, were identified as a significant barrier to effective adherence, despite the ART being provided free of charge at the facilities under study.[30] Our findings indicate that factors such as transportation issues and proximity to the hospital catchment area were well understood by patients. Interestingly, distance to the clinic and waiting times did not show any association with participants' adherence to ART. However, patients' perceptions of hospital service quality, trust in the medical system, and adherence to ART were significantly correlated (r=-0.96, p<0.01).

CONCLUSION

Overall, the average proportion of adherent individuals in this study was consistent with previous research conducted in Ethiopia. Upon closer examination of the data, it was found that 62% of surveyed patients achieved optimal adherence rates exceeding 95%. The most commonly cited factors influencing adherence to ART included "being busy," "forgetfulness," and "concerns about medication visibility."

Recommendations

To enhance adherence, it is recommended to implement structured adherence support activities, personalized dosing instructions, and systematic adherence monitoring. Utilizing reminders such as alarm clocks, pill organizers, and written schedules can also aid in improving adherence. Furthermore, every patient visit should be utilized as an opportunity to discuss adherence and review each patient's adherence status

ACKNOWLEDGEMENTS

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