THE INFLUENCE OF AGE-ASSOCIATED COMORBIDITIES ON RESPONSES TO COMBINATION ANTIRETROVIRAL THERAPY AMONG PEOPLE LIVING WITH HUMAN IMMUNODEFICIENY VIRUS AT THE ANTIRETROVIRAL THERAPY CLINIC OF JIMMA MEDICAL CENTER, SOUTH WEST ETHIOPIA

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ABSTRACT

Background: With the increased use of highly active antiretroviral therapy (HAART), Human Immunodeficiency Virus (HIV) mortality rates are declining and the life expectancy of people living with the Human Immunodeficiency Virus (PLHIV) has dramatically improved. Consequently, the majority of people living with HIV are living longer and facing a higher burden of age-associated chronic comorbidities. This could lead to an increase in polypharmacy and the risk of potentially serious drug-drug interactions (DDIs), which can cause medication toxicity, loss of efficacy, and treatment failures.

Objective: This study aimed to assess the influence of age-associated comorbidities on the therapeutic outcomes of HAART among PLHIV at the antiretroviral therapy (ART) clinic of Jimma Medical Center, South West Ethiopia.

Methods: A hospital based nested case-control study design was conducted among adult HIV infected patients at the ART clinic of Jimma Medical Center from January 3 to June 2, 2022. Data were collected on socio-demographic, clinical characteristics of patients, comorbidities and medication related information by interviewing patients and by reviewing patients' medical charts from all adult PLHIV that fulfill the inclusion criteria. The data were entered into Epi Data version 4.6.0.2 for cleaning and analyzed using a statistical package for social sciences software (SPSS) version 26.0. Logistic regressions were used to identify factors associated with treatment outcome. An odds ratio and confidence interval of 95% was used and the level of statistical significance was considered at a p-value < 0.05.

Results: A total of 224 patients (112 cases and 112 controls) were included in the study. The magnitude of immunologic and virologic failure among the study groups were (23.2% and 15.2% in the case group versus 4.5% and 11.6% in the control group) (p<0.001). Independent predictors of immunological failure were being male (Adjusted Odds Ratio (AOR) = 3.079 [1.139-8.327], having non-communicable disease comorbidity [p<0.001, AOR: 10.573 (2.810-39.779)], age ≥ 50 years (Adjusted Odds Ratio (AOR) = 2.855 [1.023-7.965], p = 0.045), history of alcohol intake (AOR = 3.648 [1.118-11.897], p = 0.032), and having a baseline CD4+ count of < 200cells/uL [p= 0.034; AOR: 3.862 (1.109-13.456). Similarly, being alcoholic [p= 0.042; AOR: 3.111 (1.044-9.271)], having a baseline CD4+ count of < 200cells/uL [p= 0.007; AOR: 5.111 (1.547-16.892)], a low level of patients medication adherence [p= 0.003; AOR: 5.920 (1.810-19.362)], bedridden baseline functional status [p= 0.020; AOR: 3.902 (1.237-12.307)], and not using cotrimoxazole prophylaxis [p= 0.033; AOR: 2.735 (1.084-6.902)] were found to be an independent predictor of virologic treatment failure but patients who were older (age≥50 years) were less likely to have virological failure [p=0.002; AOR: 0.155 (0.047-0.512)].

Conclusion: Immunological failure was higher in patient's comorbid with chronic age-associated comorbidities. However, there were no statistically significant association between the existence of age-associated chronic comorbidities and virological failure.

Key words: Age-associated comorbidity; Combination antiretroviral therapy; Ethiopia; Human immunodeficiency virus; Immunological failure; Virological failure.

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ABBREVIATIONS AND ACRONYMS

ACDS	Adherence in chronic disease scale
AIDS	Acquired immune deficiency syndrome
ART	Antiretroviral Therapy
ART-CC	Antiretroviral Therapy- Cohort Collaboration
ARV	Antiretroviral
BMI	Body mass index
BSc	Bachelor of Science
cART	Combination Antiretroviral Therapy
CBC	Complete blood cell count
CDC	Center for disease control and prevention
CD4	Cluster of Differentiation 4
COPD	Chronic obstructive pulmonary disease
CPT	Cotrimoxazole preventive therapy
CVD	Cardio-vascular disease
DDIs	Drug-Drug Interactions
DM	Diabetes mellitus
EFV	Efavirenz
EPHI	Ethiopian public health institute
FPT	Fluconazole pre-emptive therapy
HAART	Highly Active Antiretroviral therapy
HIV/ AIDS	Human Immunodeficiency Virus/ Acquired immunodeficiency syndrome
HRQOL	Health-Related Quality of Life
INH	Isoniazid
JMC	Jimma Medical Center
LMIC	Low and Middle Income Country
MSc	Master of science

NARC	Non-AIDS Related Comorbidities
NCDs	Non-communicable diseases
NCCDs	Non-communicable chronic diseases
NNRTI	Non- nucleoside/nucleotide reverse transcriptase inhibitors
NRTI	Nucleoside/nucleotide reverse transcriptase inhibitors
PI	Principal Investigator
PLHIV	People living with human immunodeficiency virus
SPSS	Statistical package for social sciences
TAHOD	TREAT Asia HIV Observational Database
TDF/3TC / DTG	Tenofovir/ Lamivudine/ Dolutegravir
UNAIDS	The Joint United Nations program on HIV/AIDS
US	United States
VL	Viral load
WHO	World Health Organization

1. INTRODUCTION

1.1. Background

Human immunodeficiency virus (HIV) is a virus that belongs to a special family of viruses called retrovirus, thus uses RNA as genetic material and causes a decrease or weaknesses in an individual's ability to fight against infections or illnesses. There are two types of the human immunodeficiency virus (HIV): (HIV-1), is the major cause of AIDS and is most common in sub-Saharan Africa and throughout the world. A second retrovirus, HIV-2, is also recognized as a causative agent of AIDS, although it is less virulent, transmissible, and widespread than HIV-1. HIV-2 is most often found in West Central Africa, part of Europe, and India. These retroviruses are primarily transmitted through sexual contact and through contact with infected blood or blood products (1).

HIV/AIDS has four WHO clinical stages based on the degree of immunosuppression and prognosis. These are stage I – asymptomatic, stage II - mild disease, stage III - moderate disease, and stage IV - advanced immunosuppression, which is important to monitor patients while on treatment and for initiation of co-trimoxazole preventive therapy (CPT) (2).

All HIV positives with a confirmed HIV diagnosis who are ready and willing should initiate ART after a detailed discussion with them about their willingness and readiness to initiate ART, the ARV regimen, dosage and schedule, the likely benefits and possible adverse effects, and the required follow-up and monitoring visits, regardless of their WHO clinical stages and CD4 counts. However, the best moment to start ART is determined by the client's clinical state and readiness. People living with HIV who start therapy early have a better prognosis or are associated with clinical and HIV preventive benefits that improve survival and life expectancy and reduce the incidence of HIV infection at the family and community levels (3).

Recommendations for the initial treatment of HIV advocate the use of a minimum of three active antiretroviral agents from at least two drug classes. The typical regimen consists of two nucleoside/nucleotide analogs with an integrase strand transfer inhibitor(InSTI) that disrupt different components of HIV replication (1,3). The preferred first-line regimen for adults and adolescents is TDF+3TC+DTG or TDF+3TC+EFV as a once-daily dose. Apart from these medications; for the prevention of opportunistic infections, HIV infected patients with any CD4 count receive TB preventive treatment, while patients with a CD4 count of ≤350 cells/ mm3 or

clinical stage 3 or 4 and cryptococcal antigen– positive people without evidence of meningitis and CD4 count <100 cells/ mm^3 should receive cotrimoxazole prophylaxis and Fluconazole pre-emptive therapy, respectively (3).

With the introduction of highly active antiretroviral therapy (HAART), HIV has become a chronic condition (4), and the life expectancy and survival of people living with HIV (PLHIV) have improved with time (5,6). For instance, people at WHO-classified clinical stage I and 15 years of age who initiated ART had 23.1 years of additional life (7). Adults with HIV infection now have life expectancies that are almost identical to those of people who do not have HIV infection (8). According to a report published by the Centers for Disease Control and Prevention (CDC), in 2018, more than half (51%) of people living with HIV in the United States (US) were aged 50 years and older, owing to lower mortality rates due to timely use of virally suppressive combination antiretroviral therapy (cART) (9).

However, this rise in HIV- positive people's survival and life expectancy does not come without a price. The vast majority of older HIV-positive adults (PLHIV) have one or more age-associated Non-AIDS-Related Comorbidities (NARC) (10) , which are the leading causes of death in people living with HIV, especially among those on long-term highly active antiretroviral therapy(HAART) (11). Diabetes mellitus (DM), hypertension, chronic renal failure, dyslipidemia, cardiovascular disease, osteoporosis, depression, mental disorders, cancer, respiratory disorders, and hepatitis B/C coinfections are the most common age-related comorbidities among people living with HIV(12–15).

This greater number of chronic age-associated comorbidities among older patients is correlated with higher use of comedications than younger patients did. Among people living with HIV (PLHIV), the majority of them used at least one comedication but some of them used five or more, apart from antiretrovirals (ARVs). This increase in comedications leads to a higher risk of polypharmacy (15), which is linked to increased complexity in the management of treatment as well as an increased risk of adverse events and drug-drug interactions (DDI), mismedication, and reduced treatment adherence, all of which can lead to clinical, immunological and virological failure as well as increased health care costs (16). Thus, this study assessed the influence of age-associated comorbidities on responses to HAART and factors associated with treatment outcomes among PLHIV at the ART clinic of Jimma Medical Center, South West Ethiopia.

1.2. Statement of the problem

Since the first instances of AIDS were identified in 1981, HIV, the virus that causes AIDS, has grown into one of the world's most critical issues. Since the beginning of the epidemic, over 76 million individuals have become infected with HIV, with 32.7 million dying from AIDS-related illnesses (end 2019). There were 38.0 million HIV-positive people globally in 2019. From these, 25.4 million persons used antiretroviral therapy (ART), up from 6.4 million in 2009 and 26.0 million people had access to ART by the end of June 2020 (17).

In 2019, an estimated 2.2 million people were living with HIV in Western and Central Europe and North American. Among this, 88% of people living with HIV in the region were aware of their status, of whom 92% were accessing antiretroviral treatment (ART) of which 82% were virally suppressed and 12,000 people died of AIDS-related illnesses (18). By the same year, in the Asia and Pacific region, an estimated 5.8 million people were living with HIV. Among those, 75% of people living with HIV in this region were aware of their status. Among those aware, 80% were on treatment, of which 91% were virally suppressed. Around 160,000 people died in the region in 2019 from an AIDS-related illness. It is becoming increasingly clear that the Asia and Pacific region is lagging behind the regions in Africa in its HIV response (19).

Sub-Saharan Africa remains among the most severely affected regions, with nearly one in every 20 adults (4.9%) living with HIV and accounting for 69% of the global total HIV cases (20). According to the Ethiopian Public Health Institute (EPHI) HIV Related Estimates for Ethiopia for 2018, the national HIV prevalence is 0.96%. According to the same estimate for 2018, there are a total of 610,335 people living with HIV, of which 62 % are females. Besides, there are an estimated 13,488 people newly infected, of whom 61.5% are females. The annual estimated AIDS-related death for 2018 is 13,556 (2). In Ethiopia as of May 2018, 79 percent of people living with HIV knew their status; 71 percent of eligible PLHIV are on ART and 87 percent of those on ART have attained viral suppression (21).

Once fatal, HIV infection has become a chronic condition for those who have access to care and treatment. Combination antiretroviral therapy (cART) has proved to be not only lifesaving but life-extending for persons with HIV infection (22). According to the Centers for Disease Control and Prevention, nearly half of the population with an HIV infection diagnosis in the US are now at least 50 years of age (9). A study from another developed country, the Netherlands, predicts that the

proportion of HIV-infected patients aged 50 years or older will increase from 28% in 2010 to 73% in 2030 (23). Different studies from developing countries also showed that combination antiretroviral therapy (cART) increases the life expectancy of people living with HIV. For instance, a study done in Nigeria showed that from electronic records of 17,312 subjects enrolled for HIV/AIDS care and treatment 2075 (12.0%) were aged 50 years and above. It also showed that the percentage of older patients increased from 10.3% in 2006 to 13.8% in 2010 and 15.3% in 2014 (24). A cohort study in Dilla, Ethiopia showed an 8 years survival difference between the groups with and without ART (25).

Despite advances in the life expectancy of people living with HIV, HIV-infected individuals are experiencing an increasing number of and more varied age-associated comorbidities (6,9, 21–28, 29–32,). In 2030, 84% of HIV-infected patients are predicted to have at least one non-communicable disease (NCD), up from 29% in 2010, with 28% of HIV-infected patients in 2030 having three or more NCDs (23). Another study predicts as age-associated comorbidities among this population increases sharply over the coming years. For the population not living with HIV (ages 15+), the prevalence of neoplasms/cancers, cardiovascular diseases, and diabetes mellitus increases by about one-quarter between 2015 and 2040. This prevalence will be more than double among people living with HIV (PLHIV) by 2040 (38).

Non-communicable diseases (NCDs) among people living with HIV are an increasing global public health issue. Many countries with HIV epidemics are now experiencing growing rates of NCDs, which contribute to ill-health, poverty, and inequities and slow the development of countries. The four NCDs that account for the greatest number of comorbidities among people living with HIV in low and middle-income countries (LMICs) are cardiovascular diseases (CVD), cervical cancer, depression, and diabetes. The risk of cervical cancer among women living with HIV compared to women without HIV has increased up to fivefold. Death rates from NCDs are nearly twice as high in low and middle-income countries (LMICs) compared to high-income countries. Every year 15 million people die before age 70 from NCDs, with 86% of these premature deaths occurring in developing countries (39).

One of the many consequences of an aging population and the increasing burden of NCDs will be an increase in polypharmacy (23). The combination of ART with polypharmacy for the management of comorbidities significantly increases the chance of potentially serious DDIs, which

can lead to drug toxicity, loss of efficacy, and treatment failures (40). In the end, this newly emerging challenge results in decreasing life expectancy, increased health care burden, and costs among PLHIV (41).

In Ethiopia, despite the high prevalence of age-associated comorbidities among PLHIV, little is known about their influence on the therapeutic outcomes of highly active antiretroviral therapy. Thus, this study aimed to assess the influence of age-associated comorbidities on responses to highly active antiretroviral therapy (cART) and factors associated with HIV treatment outcome among people living with HIV at the ART clinic of Jimma Medical Center, South West Ethiopia.

1.3. Significance of the study

Despite the high prevalence of age associated comorbidities among people living with human immunodeficiency virus (PLHIV), limited studies were done about their influence on the therapeutic outcomes of highly active antiretroviral therapy (HAART) among people living with HIV in developing countries like Ethiopia. So the need for further study in our setup is unquestionable to assess the influence of age-associated comorbidities on treatment outcomes and predict factors responsible for treatment outcomes.

By assessing the influence of age-associated comorbidities on treatment outcomes of cART among people living with HIV, this study revealed areas that need improvement or identifying the associated factors of treatment outcome, it enables health care professionals/government to tailor intervention towards the modifiable factors and preventive mechanisms.

Furthermore, the findings generated by this study can be used as an input data or as additional information and can provide directions for further research activities in the area.

2. LITERATURE REVIEW

2.1. The prevalence of age-associated comorbidities

Another multicenter, cross-sectional study conducted in 2019 in seven Portuguese centers showed that, among 401 patients enrolled the large majority of patients (90%) had at least one NARC (the mean number was 2.1 and median was 2.0 (range 0–6)) and nearly 35% had three or more NARC. The most frequent NARC was hypercholesterolemia (60.8% of patients), followed by arterial hypertension (39.7%). Other NARC included chronic anxiety/ depression (23.9% of patients), chronic hepatitis C (14.2%), diabetes mellitus (13.5%), and renal lithiasis (11.2%)(10).

A prospective, observational cohort study of HIV-positive adults in Asia 2019 showed that, among 5411 patients included in the virological failure analysis, 1858 (34%) had hypertension, 570 (11%) had diabetes mellitus, 2689 (50%) had dyslipidemia and 353 (7%) had impaired renal function. From a total of 5621 patients included in the immunological failure analysis, there were 2105 (37%) patients with hypertension, 607 (11%) with diabetes, 2748 (49%) with dyslipidemia, and 404 (7%) with impaired renal function (42).

A Prospective multicenter observational study conducted in US cities in 2019 showed that the most common comorbidities were psychiatric disorders (54.2%), dyslipidemia (46.0%), hypertension (40.4%), and chronic kidney disease (26.0%). With the exception of hepatitis B virus infection and psychiatric disorders, the prevalence of each comorbidity significantly increased with increasing age (43).

A cross-sectional study conducted in Thailand 2018 showed that, among 874 patients, 388 (44%) had comorbidities. Of all the patients who had comorbidities, 347 (89%) had metabolic complications, including hyperlipidemia in 271 (70%) patients, hypertension in 106 (27%) patients, diabetes mellitus in 93 (24%) patients, and impaired fasting glucose in 31 (8.0%) patients (44).

Another cross sectional study conducted in Thailand 2020 shows, among 307 HIV-positive patients aged 50 years and older nearly half of the patients (49.2%) had a diagnosis of at least 1 comorbidity of interest and 7.8% had 3 or more comorbidities. Sixty-nine patients (22.5%) were multimorbid and the prevalence of multimorbidity increased with age: 14.2% (50-54 years), 30.4% (55-59 years)

and 31.7% (≥60 years), respectively. The most common comorbidities were dyslipidemia (33.9%), hypertension (21.5%) and diabetes mellitus (8.1%) (30).

An observational, retrospective, cross-sectional database study conducted in 2018 in Japan on 1445 patients having a prescription record for antiretrovirals found that 523 (36.2%) patients had multimorbidity (two or more chronic comorbidities) and 972 (67.3%) PLHIV patients had a total of 1923 chronic comorbidities. Lipid disorders (31.6%), diabetes (26.8%), hypertension (18.2%), and hepatitis B/C coinfection (18.2%) were the most prevalent chronic comorbidities (35). Comorbidities were seen more frequently in our elderly patients (25%) compared to the younger individuals (3.3%) (27).

According to an institution-based cross-sectional study conducted in Hawassa, Southern Ethiopia 2020, among 382 PLHIV more than half (196 (51.3%)) of the respondents were affected by at least one of the NCCDs. While 34 (8.9%) had multimorbidity by these chronic diseases. Rheumatoid arthritis and gouty arthritis were two of the musculoskeletal problems that 146 (38%) of the study's participants reported having. Of which, 143 (97.9%) were mostly affected by rheumatoid arthritis. The respiratory system was the second most commonly impacted body system, with 46 (12.0%) cases of chronic bronchitis and asthma. Seventeen patients had cardio- vascular problems; of this, HTN was reported by 16 (94.1%) of the patients. Malignant cancers affected 15 (8.2%) patients; of which, 8 (53.3%) were reproductive system cancers (31).

A facility based cross-sectional study conducted in Northeast Ethiopia 2019 showed; among 408 HIV-infected adults a total of 36 (8.8%) patients had diabetes. Diabetes prevalence increased significantly with age of the patients, 4.7% for age 18–34 years, 6.8% for 35–45 years and 21.8% for > 45 years, and was significantly higher in older patients (aged > 45 years): 21.8% vs. 5.8% (45). Another cross sectional study at Debre Markos, Northwest Ethiopia 2020 showed that, among a total of 412 HIV-positive adults attending the ART clinic the overall magnitude of hypertension was 41.3% and approximately, fifth (5.1%) of the participants had diabetes mellitus (46).

An institution based cross sectional study at Harar, Eastern Ethiopia 2018 showed that, among 425 patients, 30 patients had DM, corresponding to a prevalence of 7.1% and the prevalence of hypertension (BP ≥140/90 mmHg) among the study participants was 12.7% (54/425) (47).

2.2. Treatment outcomes of adult HIV positive patients on cART and associated factors

In a single center, retrospective, cohort study that included 158 patients in New York, USA in 2019, 89.2% (n=141/158) of patients achieved an immunologic response overall. The CD4 cell count was significantly increased by 50 to 150 cells/μL within 14 months of study initiation in 92.5% (n=74/80) of young (age<50 years) and 85.9% (n=67/78) of elderly (age≥50years) patients. Regarding virologic response, there was no discernible difference between the two groups (older, 64.1%; n=80/78 versus young, 65%; n=52/80). Overall, it was found that the older group had more comorbidities; however, more young individuals had asthma and COPD (48).

An ongoing cohort study in Guatemala, a country in central America,2021 among 664 PLHIV found that, participants with multiple prior ART regimens, treatment interruptions, low CD4 count at diagnosis and having no comorbidities were associated with higher odds of persistent viremia. These variables were also significantly associated with virologic non-supression (VNS). Excessive alcohol consumption was also significantly associated with VNS in men but not in women (49).

A multi-site observational cohort study done on 3555 individuals in Canada 2011 showed that older age, male sex, and having an AIDS diagnosis at baseline predicted increased likelihood of suppression (50).

A prospective, observational cohort study of HIV-positive adults in Asia 2019 showed that, among 5411 patients included in the virological failure analysis, there were 912 (17%) virological failures. Although not statistically significant, patients aged ≥50 years with comorbidities performed slightly better than the other three groups and from a total of 5621 patients included in the immunological failure analysis, there were 391 patients (7%) who had an immunological failure. Patients aged ≥50 years were shown to have slower increases in CD4 cell counts compared to patients <50 years. At four years from cART initiation, patients aged <50 years with comorbidities showed the biggest median change in CD4 cell count, while the median change in the CD4 cell count was the smallest for patients aged ≥50 years with comorbidities. Those aged ≥50 years with comorbidities had worse immunological outcomes than their younger counterparts either with or without comorbidities. Patients aged ≥50 years with comorbidities were more likely to develop immunological failure compared to those patients aged <50 years with or without comorbidities. Other factors associated with an increase in hazard for failure were cART adherence <95% compared to adherence≥95%,

male sex, and lower CD4 count. In the univariate analyses, having age-related comorbidities, cART adherence , pre-ART VL, pre-ART CD4, initial ART regimen, hepatitis C co-infection , prior AIDS diagnosis and ever smoked were associated with virological failure. In multivariate analysis, those with adherence <95% compared to adherence ≥95% and a higher CD4 count at start of cART; CD4 > 200 cells/lL were less likely to have virological failure (42).

A case–control study conducted in Mexico 2019 showed that, among 125 adult HIV positive patients enrolled in the study, 60 (48%) of patients were aged 50 years or older. From this, 80% of the older group and 63% of the younger group exhibited viral suppression (36).

A retrospective observational study in Israel 2016 showed that, among 418 patients who had participated in the study, the older patients' CD4 cell counts were significantly lower than those of the younger patients at the end of the follow-up period. Compared to 33% of younger patients, 50% of older patients had CD4 cell counts ≤ 350 cells/mL. Though not statistically significant, the mean change in CD4 cell counts (CD4) was lower in older patients (183 cells/mL) compared to younger patients (200 cells/mL). Comparing the older subgroup of patients with a similar CD4 cell count at the time of HIV diagnosis to the younger subgroup, it was shown that the older group of patients had greater VL, lower CD4 counts, higher mortality rates, and higher rates of AIDS-defining diseases. Low CD4 counts at the time of HIV diagnosis and delayed HIV diagnosis can affect the immunological, virological, and clinical outcome of patients (27).

An observational and retrospective study in China that assessed the risk factors for suboptimal CD4 recovery in HIV infected population on 1744 study subjects showed that patients who had a low level of CD4+ T-cell count (< 200 cell/ μL) during the initiation of ART exhibited more difficulties recovering to a normal level. Compared with baseline CD4 > 350 cell/μL, patients with baseline CD4 ≤ 200 cell/μL or 200 < CD4 ≤ 350 cell/μL were 42.6, and 4.5 times more likely to be incomplete CD4 recovery, respectively (51).

An African cohort study conducted in Kenya, Uganda, Tanzania and Nigeria 2020 that assessd the impact of age on CD4 recovery and viral suppression over time among adults living with HIV who initiated antiretroviral therapy reported no statistically significant difference between adults ≥ 50 years old and those < 50 years old (52).

A study conducted in South Africa 2019, which assessed the association between a detectable HIV viral load and non-communicable diseases comorbidity showed that, among 330 adult HIV positive patients recruited nineteen percent of the study participants had a detectable HIV viral load (VL> 40 copies/ml), and 8% had a viral load of >1000 copies/ml. They found no association between a detectable HIV viral load and NCD comorbidity. In univariable regression models, ever smoking, and having a low CD4 count (CD4 < 300 cells/mm3) were associated with higher odds of having a detectable viral load. The final multivariable model showed that female gender, age <35years, low CD4 count (CD4 count <300 cells/ml), and ever smoking were associated with higher odds of a detectable HIV viral load (53).

A retrospective cross sectional study conducted in Botswana 2016, which assesses the prevalence of non-AIDS defining conditions and their associations with virologic treatment failure among a total of 300 adult patients on anti-retroviral treatment showed a hypertension prevalence of 17.5%. They found no association between Non-AIDS defining conditions (NADCs) and virologic treatment failure. The variables that showed a statistically significant association with virologic treatment failure were: treatment line, history of non-adherence, history of treatment switches, history of social problems, being active on treatment at site, and death. Finally, a history of non-adherence to medications and being on second-line or salvage treatment were found as an independent predictors of virologic failure (54).

A descriptive cross-sectional study conducted in Uganda 2017, among 100,678 patients reported that, young age, poor adherence and having active TB increased the odds of virological non-suppression. However, being on second/third line regimens protected patients against virological non-suppression (55).

A facility based cross-sectional study conducted at Dire Dawa, Ethiopia 2019, which assessed the magnitude of clinical and immunological failure and their associated factors among HIV-positive adults taking first-line antiretroviral therapy showed that among a total of 949 study participants, The magnitude of immunological failure alone was 19.3%; and CD4 count ≤100 cells/, poor adherence, restarting after interruption of medication, regimen change, ambulatory/bedridden functional status at the last visit on ART and patients who died had higher odds of failure (56).

A retrospective cohort study done in Jigjiga, Ethiopia 2020 to assess the immunological and clinical response to antiretroviral therapy according to baseline CD4+ T-cell count with a total of 311 patients showed that patients with lower baseline CD4 cell counts had lower peaks of CD4 cell counts. While, patients with a high baseline CD4 cell count (>200 cells/μl) had CD4 cell counts that returned to almost normal levels; and female HIV patients showed a better CD4 cell count after HAART initiation than male (57).

A cross-sectional study conducted at Mizan Tepi University teaching hospital, Ethiopia 2021 showed that bedridden functional status and low baseline CD4 cell count were found to be an independent predictors of treatment failure (58).

A retrospective, longitudinal study conducted in southern Ethiopia 2015 on the prevalence and predictors of immunological failure among HIV Patients on HAART showed that among a total of 1,321 patients included in the study; the prevalence of immunological failure was 17.6%. During univariable as well as multivariable analysis, being at WHO Stage III or IV or having a higher CD4 cell count at baseline were associated with increased hazard for immunological failure (59).

A cross-sectional study conducted in Adigrat, Ethiopia 2020 showed that among a total of 393 study participants, the overall prevalence of virological failure was 12.47% (60).

A retrospective cohort study done in south wollo zone, Ethiopia 2020 showed that among a total of 384 patients, the prevalence of virologic failure was 15.9%. Being divorced, being naïve to antiretroviral therapy, having low (<100 cells/mm3) baseline CD4 cell count and nonadherence were found to be significant predictors of antiretroviral treatment failure. However no statistically significant association were found between baseline WHO clinical stage and virological treatment failure (61).

A matched case-control study conducted among a total of 306 patients in Gonder, Ethiopia 2017 showed that patients aged<35 years, who had had CD4+ count < 200 cells/mm3, showed poor adherence to antiretroviral therapy(ART), and had taken ART for longer durations of 25–47 months and ≥48 months were significantly associated with the higher odds of virological failure (62).

An unmatched case-control study conducted in Kombolcha, Ethiopia 2020 among 389 adults on first-line highly active antiretroviral therapy, showed that clients aged <35 years compared with

older clients, those who did not disclose their HIV status and those with poor adherence were significantly associated with higher odds of virological failure (63).

An unmatched case-control study done at Waghimra zone, Ethiopia 2020 among a total of 276 adult HIV Patients on First-Line Antiretroviral Therapy showed that poor adherence to treatment, longer duration on ART, experiencing drug toxicity, and older age are factors that increase the risk of virologic failure (64).

A hospital based matched case-control study conducted in Woldia and Dessie hospitals; Ethiopia 2019 showed that among 308 adult patients on first-line antiretroviral treatment, poor adherence for ART treatment predicts virological failure (65).

An institution-based unmatched case–control study done in Wollo, Ethiopia 2020 among a total of 377 adults on second line antiretroviral therapy showed that patients who had poor adherence to ART, not disclosed their ART status, opportunistic infection, low CD4 counts <350 cell/mm3, low BMI (<16 kg/m2), and young age 15–29 year patients were determinants of virologic failure (66).

An unmatched case-control study conducted in Nekemte Specialized Hospital, Ethiopia 2021 among 252 HIV-positive patients receiving antiretroviral treatment reported that antiretroviral treatment initiation at an advanced stage (baseline WHO clinical stage III & IV), lower CD4 count (<100cells/uL), and poor adherence were determinants of treatment first-line antiretroviral treatment failure (67).

A retrospective cross-sectional study conducted at Shashemene Referral Hospital, Ethiopia 2020 among 69 study participants showed a statistically significant association of a baseline advanced World Health Organization (WHO) clinical stage (stage 3&4) and poor adherence with antiretroviral treatment failure (68).

A cross sectional study conducted at Debre-Markos Referal Hospital, Ethiopia 2020 among 304 adult patients on antiretroviral therapy showed that, the magnitude of virological failure was 10.5%. It also identified lower income, lack of social support, interruption of ART, drug non-adherence, non-working functional status, WHO stage III or IV, CD4 count <200 cells/ml and TB co-infection were significantly associated with virological failure (69).

A case-control study conducted at Jimma, Ethiopia 2016 showed that among a total of 240 participants ((120 cases (HIV infected patients living with chronic non-communicable diseases) and 120 controls (people living with HIV only)) about 29.17% of cases and 16.67% of controls had poor immunologic restoration. Male sex, smoking, and co-morbidity with chronic non-communicable disease(s) were independent predictors of poor immunologic restoration (70).

2.3. Conceptual framework

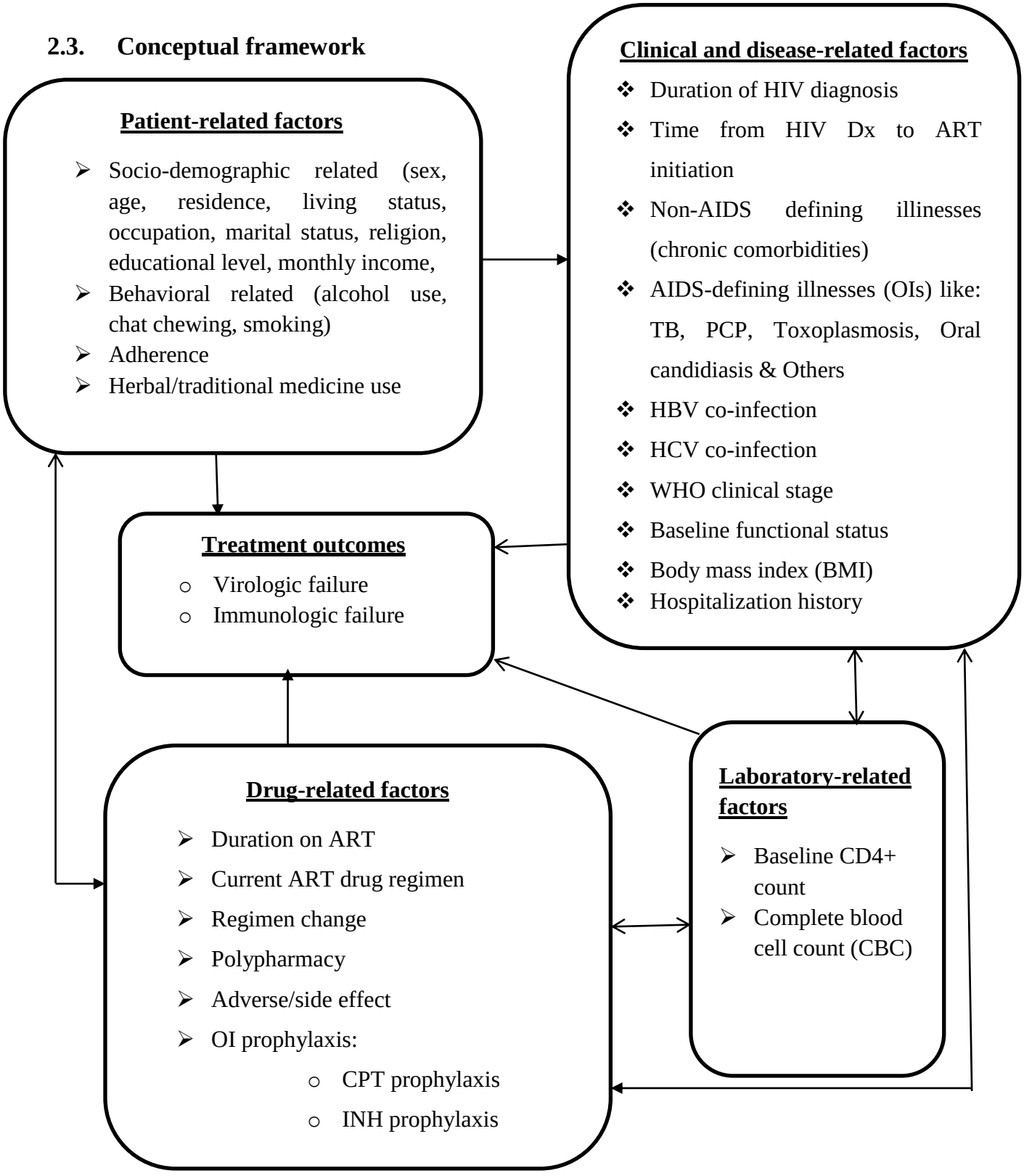


Figure 1: Conceptual framework for factors associated with treatment outcome

3. OBJECTIVE

3.1. General objective

- To assess the influence of age-associated comorbidities on responses to highly active antiretroviral therapy (HAART) among people living with HIV at the ART clinic of JMC from January 3 to June 2, 2022.

3.2. Specific objectives

- To assess the magnitude of virological failure among cases and controls on highly active antiretroviral therapy.
- To assess the magnitude of immunological failure among cases and controls on highly active antiretroviral therapy.
- To identify factors affecting treatment outcomes of adult people living with HIV on highly active antiretroviral therapy (HAART).

3.3. Research questions

- What is the magnitude of virological failure among cases and controls at Jimma Medical Center ART clinic?
- What is the magnitude of immunological failure among cases and controls at Jimma Medical Center ART clinic?
- What are the factors that affect treatment outcomes of people living with HIV at Jimma Medical Center ART clinic?

3.4. Research hypothesis

- It was hypothesized that age-associated comorbidities may worsen therapeutic outcomes of cART, because of the risk of polypharmacy, which significantly increases the chance of potentially serious drug-drug interactions (DDIs), which can lead to drug toxicity, loss of efficacy, and treatment failures and additive negative effects of these health conditions.

4. METHODOLOGY

4.1. Study setting and period

The study was conducted at the ART clinic of Jimma Medical Center (JMC), a tertiary teaching hospital in Jimma town, South-West of Ethiopia. It is located 352 kilometers from Addis Ababa, the capital city of Ethiopia. Currently, JMC is the only medical center in the southwestern part of Ethiopia with a bed capacity of 800 starting from 2015 with a total of 1600 health professional staff. Currently, it is providing services for approximately 16,000 inpatients, 220,000 outpatient attendants, 12,000 emergency cases, and 4500 deliveries in a year coming to the hospital from the catchment population of about 20 million people. The medical services provided by the JMC include oncology, surgery, orthopedics, ophthalmology, internal medicine, pediatrics, gynecology and obstetrics, dermatology, psychiatric service, pathology, pharmacy, medical laboratory, intensive care unit, radiology, and others as both inpatient and outpatient services. ART clinic is one of the units in JMC. It comprises ART pharmacy, TB clinic, voluntary counseling and testing (VCT), adult and pediatric follow-up clinic, data clerkship, laboratory, and cervical cancer screening unit which gives services for about 3108 adult HIV patients. The study was conducted from January 3 to June 2, 2022 (71).

4.2. Study design

- A hospital based nested case-control study was conducted among adult people living with HIV at the ART clinic of Jimma Medical Center.

4.3. Population

4.3.1. Source population

- All adult people living with HIV who were on highly active antiretroviral therapy (HAART) at the ART clinic of JMC.

4.3.2. Study population

- Adult people living with HIV who were on highly active antiretroviral therapy (cART) at the ART clinic of JMC during the study period and who fulfilled the inclusion criteria.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria

- ✔ Age greater or equal to 18 years.
- ✔ Adult people living with HIV/AIDS (PLWHA) on HAART, who were diagnosed to have one or more chronic NCD (s) were taken as cases and those patients who were not diagnosed to have any type of chronic NCD (s) were considered as controls.
- ✔ Patients who had regular follow up and who were on highly active antiretroviral therapy (cART) for more than six months.

4.4.2. *Exclusion criteria*

- ✔ Patients who were refused or unwilling to participate in the study.
- ✔ Patients with acute HIV infection.
- ✔ Patients with <2 CD4/ viral-load measurements
- ✔ Patients who had been seriously sick, and unable to give information.
- ✔ Patients with incomplete data.

4.5. Sample Size Determination and Sampling Procedure

The sample size was determined by using the single population proportion formula and the proportion was taken as 17% according to the study conducted in the TREAT Asia HIV Observational Database (TAHOD) cohort (42). Considering 95% confidence interval (CI) and 5% margin of error, the sample size was calculated as follows:

$$N=\frac{(Z\alpha/2)^2 p(1-p)}{d^2}$$

Where, n- Required Sample size

z- Standard deviation normal value at 95% CI which is 1.96

p- The proportion of virological failure among adult HIV positive patients on HAART was 17%
d- Possible margin of error that can be tolerated which is 5% (0.05)

1-p = q = 0.83, which was proportion of population that do not possess the character of interest

Sample size, calculated by

n- Required number

$$n = \frac{(Z1-\alpha/2)^2 * P(1-P)}{d2}$$

d= Expected margin of error =0.05

Z α/2= 95% confidence interval (C.I) =1.96

p= 0.17; There by $n = ((1.96)^2 \times 0.17 \times 0.83)/ (0.05)^2 = 217$

The source populations were the total number of patients under follow-up at JMC ART clinic which was 3108. This information was obtained from the ART registered data information system. Since the source population of HIV patients is 3108 which is <10,000, a population correction formula was used to determine the adjusted minimum sample size.

$$\text{Corrected sample size } nf = n/(1+\frac{n}{N}) = \frac{217}{1+\frac{217}{3108}} = \mathbf{203}$$

The calculated sample size; by using the above correction formula is 203. By considering 10% (~ 21) contingency the final minimum sample size was 224**.**

Then, from a total of 224 patients 112 patients were taken as cases (adults living with HIV & comorbid with NCDs) and the other 112 patients were taken as controls (adults living with HIV only)

4.5.1. Sampling Technique

- ✔ A purposive sampling technique was used

4.6. Study variables

4.6.1. Dependent variable:

- **Treatment outcomes**
  - Virological failure
  - Immunological failure

4.6.2. Independent variables:

- **Patient-Related factors**
  - Socio-demographic data, behavioral factors and lifestyle variables:

- ☞ Sex, age, residence, living status, occupation, monthly income (Birr), marital status, educational status, exercise, alcohol consumption, chat chewing, smoking, adherence, and herbal drug use.

❖ **Clinical and disease-related factors**

- ✓ Duration of HIV diagnosis
- ✓ Time from HIV Dx to ART initiation
- ✓ WHO clinical stage
- ✓ Baseline functional status
- ✓ Body mass index (BMI)
- ✓ Hospitalization history
- ✓ Non-AIDS defining illinesses (chronic comorbidities)
- ✓ AIDS-defining illnesses (opportunistic infections) like: TB, PCP, Toxoplasmosis, Oral candidiasis & Others
- ✓ HBV co-infection
- ✓ HCV co-infection

❖ **Drug-related factors**

- ☞ Duration on ART
- ☞ Current ART drug regimen
- ☞ Polypharmacy
- ☞ Regimen change
- ☞ Adverse/side effect
- ☞ OI prophylaxis:
  - Cotrimoxazole (CPT) prophylaxis
  - Isoniazid (INH) prophylaxis

❖ **Laboratory-related factors**

- Baseline CD4+ count
- Complete blood cell count (CBC)

4.7. Data collection procedures (instrument, personnel, technique)

4.7.1. Clinical procedures and patient recruitment

Eligible patient's age greater than 18 years old and who were on follow-up at JMC ART clinic were selected for this study. Patients who met the inclusion requirements were enrolled in the study. The patients who had their appointment in the allocated data collection period were selected depending upon their follow-up schedule. Then, those patients who fulfill the inclusion criteria were asked for their volunteerism to be a part of the research after they had been informed of the clear purpose of the study and their confidentiality was kept.

Patients with HIV/AIDS who were also diagnosed with non-communicable diseases (NCDs) in the study area had a different follow-up clinic and consultation day. During the data collecting period, individuals with HIV/AIDS who came in for a HAART refill and consultation were interviewed, and their medical records (for HIV and NCD) were reviewed. The patient's assistance was then used to verify the accuracy of the patient-reported NCD diagnosis and the medications they were taking at the appropriate follow-up clinic.

Then, patients were grouped into two categories based on the presence or absence of non-communicable diseases (NCDs) of interest: (i) patients living with HIV and comorbid with one or more non communicable disease/s (NCDs) were considered as cases, and (ii) patients living with HIV only without any NCD/s were considered as controls.

Due to the observational nature of the study, viral load (VL) and CD4 testing wasn't performed on a predefined basis but depending on the patients' clinical condition, availability, and functionality of measuring instruments and chemicals. The patients who had at least 2 HIV viral load tests after 6 months of treatment and 2 CD4+ T cell count measurements, which were done at baseline and post 6 months of treatment were included for comparison. Data regarding VL, and CD4+ counts were extracted from the medical charts and records.

4.7.2. Data Collection Instrument

The data were collected by using a semi-structured questionnaire prepared from a review of previously published related literature (30,42,45,46,70), and medical record reviews of patients. The tool had two-parts, the patient interview part and the chart review part. It includes socio-

demographic, behavioral, medication-related, and laboratory as well as clinical and diseases related character of the patient.

The standard tool, the Adherence in Chronic Diseases Scale (ACDS), was used to evaluate HAART adherence. This scale includes 7 questions with sets of 5 suggested answers to each question. The questions take into account both the behavior that directly determines adherence (Questions 1–5) and situations that may have an indirect impact on adherence (Questions 6 and 7). Patients were questioned, and the proposed responses were marked with an X (A-E). The scores for each proposed answer were A-4, B-3, C-2, D-1, and E-0. Accordingly, patients were classified as having low, moderate, or high levels of HAART adherence if their total score was under 21, between 21 and 26, or greater than 26, respectively (72).

4.7.3. Data Collection Process and personnel

Inclusion of the control group was done concurrently with the number of cases per day; for instance, if 3 patients in the case group were questioned per day, the same procedure was followed for the control group. Thus, the final analysis included 112 patients from the case group and 112 patients from the control group.

Four trained BSc nurses who work at the JMC ART clinic collected the data by interviewing the study participants and reviewing patient's medical charts and records after the data collection tools were pre-tested.

4.8. Outcome measurement and outcome validating

Outcome measurement

This study assessed the influence of age-associated comorbidities on response to cART as defined as the proportion of patients with virological failure and immunological failure.

Although the WHO recommends three types of criteria to define antiretroviral treatment failure, namely clinical, immunological, and virologic, the focus of this study was on immunological and virological failure. Our failure outcomes were defined to be in line with Ethiopian National Comprehensive HIV Prevention, Care and Treatment manual 2021 (73) and the World Health Organization (WHO) 2019 guidelines (74) as follows: (i) Viral load above 1000 copies/mL based on two consecutive viral load measurements in 3 months apart, with adherence support

following the first viral load test. (ii) Immunological failure was defined as CD4 count at or below 250 cells/mm^3 following clinical failure, or Persistent CD4 levels below 100 cells/mm^3. Changes in CD4 count were evaluated during the follow-up period of the study to assess any change in treatment outcome among different comparative groups.

Types of age associated comorbidities

The presence or absence of the target chronic non-communicable diseases (NCDs) was assessed by patient-reported NCD diagnosis, which was then verified by looking up the patient's diagnosis in their medical charts and records and using the medications they were taking as a proxy indicator for their diagnosis. The prevalence (number and types) of chronic non-communicable diseases (NCDs) can also be determined by counting them.

4.9. Data quality control and assurance

The prepared questionnaires were translated from English into the local languages (Amharic and Afan Oromo), and back translated into English (annex I; part I, II, III) to assure its information consistency. A pre-test was conducted on 5% (12 patients) of the total sample size both on patients and medical charts, and necessary modifications were done on the data collection tool. Regular supervision was given to data collectors by the principal investigator to check the completeness, clarity, and accuracy of data to be conducted. Unclear and incomplete data were excluded from analysis.

4.10. Statistical analysis

The Data were coded, cleaned, entered, and compiled to Epi-data version 4.6.2.0 and then exported for analysis to SPSS version 26.0. Descriptive statistics including frequency, means, medians, standard deviations (SD), and percentiles present the results.

Categorical variables were analyzed by using the chi-square test and expressed as percentages, and continuous data were expressed as mean ± standard deviation. The mann-Utiney U-test was used to analyze the median value of continuous variables (duration on ART, and duration of HIV diagnosis) among study groups. Binary logistic regression was used to analyze the association between independent variables and treatment outcome. In binary logistic regression analysis, variables with p values <0.25 were selected for further multiple logistic regression analysis.

Collinearity diagnostic test was done for the independent predictor's age and presence or absence of NCD-comorbidity. A collinearity statistics between age and NCD-comorbidity showed a tolerance of 0.871 and a variance inflation factor (VIF) of 1.149. So, there was no problem of collinearity.

Multiple logistic regression analysis was used to determine the independent predictors of treatment outcome. The Odds ratio with a 95% confidence interval (CI) was calculated to measure the strength of association between covariates and outcome variables. Probability values p-value <0.05 was accepted as statistically significant. The outputs of processed data were presented using tables and figures accordingly.

4.11. Ethical clearance

Ethical approval was obtained from an institutional review board (IRB) of inistitute of health, Jimma University and a permission letter was given to the JMC administration office. Participants in the study were informed of the goals of the study and their unequivocal right to withdraw from it at any time. Patients were identified by identification numbers rather than names and all participants in this study were given both verbal and written informed consent. The confidentiality and privacy of personal information were protected.

4.12. Plan for Dissemination of Results

The final findings of the study will be submitted to the Department of clinical pharmacy, School of Pharmacy, Institute of Health, Jimma University and presented at the annual research symposium of the university. And also, it will be disseminated to Jimma medical center and other concerned bodies. Finally, to the ability of the principal investigator all efforts will be made to publish the findings in a scientific Journal for local and international use

4.13. Operational and Term definitions

An **adult:** is a person older than 18 years of age

Younger adults: those less than 50 years

Older adults: those 50 years and older (75)

Age-associated comorbidities: Diseases that emerge following the patient's age get advanced like hypertension, diabetes, dyslipidemia, and impaired renal function, etc.

Comorbidity: Diseases or disorders that exist together with an index disease or co-occurrence of two or more diseases or disorders in an individual (70).

Chronic Non-Communicable Disease: Diseases that cannot be transmitted to others through contact from the index person and are not caused by disease-causing microorganisms, and patients are on follow-up for care and treatment at health institution at least for the last 30 days (70).

Multi-Morbidity: Being affected by two or more chronic, non-communicable diseases (70).

Co-medication: Comedication was defined as a non-antiretroviral medication that was prescribed for usage for more than 30 days during the study period (15).

Polypharmacy: The use of four or more non-HIV drugs (apart from HAART; considering HAART as a single medication), complimentary medications, or dietary supplements since the last visit (76).

Combination antiretroviral therapy (cART): In accordance to the national treatment guidelines for adults with HIV infections, it is defined as the use of at least three antiretroviral drugs from at least two different classes (77), it may also be called as highly active antiretroviral therapy.

Persistent CD4 count: Persistent is to mean at least 2 CD4 measurements below the threshold (100 cells/mm^3) (73).

5. RESULTS

5.1. Study participant enrollment

Among a total of 224 study participants included in the study, 112 were HIV positive patient's on HAART comorbid with one or more chronic non communicable disease/s, which were considered as the case group; Whereas, the remaining 112 HIV/AIDS patients on HAART without any chronic non communicable disease/s were considered as a control group (figure 2).

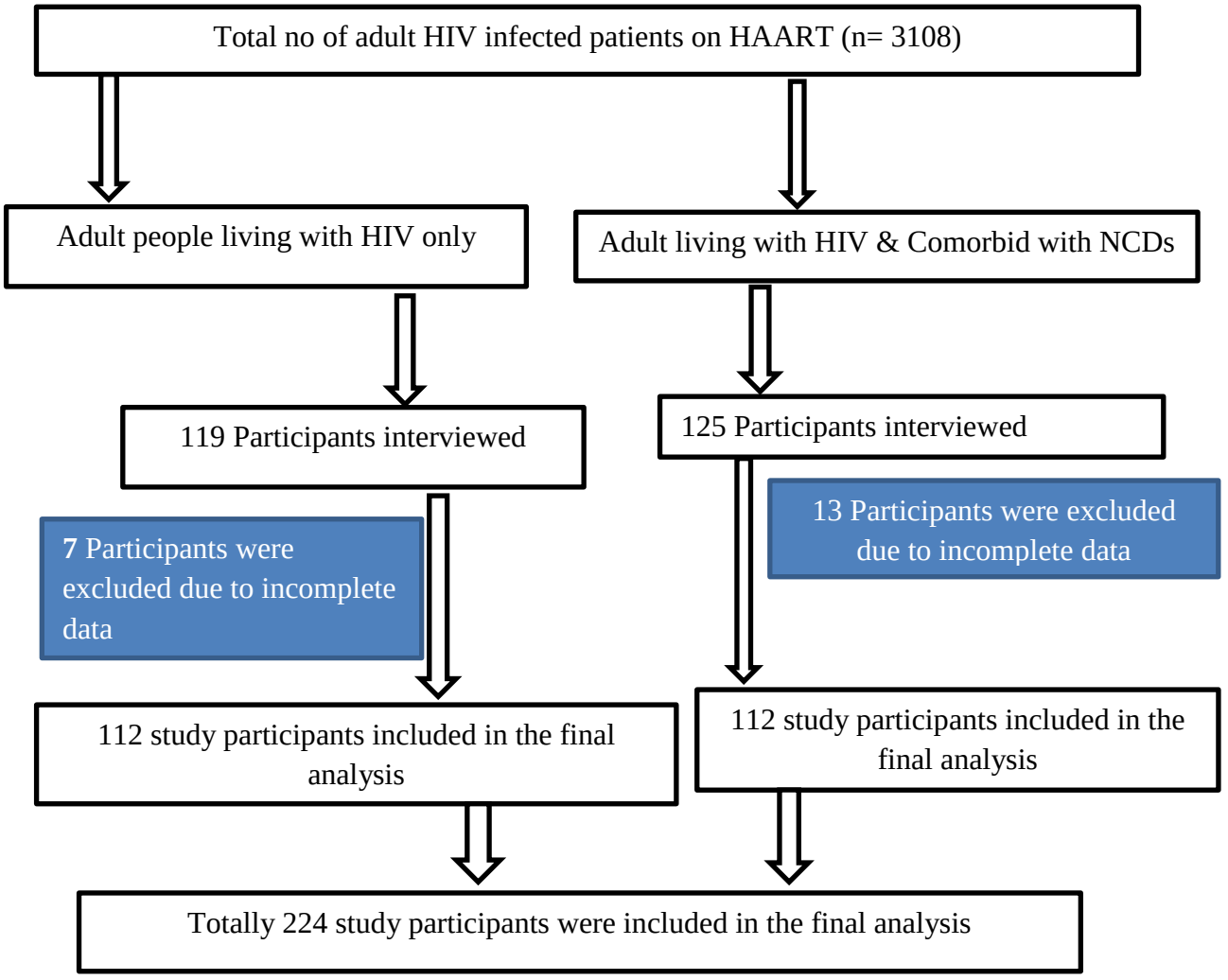


Figure 2: Participant's enrollment at the ART clinic of JMC from January 3 to June 2, 2022

5.2. Patient's socio-demographic characteristics

Among a total of 224 study participants included in the study, the majority of the study participants were females in both study groups (57.1% vs. 42.9% in the case group; 67.0% vs. 33.0% in the control group). The mean ± SD age of the study participants was 49.29 ± 10.39 and 41.92 ± 8.74 years for the case and control groups, respectively. Sixty (53.6%) of patients in the cases group were in the age range of 50 years and above, whereas more proportion of patients was in the age range of 35-49 years (61.6%) among controls. From a total of 107 (47.8%) of the study participants who were married, 56 (52.3%) were occupied by patients in the control group (Table 1).

Table 1: Comparative baseline socio-demographic characteristics of the study population, JMC, from January 3 to June 2, 2022.

Variables		**Cases [n (%)]**	**Controls [n (%)]**	**Total [n(%)]**	**P-value**
Gender	Male	48 (42.9)	37 (33.0)	85 (36.6)	0.130
	Female	64 (57.1)	75 (67.0)	139 (63.4)	
Age (years)	Mean ±SD	49.29 ± 10.39	41.92 ± 8.74	45.60 ± 10.26	< 0.001
	18-34	6 (5.4)	19 (17.0)	25 (11.2)	
	35-49	46 (41.1)	69 (61.6)	115 (51.3)	
	50 and above	60 (53.6)	24 (21.4)	84 (37.5)	
Marital Status	Married	51 (45.5)	56 (50.0)	107 (47.8)	0.745
	Single	6 (5.4)	6 (5.4)	12 (5.4)	
	Divorced	25 (22.3)	27 (24.1)	52 (23.2)	
	Widowed	30 (26.8)	23 (20.5)	53 (23.7)	
Home residence	Rural	14 (12.5)	20 (17.9)	34 (15.2)	0.264
	Urban	98 (87.5)	92 (82.1)	190 (84.8)	
Educational Status	No formal education	24 (21.4)	16 (14.3)	40 (17.9)	0.211
	Primary (1-8)	43 (38.4)	53 (47.3)	96 (42.9)	
	Secondary (9-12)	24 (21.4)	29 (25.9)	53 (23.7)	

	College and above	21 (18.8)	14 (12.5)	35 (15.6)	
Occupation	Government employee	20 (17.9)	15 (13.4)	35 (15.6)	0.008
	Non-government employee	5 (4.5)	1 (0.9)	6 (2.7)	
	Private (self-employed)	48 (42.9)	72 (64.3)	120 (53.6)	
	Unemployed	39 (34.8)	24 (21.4)	63 (28.1)	
Monthly income(ETB)	No regular income	62 (55.4)	45 (40.2)	107 (47.8)	0.071
	<1000	15 (13.4)	19 (17.0)	34 (15.2)	
	1000- 2000	10 (8.9)	22 (19.6)	32 (14.3)	
	2000-3000	12 (10.7)	9 (8.0)	21 (9.4)	
	≥3000	13 (11.6)	17 (15.2)	30 (13.4)	
Living condition	Living alone	30 (26.8)	19 (17.0)	49 (21.9)	0.184
	Living with family	81 (72.3)	91 (81.3)	172 (76.8)	
	Living with other relatives	1 (0.9)	2 (1.8)	3 (1.3)	
Having Children	Yes	96 (85.7)	89 (79.5)	185 (82.6)	0.217
	No	16 (14.3)	23 (20.5)	39 (17.4)	
Disclosure status	Yes	108 (96.4)	106 (94.6)	214 (95.5)	0.518
	No	4 (3.6)	6 (5.4)	10 (4.5)	
Family Hx of any NCD	Yes	30 (26.8)	17 (15.2)	47 (21.0)	0.033
	No	82 (73.2)	95 (84.8)	176 (79.0)	

ETB: Ethiopian birr; NCD: Non-communicable disease

5.3. Patient's behavioral and lifestyle characteristics

Majority of the study subjects 137 (61.2%) were claimed to be alcohol consumers and they were relatively equally distributed among the case and the control groups, 68 (60.7%) versus 69 (61.6%). Eighty-one (36.2%) of the study participants were smokers. Forty three (38.4%) of them were cases, while 38 (33.9%) were control groups. Concerning chat chewing history, 71 (31.7%) were chat chewers and their proportion was slightly higher in the control group than in cases, 37 (33.0%) versus 34 (30.4%) (Table 2).

Table 2: Patients behavioral and lifestyle characteristics of the study population, JMC, from January 3 to June 2, 2022.

Variables		Cases [n (%)]	Controls [n (%)]	Total [(n(%)]	P-value
Alcohol consumption	Yes	68 (60.7)	69 (61.6)	137 (61.2)	0.891
	No	44 (39.3)	43 (38.4)	87 (38.8)	
Smoking history	Yes	43 (38.4)	38 (33.9)	81 (36.2)	0.487
	No	69 (61.6)	74 (66.1)	143 (63.8)	
Chat chewing	Yes	34 (30.4)	37 (33.0)	71 (31.7)	0.667
	No	78 (69.6)	75 (67.0)	153 (68.3)	
Self medication practice	Yes	44 (39.3)	39 (34.8)	83 (37.1)	0.489
	No	68 (60.7)	73 (65.2)	141 (62.9)	
Herbal/traditional medicine user	Yes	4 (3.6)	8 (7.1)	12 (5.4)	0.235
	No	108 (96.4)	104 (92.9)	212 (94.6)	
Physical exercise	Yes	35 (31.3)	46 (41.1)	81 (36.2)	0.126
	No	77 (68.8)	66 (58.9)	143 (63.8)	
Reduce salt in their diet	Yes	93 (83.0)	74 (66.1)	167 (74.6)	0.004
	No	19 (17.0)	38 (33.9)	57 (25.4)	
Reduce fat in their diet	Yes	92 (82.1)	72 (64.3)	164 (73.2)	0.003
	No	20 (17.9)	40 (35.7)	60 (26.8)	
Reduce sugary beverages in their diet	Yes	92 (82.1)	82 (73.2)	174 (77.7)	0.109
	No	20 (17.9)	30 (26.8)	50 (22.3)	

5.4. Patients anthropometric, clinical, immunological, medication and hematologic characteristics

5.4.1. Anthropometric characterstics

The mean ± SD baseline body mass index (BMI) was 20.15 ± 3.62 and 19.51 ± 2.79 kg/m2 for the case and control groups, respectively. Regarding baseline BMI, 44 (39.3%) of cases and 42 (37.5%) of controls had low BMI or underweight (BMI <18.5) (Table 3).

Table 3: Anthropometric characteristics of the study population, JMC, from January 3 to June 2, 2022.

Variables		Cases [n (%)]	Controls [n (%)]	Total [(n(%)]	P-value
Baseline weight (kg) (Mean ±SD)		53.70 ± 11.47	51.06 ± 8.84		0.055
Baseline BMI (Kg/m2) (Mean ±SD)		20.15 ± 3.62	19.51 ± 2.79		0.135
Baseline BMI (kg/m2)	underweight (< 18.5)	44 (39.3)	42 (37.5)	86 (38.4)	0.022
	normal weight (18.5-24.5)	55 (49.1)	68 (60.7)	123 (54.9)	
	overweight (25-30)	11 (9.8)	2 (1.8)	13 (5.8)	
	obese (> 30)	2 (1.8)	-	2 (0.9)	

5.4.2. Clinical and disease-related characteristics of the study participants

At baseline, majority of the study participants in both the case and control groups were at WHO clinical stage III, 39 (34.8%) versus 32 (28.6%). Eighteen (16.1%) versus 24 (21.4%) of the study participants in the case and control groups began treatment at WHO clinical stage I. Seventy-two (64.3%) of the study participants in the case group and seventy (62.5%) in the control group had a working baseline functional status, while 17 (15.0%) and 19 (17.0%), respectively, were bedridden.

Six (5.4%) of cases and 4 (3.6%) of controls had HBV co-infection. Similarly, patients co infected with HCV were 2 (1.8%) in each group. There were 33 (29.5%) and 39 (34.8%) of patients diagnosed and treated for TB among the case and control groups respectively. Pulmonary TB was the most common type of TB in both groups. Eleven (9.8%) of cases and 26

(23.2%) of controls had opportunistic infections other than TB. Forty (35.7%) of cases and 15 (13.4%) of controls had hospitalization history. The median duration of HIV diagnosis was 167.44 months (IQR: 137.77-191.44 months) among cases and 141.72 months (IQR: 116.74-171.86 months) among controls. The median duration of HIV diagnosis was statistically different between the two groups (Mann-Whitney U-test, p<0.001) (Table 4).

Table 4: clinical and disease-related characteristics of the study population, JMC, from January 3 to June 2, 2022.

Variables		**Cases [n (%)]**	**Controls [n (%)]**	**Total [(n(%)]**	**P-value**
WHO baseline clinical stage	Stage I	18 (16.1)	24(21.4)	42 (18.8)	0.310
	Stage II	24 (21.4)	32 (28.6)	56 (25.0)	
	Stage III	39 (34.8)	32 (28.6)	71 (31.7)	
	Stage IV	31 (27.7)	24 (21.4)	55 (24.6)	
Duration of HIV Dx (months)	Median	167.44	141.72	156.72	< 0.001
	6-60	6 (5.4)	9 (8.0)	15 (6.7)	0.364
	60-120	16 (14.3)	22 (19.6)	38 (17.0)	
	≥ 120	90 (80.4)	81 (72.3)	171 (76.3)	
Time from HIV Dx to ART initiation	Within the same month	43 (38.4)	48 (42.9)	91 (40.6)	0.231
	1-24	43 (38.4)	48 (42.9)	91 (40.6)	
	≥ 24	26 (23.2)	16 (14.3)	42 (18.8)	
Baseline functional status	Working	72 (64.3)	70 (62.5)	142 (63.4)	0.933
	Ambulatory	23 (20.5)	23 (20.5)	46 (20.5)	
	Bedridden	17 (15.0)	19 (17.0)	36 (16.1)	
HBV co-infection	Negative	26 (23.2)	37 (33.0)	63 (28.1)	0.240
	Not tested	80 (71.4)	71 (63.4)	151 (67.4)	
	Positive	6 (5.4)	4 (3.6)	10 (4.5)	
HCV co-infection	Negative	20 (17.9)	31 (27.7)	51 (22.8)	0.213
	Not tested	90 (80.4)	79 (70.5)	169 (75.4)	
	Positive	2 (1.8)	2 (1.8)	4 (1.8)	
TB treatment history	Yes	33 (29.5)	39 (34.8)	72 (32.1)	0.391
	No	79 (70.5)	73 (65.2)	152 (67.9)	
Type of TB	Pulmonary	21 (61.8)	29 (76.3)	50 (69.4)	0.142
	Disseminated	4 (12.1)	7 (17.9)	11 (15.3)	
	Unknown	8 (23.5)	3 (7.9)	11 (15.3)	
OI other than TB	Yes	11 (9.8)	26 (23.2)	37 (16.5)	0.007
	No	101 (90.2)	86 (76.8)	187 (83.5)	
Hospitalization history	Yes	40 (35.7)	15 (13.4)	55 (24.6)	< 0.001
	No	72 (64.3)	97 (86.6)	169 (75.4)	

5.4.3. Types of non-communicable diseases among the study participants

Among a total of 112 HIV infected patients comorbid with chronic non communicable diseases, hypertension was the most prevalent 32 (28.6%). Whereas, cardiac (heart failure) and epilepsy were the least prevalent with a prevalence of 5 (4.5%) each (Figure 3).

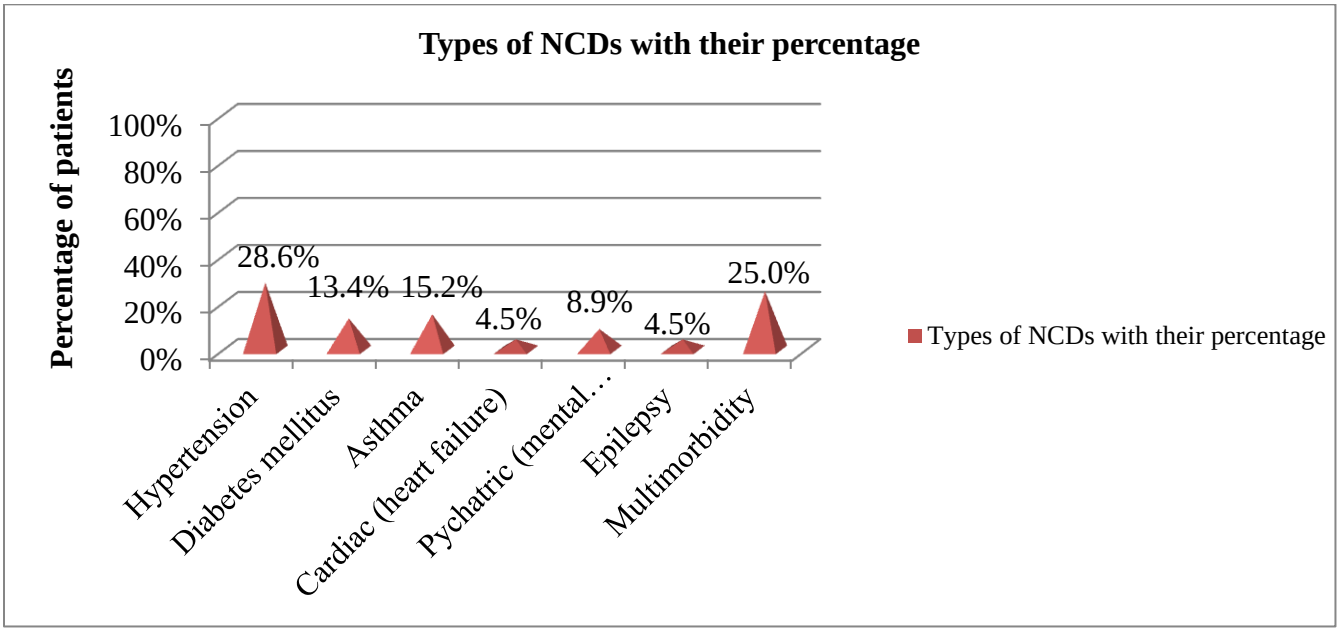


Figure 3: Types of non-communicable diseases among the cases with their respective percentage from January 3 to June 2, 2022.

5.4.4. Medication related characterstics of the study population

The median duration of ART among cases and controls were 161.32 and 136.27 months, respectively (Mann-utiney U-test, P=0.002). Ninety (80.35%) of cases and 96 (85.71%) of controls were on the first line ART regimen, TDF/3TC/DTG. About 80 (71.4%) of patients among cases and 76 (67.9%) among controls were on cotrimoxazole preventive therapy and 95 (84.8%) of cases and 96 (85.7%) of controls took isoniazid (INH) preventive therapy. One hundred and twelve (100.0%) of cases and 110 (98.2%) of controls undergo regimen change, with the 1st line regimen that 88 (78.6%) of cases and 96 (85.71) of controls switched to. Forty five (40.2%) of cases and 38 (33.9%) of controls had encountered adverse/side effects. Similarly, 26 (23.2%) in the case group but no patients in the control group were polymedicated (Table 5).

Table 5: Medication -related characteristics of the study population, JMC, from January 3 to June 2, 2022.

Variables		Cases [n (%)]	Controls [n (%)]	Total [(n(%)]	P-value
Duration on ART (months)	Median	161.32	136.27	146.22	0.002
	6-60	8 (7.1)	11 (9.8)	19 (8.5)	0.103
	60-120	22 (19.6)	34 (30.4)	56 (25.0)	
	≥ 120	82 (73.2)	67 (59.8)	149 (66.5)	
Current HAART regimens	TDF/3TC/DTG	90 (80.35)	96 (85.71)	186 (83.04)	
	TDF/3TC/ATV/r	10 (8.93)	6 (5.36)	16 (7.14)	
	AZT/3TC/ATV/r	8 (7.14)	5 (4.46)	13 (5.80)	
	ABC/3TC/ATV/r	2 (1.79)	5 (4.46)	7 (3.13)	
	AZT/3TC/Lop/r	1 (0.89)	0	1 (0.45)	
	ABC/3TC/DR/r + DTG	1 (0.89)	0	1 (0.45)	
Regimen change	Yes	112 (100.0)	110 (98.2)	222 (99.1)	0.155
	No	0	2 (1.8)	2 (0.9)	
Switching to	1st line regimen	88 (78.57)	96 (85.71)	184 (82.14)	0.085
	$2^{nd}/3^{rd}$ line regimen *	24 (21.43)	14 (12.5)	38 (16.96)	
Co-trimoxazole preventive therapy Hx	Yes	80 (71.4)	76 (67.9)	156 (69.6)	0.561
	No	32 (28.6)	36 (32.1)	68 (30.4)	
INH prophylaxis history	Yes	95 (84.8)	96 (85.7)	191 (85.3)	0.850
	No	17 (15.2)	16 (14.3)	33 (14.7)	
Adverse/side effect encountered	Yes	45 (40.2)	38 (33.9)	83 (37.1)	0.333
	No	67 (59.8)	74 (66.1)	141 (62.9)	
Polypharmacy	Yes	26 (23.2)	0	26 (11.6)	< 0.001
	No	86 (76.8)	112 (100.0)	198 (88.4)	

* only 1 patient switched to 3^{rd} line regimen

3TC: Lamivudine; DTG: Deltugravir; AZT: Zidovudine: TDF: Tenofovir; ABC: Abacavir; ATV/r: Atazanavir-ritonavir; DR/r: Darunavir-ritonavir; Lop/r: Lopinavir-ritonavir

5.4.5. The level of medication adherence among study participants based on the adherence in chronic disease scale (ACDS)

In the study participants, low adherence was found in 22.3% of cases and 3.6% of controls. However, the proportion of patients with high adherence was higher among the controls group (48.2%) as compared to the case group (34.8%) (Figure 4).

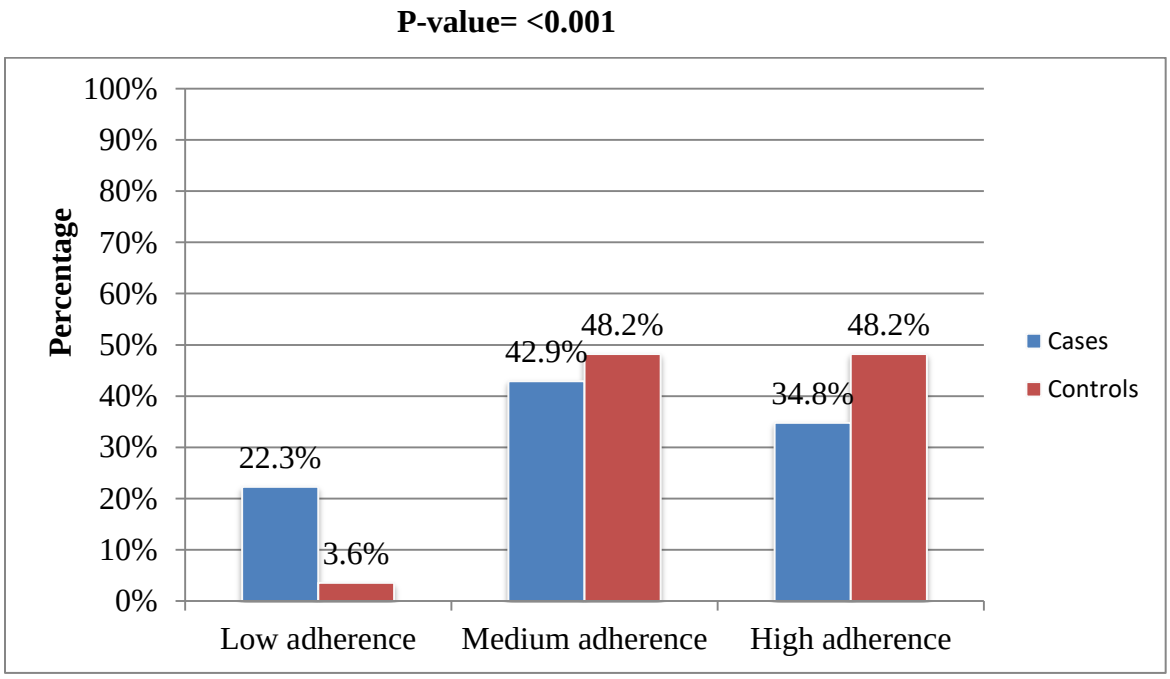


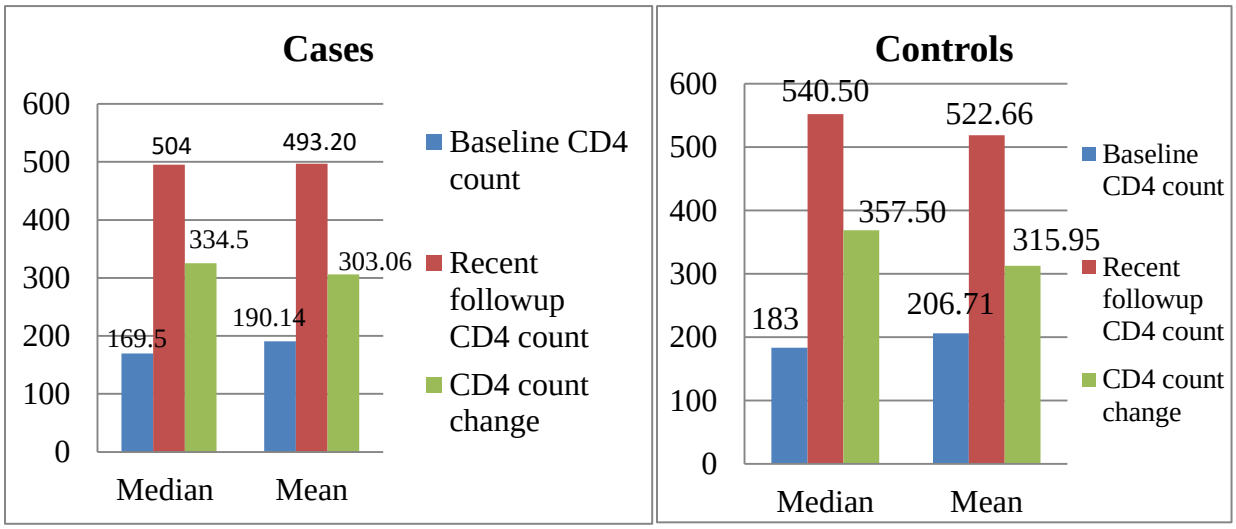
Figure 4: The level of medication adherence among study participants at JMC ART clinic from January 3 to June 2, 2022.

5.4.6. Immunological characteristics among study groups

Seventy two (64.3%) of cases and 65 (58.0%) of controls had a baseline CD4 count of <200cells/uL. The median CD4 count has increased from 169.5 cells/ul, at the initiation of ART to 504 cells/ul, at the most recent visit. A median CD4 count change of 334.50 cells/µl was observed after 161.32 months on ART. The median rate of CD4+ T cell increase was 2.07 cells/month on ART among the case group.

Similarly, the median CD4 count has increased from 183 cells/ul, at the initiation of ART to 540.50 cells/ul, at the most recent visit. A median CD4 count change of 357.50 cells/µl was

observed after 136.27 months of ART treatment. The median rate of CD4+ T cell increase was 2.62 cells/month on ART among controls (Figure 5).



A **B**

Figure 5: The median and mean CD4 count change among cases (fig. A) and controls (fig. B) at JMC ART clinic from January 3 to June 2, 2022.

5.4.7. Hematologic factors

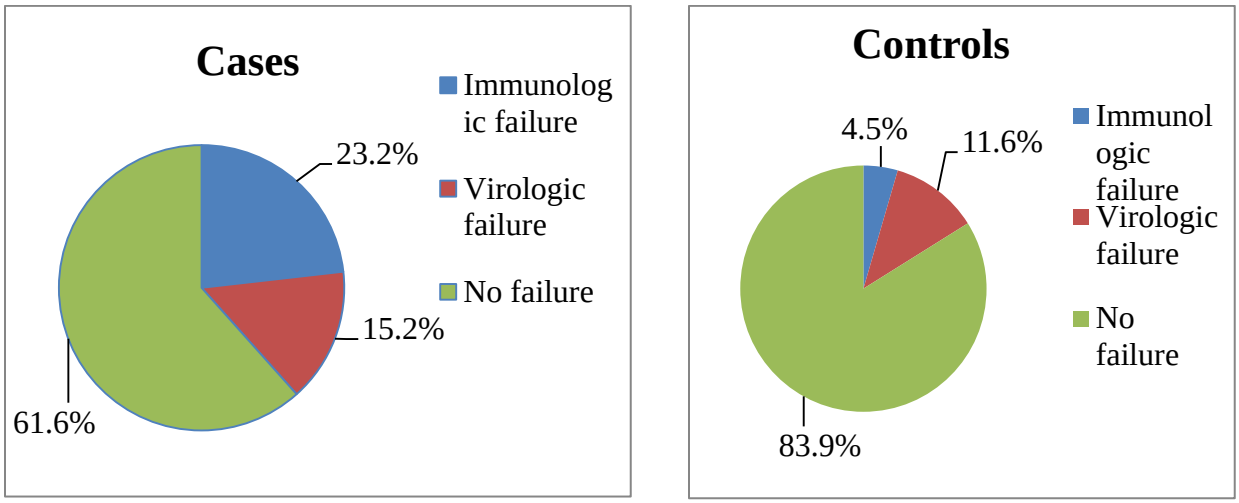
The baseline and the recent visit mean of white blood cell count (WBC) among the cases and control groups were (2.80 ± 6.67×10^3 /µL versus 2.81 ± 6.27×10^3 /µL) and (3.75 ±7.89 ×10^3 /µL versus 3.95 ± 6.94×10^3 /µL), respectively. The mean and standard deviation baseline platelet count for the case and control groups were 121.91 ± 281.38×10^3 cell/ µL and 114.89 ± 263.02× 10^3 cell/ µL respectively. The recent one was 106.82 ± 272.42×10^3 cell/ µL for cases and 111.42 ± 290.00×10^3 cell/ µL for controls (Table 6).

Table 6: Baseline and recent laboratory findings of adult HIV/AIDS patients at the ART clinic of Jimma Medical Center, from January 3 to June 2, 2022.

Variables	**Baseline**			**Recent**		
	(Mean ± std.deviation)			**(Mean±std.deviation)**		
	Cases	**Controls**	**P-value**	**Cases**	**Controls**	**P-value**
White blood cell* $10^3/\mu L$	6.67 ± 2.80	6.27± 2.81	0.286	7.89 ± 3.75	6.94 ± 3.95	0.066
Red blood cell (10^6 cell/μL)	4.25 ± 0.86	4.14 ± 1.02	0.411	4.53±0.74	4.19±0.76	0.001
Hemoglobin (mg/dl	13.49±3.60	12.56 ± 2.72	0.030	14.22 ± 2.04	13.48 ± 2.04	0.007
Hematocrit (%)	39.68 ± 7.39	37. 68 ± 8.26	0.057	41.67 ± 7.84	39.85 ± 6.17	0.055
Platelet count (10^3 cells/μL)	281.38± 121.91	263.02±114.89	0.247	272.42±106.82	290.00±111.42	0.229

5.5. Treatment outcomes of the study participants among the study groups

From a total of 224 study participants (112 cases and 112 controls), twenty six (23.2%) of the study participants in the case group and 5 (4.5%) in the control group had immunological failure (P<0.001). Similarly, 15.2% in the case group and 11.6% in the control group had virological failure (P-value=0.433). The overall magnitude of immunological and virological failure among the study participants 13.8% and 13.4%, respectively (Figure 6).



A B

Figure 6: Treatment outcomes of the study participants among cases (fig. A) and controls (fig. B) at JMC ART clinic from January 3 to June 2, 2022.

5.6. Factors associated with immunological failure

As a primary outcome of interest immunologic failure was assessed for its association against several socio-demographic, behavioral, anthropometric, clinical and immunological characteristics. On the bivariate analysis, a variable which showed statistically significant associations with immunologic failure were non-communicable disease comorbidities (NCD-comorbidity) [p < 0.001; Crude Odds Ratio (COR): 6.470 (2.384-17.557)], gender [p = 0.002; COR: 3.580; 95% CI, (1.618-7.921)], age [p < 0.001; COR: 4.333 (1.926-9.750)], being alcohol dranker [p= 0.021; COR: 3.013 (1.182-7.682)], cigarette smoker [p= 0.008; COR: 2.857 (1.317-6.197)], baseline BMI [p= 0.020; COR: 2.483(1.151-5.355)], baseline WHO clinical stage [p=0.016; COR: 4.250 (1.308-13.808)], baseline CD4+ count [p= 0.012, COR: 3.604 (1.327-9.787)], adherence to medication. [p= 0.004; COR: 4.781 (1.640-13.935)], baseline functional status [p= 0.011; COR: 3.256 (1.318-8.046)], HBV co-infection [p= 0.045; COR: 3.068 (1.024-9.191)], cotrimoxazole preventive therapy use [p= 0.021; COR: 2.476 (1.144-5.360)], history of tuberculosis co-infection [p= 0.015; COR: 2.610 (1.208-5.636)], adverse/side effects [p= 0.001: COR: 3.752 (1.694-8.307)], and polypharmacy [p= 0.011; COR: 3.382 (1.322-8.652)].

Finally, being male [p=0.027, (Adjusted Odds Ratio (AOR) = 3.079 [1.139-8.327], having NCD-comorbidity [p< 0.001, AOR: 10.573 (2.810-39.779)], age ≥ 50 years [p = 0.045, AOR: 2.855 [1.023-7.965], history of alcohol intake (AOR = 3.648 [1.118-11.897], p = 0.032), and having a baseline CD4+ count of < 200cells/uL [p= 0.034; AOR: 3.862 (1.109-13.456) were found to be an independent predictor of immunologic treatment failure (Table 7).

Table 7: Factors associated with immunological failure among the study participants, JMC, from January 3 – June 2, 2022.

Variables		Immunologic outcome		Bivariate analysis			Multivariate analysis		
		Failure N (%)	No failure N (%)	P-value	COR	95% CI	P-value	AOR	95% CI
Gender	Male	20 (64.5)	65 (33.7)	0.002	3.580	(1.618-7.921)	**0.027 ***	3.079	(1.139-8.327)
	Female	11 (35.5)	128 (66.3)	1	-	-	1	-	-
Age (years)	< 50	10 (32.3)	130 (67.4)	1	-	-	1	-	-
	≥ 50	21 (67.7)	63 (32.6)	<0.001	4.333	(1.926-9.750)	**0.045 ***	2.855	(1.023-7.965)
Alcoholic history	Yes	25 (80.6)	112 (58.0)	0.021	3.013	(1.182-7.682)	**0.032 ***	3.648	(1.118-11.897)
	No	6 (19.4)	81 (42.0)	1	-	-	1	-	-
Smoking history	Yes	18 (58.1)	63 (32.6)	0.008	2.857	(1.317-6.197)	0.071	2.512	(0.925-6.820)
	No	13 (41.9)	130 (67.4)	1	-	-	1	-	-
Baseline BMI	<18.5	16 (51.6)	58 (30.1)	0.020	2.483	(1.151-5.355)	0.402	1.618	(0.525-4.984)
	≥ 18.5	15 (48.4)	135 (69.9)	1	-	-	1	-	-
WHO baseline clinical stage	Stage I	4 (12.9)	38 (19.7)	1	-	-	1	-	-
	Stage II	5 (16.1)	51 (26.4)	0.920	0.931	(0.234-3.703)	0.742	0.760	(0.148-3.899)
	Stage III	5 (16.1)	66 (34.2)	0.639	0.720	(0.182-2.844)	0.198	0.333	(0.063-1.776)
	Stage IV	17 (54.8)	38 (19.7)	0.016	4.250	(1.308-13.808)	0.200	2.571	(0.606-10.909)
Baseline CD4+ count	< 200	26 (83.9)	114 (59.1)	0.012	3.604	(1.327-9.787)	**0.034 ***	3.862	(1.109-13.456)
	≥ 200	5 (16.1)	79 (40.9)	1	-	-	1	-	-
Adherence	Low	9 (29.0)	20 (10.4)	0.004	4.781	(1.640-13.935)	0.170	2.860	(0.638-12.809)

	Medium	14 (45.2)	88 (45.6)	0.263	1.690	(0.675-4.235)	0.408	1.717	(0.477-6.179)
	High	8 (25.8)	85 (44.0)	1	-	-	1	-	-
Baseline functional status	Working	15 (48.4)	127 (65.8)	1	-	-	1	-	-
	Ambulatory	6 (19.4)	40 (20.7)	0.643	1.270	(0.462-3.491)	0.637	0.695	(0.153-3.158)
	Bedridden	10 (32.3)	26 (13.5)	0.011	3.256	(1.318-8.046)	0.615	1.460	(0.335-6.363)
HBV co-infection	Negative	4 (12.9)	59 (30.6)	1	-	-	1	-	-
	Not tested	26 (83.9)	125 (64.8)	0.045	3.068	(1.024-9.191)	0.392	1.769	(0.479-6.526)
	Positive	1 (3.2)	9 (4.7)	0.751	1.450	(0.147-14.344)	0.374	0.192	(0.005-7.313)
CPT History	Yes	16 (51.6)	140 (72.5)	1	-	-	1	-	-
	No	15 (48.4)	53 (27.5)	0.021	2.476	(1.144-5.360)	0.082	2.464	(0.891-6.815)
History of TB co-infection	Yes	16 (51.6)	56 (29.0)	0.015	2.610	(1.208-5.636)	0.073	2.645	(0.914-7.654)
	No	15 (48.4)	137 (71.0)	1	-	-	1	-	-
Adverse/side effect encountered	Yes	20 (64.5)	63 (32.6)	0.001	3.752	(1.694-8.307)	0.154	2.146	(0.752-6.121)
	No	11 (35.5)	130 (67.4)	1	-	-	1	-	-
Polypharmacy	Yes	8 (25.8)	18 (9.3)	0.011	3.382	(1.322-8.652)	0.301	1.987	(0.541-7.303)
	No	23 (74.2)	175 (90.7)	1	-	-	1	-	-
NCD comorbidity	Yes	26 (83.9)	86 (44.6)	< 0.001	6.470	(2.384-17.557)	**< 0.001 ***	10.573	(2.810-39.779)
	No	5 (16.1)	107 (55.4)	1	-	-	1	-	-

* Variables which showed a statistically significant association ($p<0.05$) on multivariable logistic regression.

5.7. Factors associated with virological failure

Virological treatment failure was another primary outcome of interest that was assessed for its association against the main independent variable for this study (NCD-comorbidity) and it was not associated with the presence of NCD-comorbidity (p=0.434) [COR:1.363 (0.628-2.958)].

In addition, virologic status was assessed against several socio demographic, behavioral anthropometric, clinical and immunological characteristics.

Variables associated with virological failure in the bivariate analyses were age [p= 0.039; COR: 0.372 (0.145-0.951)], habit of alcohol drinking [p= 0.011; COR: 3.661 (1.345-9.966)], smoking [p= 0.039; AOR: 2.268 (1.043-4.932)], baseline BMI [p=0.013; COR: 2.680 (1.228-5.848)], WHO baseline clinical stage III [P=0.046; COR: 8.339 (1.043-66.653)], WHO baseline clinical stage IV [p= 0.029; COR: 10.250 (1.267-82.942)], baseline CD4+ count [p= 0.006; COR: 4.561 (1.532-13.578)], patients level of medication adherence [p= 0.001; COR: 5.704 (2.062-15.777)], baseline functional status [p= 0.013; COR: 3.308 (1.285-8.516)], HBV co-infection [p= 0.042; COR: 4.583 (1.058-19.864)], history of taking cotrimoxazole preventive therapy [p= 0.040; COR: 2.269 (1.037-4.963)], history of TB co-infection [p= 0.027; COR: 2.404 (1.102-5.241), and adverse/side effects that were encountered [p= 0.019; COR: 2.536 (1.162-5.537)].

Finally, being alcoholic [p= 0.042; AOR: 3.111 (1.044-9.271)], having a baseline CD4+ count of < 200cells/uL [p= 0.007; AOR: 5.111 (1.547-16.892)], a low level of patients medication adherence [p= 0.003; AOR: 5.920 (1.810-19.362)], not using cotrimoxazole preventive therapy [p= 0.033; AOR: 2.735 (1.084-6.902), having a baseline bedridden functional status [p= 0.020; AOR: 3.902 (1.237-12.307)] were found to be an independent predictor of virologic treatment failure but being older (age ≥ 50 years) was protective from virologic failure [p= 0.002; AOR; 0.155(0.047-0.512)](Table8).

Table 8: Factors associated with virological failure among the study participants, JMC, January 3-June 2, 2022.

Variables		Virological outcome		Bivariate analysis			Multivariate analysis		
		Failure N (%)	No failure N (%)	P-value	COR	95% CI	P-value	AOR	95% CI
Age	< 50	24 (80.0)	116 (59.8)	1	-	-	1		
	≥ 50	6 (20.0)	78(40.2)	0.039	0.372	(0.145-0.951)	**0.002 ***	0.155	(0.047-0.512)
Alcoholic history	Yes	25 (83.3)	112 (57.7)	0.011	3.661	(1.345-9.966)	**0.042 ***	3.111	(1.044-9.271)
	No	5 (16.7)	82 (42.3)	1	-	-	1	-	-
Smoking history	Yes	16 (53.3)	65 (33.5)	0.039	2.268	(1.043-4.932)	0.267	1.785	(0.641-4.971)
	No	14 (46.7)	129 (66.5)	1	-	-	1	-	-
Baseline BMI	<18.5	16 (53.3)	58 (29.9)	0.013	2.680	(1.228-5.848)	0.645	1.298	(0.428-3.936)
	≥ 18.5	14 (46.7)	136 (70.1)	1	-	-	1	-	-
WHO baseline clinical stage	Stage I	1 (3.3)	41 (21.1)	1	-	-	1	-	-
	Stage II	6 (20.0)	50 (25.8)	0.148	4.920	(0.569-42.530)	0.270	4.010	(0.341-47.195)
	Stage III	12 (40.0)	59 (30.4)	0.046	8.339	(1.043-66.653)	0.120	6.682	(0.611-73.094)
	Stage IV	11 (36.7)	44 (22.7)	0.029	10.250	(1.267-82.942)	0.119	7.052	(0.606-82.029)
Baseline CD4+ count	< 200	26 (86.7)	114 (58.8)	0.006	4.561	(1.532-13.578)	**0.007 ***	5.111	(1.547-16.892)
	≥ 200	4 (13.3)	80 (41.2)	1	-	-	1	-	-
Adherence	Low	11 (36.7)	18 (9.3)	0.001	5.704	(2.062-15.777)	**0.003 ***	5.920	(1.810-19.362)
	Medium	10 (33.3)	92 (47.4)	0.976	1.014	(0.393-2.618)	0.300	0.563	(0.190-1.669)
	High	9 (30.0)	84 (43.3)	1	-	-	1	-	-

Baseline functional status	Working	13 (43.3)	129 (66.5)	1	-	-	1	-	-
	Ambulatory	8 (26.7)	38 (19.6)	0.129	2.089	(0.806-5.413)	0.092	2.725	(0.848-8.757)
	Bedridden	9 (30.0)	27 (13.9)	0.013	3.308	(1.285-8.516)	**0.020 ***	3.902	(1.237-12.307)
HBV co-infection	Negative	8 (26.7)	55 (28.4)	1.00	-	-	1.00	-	-
	Not tested	18 (60.0)	133 (68.6)	0.874	0.930	(0.382-2.266)	0.341	0.577	(0.186-1.788)
	Positive	4 (13.3)	6 (3.1)	0.042	4.583	(1.058-19.864)	0.386	2.311	(0.348-15.338)
CPT History	Yes	16 (53.3)	140 (72.2)	1.00	-	-	1.00	-	-
	No	14 (46.7)	54 (27.8)	0.040	2.269	(1.037-4.963)	**0.033 ***	2.735	(1.084-6.902)
History TB co-infection	Yes	15 (50.0)	57 (29.4)	0.027	2.404	(1.102-5.241)	0.131	2.103	(0.801-5.524)
	No	15 (50.0)	137 (70.6)	1	-	-	1	-	-
Adverse/side effect encountered	Yes	17 (56.7)	66 (34.0)	0.019	2.536	(1.162-5.537)	0.141	2.050	(0.788-5.332)
	No	13 (43.3)	128 (66.0)	1	-	-	1	-	-

* Variables which showed a statistically significant association ($p<0.05$) on multivariable logistic regression

6. DISCUSSION

Numerous studies have shown that individuals living with HIV have a higher risk of developing a variety of chronic non-communicable diseases (NCDs), including cardiovascular disease (CVD), hypertension, diabetes, chronic obstructive pulmonary disease (COPD), kidney disease, and cancers, compared to the general population. Increased survival due to effective ART, lifestyle factors, long-term ART complications, and other aging-associated diseases have a significant impact on the confluence of HIV and NCDs (75).

This study used individuals with HIV/AIDS and age-associated comorbidities as cases and patients with HIV/AIDS alone as controls to assess the influence of age-associated comorbidities on the therapeutic outcomes of highly active antiretroviral therapy (HAART). The study's core questions revolve around the magnitude of immunological and virological failure among study participants as well as the associated factors of such failure.

Based on the current study, a high prevalence of hypertension and multimorbidity - the presence of two or more chronic age-associated comorbidities were observed. Hypertension was the predominant disease with an overall prevalence of 14.3%. However, it was 28.6% in HIV infected patients comorbid with NCD-comorbidity (cases). It is lower than studies conducted in Botswana (17.5%) (54). US (40.4%) (43), Asia (34%) (42), and Portuguese (39.7%) (10). The reason why lower in our case might be due to the smaller sample size (n= 224) used in our study but in those study listed above larger sample sizes (300 for Botswana, 10000 for US, 5411 for Asia, and 401 for Portuguese) were used. The other reason for this discrepancy might be the difference in study design that was an ongoing prospective cohort study for US and Asia while ours is nested case-control. The other possible explanation for this discrepancy might be due to the fact that patients enrolled in US and Asia studies were seen in HIV specialty clinics with specialists. Despite JMC being the only government hospital that serves South Western parts of Ethiopia, it didn’t have a specialist engaged in the prevention and management of AIDS and non AIDS defining illnesses, and most HIV patients were seen by medical interns doing clinical attachment and rotating weekly. So that miss diagnosis was not uncommon.

The prevalence in the current study is comparable to study done in Harar, Ethiopia (12.7%)(47). However, it is much higher than the study conducted at Hawassa (4.2%)(31) , this might be due to differences in risk factors for developing the disease among study patients.

The current study showed the prevalence of multimorbidity of 25.0% among the case group. This is comparable to the study done in Thailand (22.5%)(30). However, it is lower than the study conducted in Japan (36.2%) (35). The reason why lower in this study might be due to the smaller sample size in our study (224 versus 1445 in Japan). The other possible reason might be methodological difference (observational retrospective cross-sectional study in Japan versus nested case control study in the current study). It was higher than the study conducted in Hawassa (8.9%) (31).

Based on the present study, the overall magnitude of immunological failure was 31 (13.8%). Twenty six (23.2%) of cases and 5 (4.5%) of controls had immunological failure. This is higher than the study conducted in Asia (7%) (42) but lower than study conducted at Dire Dawa, Ethiopia which was 19.3% (56). The reason why higher than the study in Asia might be because of difference in the age of the patient involved in the study. In our case 37.5% of patients included in the study were ≥50 years but in Asia only 9.6% of patients were ≥50 years. The reason why lower than study in Dire-Dawa might be due to the lower sample size of our study (224 versus 949).

The overall magnitude of virological failure in our study was 13.39% (15.18% of cases and 11.60% of controls). This is comparable to studies done in Adigrat (60) and South Wollo (61), Ethiopia which showed virologic failure prevalence of 12.5% and 15.9%, respectively. A similar study done in Asia (42) showed a 17% virological failure. This difference might be due to the difference in criteria used to define virological failure. They assumed a patient who had a single viral load > 1000 as virological failure. This magnitude might be comparable or lower if they used a confirmatory viral load test as per WHO 2016 guidance. Another study conducted at Mizan-Tepi University, South West Ethiopia reported a far different result from our study, which was 2.3% (58). The possible reason for the observed discrepancy could be attributed to differences in the assessment of failure, availability, and functionality of measuring instruments and chemicals, and the patient's financial circumstances. This variation might also be cause by methodological difference; they assessed patients only on first-line antiretroviral therapy.

Gender is one associated factor for immunological failure. Male patients had three times more likely to develop immunological failure compared to female patients. This is similar to studies conducted in Asia (42), and Ethiopia (57). This is due to biological and genetic difference between males and females. Infections caused by bacteria, viruses, fungi, and parasites are more severe and more frequent in men than in women. Contrarily, females typically exhibit stronger immune responses to antigenic threats such as infection (78–80).

Our study also identified age as an independent predictor of immunologic failure. Patients aged ≥50 years had nearly three times more likely to have immunological failure compared to those aged <50 years. This is consistent with studies done in USA (48), Israel (27), and Asia (42) which showed a slower increase in CD4 cell counts in patients aged ≥50 years compared to their younger counter parts. This is due to aging-related decreases in naive T cell production as well as a reduction in the size of the thymus, an organ vital to the maturation of T lymphocytes and the development of the human immune system (26). But, an African cohort study conducted in Kenya, Uganda, Tanzania and Nigeria which assessed the impact of age on CD4 recovery found no significant differences in ART response in participants < 50 years and ≥ 50 years old. This discrepancy might be due to differences in the median CD4 count at ART initiation. Participants aged 50 and older had a greater median CD4 count at the start of ART compared to participants under 50, although it did not reach statistical significance (306 cells/mm3, vs. 277cells/mm3). In the current study, the reverse is true: patients 50 and older had a lower median CD4 count compared to the younger although it did not reach statistical significance (166.50 cells/mm3 Vs 179.50 cells/mm3)(52). However, this study identified the less likelihood of virological failure in patients aged 50 years and above as compared to younger patients (age less than 50 years). This is consistent with studies done in Uganda (55), Canada (50), and Ethiopia (62,63) which showed the less likelihood of virological failure as the patients age gets advanced. On the contrary, another study conducted in Waghimra Zone, Northern Ethiopia (64), reported that patients older than 35 years had more likelihood of virological failure as compared with thier younger counterparts. The possible reason might be due to the majority of patients included in our study being younger adults (62.5% versus 37.5%).

In this study, HIV infected patients comorbid with chronic age associated comorbidities (cases) were more than 10 times more risky for immunological failure than patients infected with HIV alone (controls). It is consistent with the study done at Jimma in 2016, even though our immunologic failure criteria had slight differences (they used WHO 2010 guideline but, we used WHO 2016 guidelines) to define failure (70).

Patients who were consuming alcohol had three times more likelihood of immunological failure compared to those who never consumed. Alcohol impacts the immune system through the involvement of the hypothalamic–pituitary–adrenal axis that finally leads to immune suppression as a result of a decrease in cytokine production (78). By contrast, a study done in French (81) found a significant association between alcohol consumption and CD4 cell count; compared with abstinent patients, those reporting low alcohol consumption was more likely to have significantly higher CD4 cell count. Similarly, the odds of virological failure were three times more among those who drank alcohol as compared to those who never drank. This finding is supported by studies done in Guatemala, central America (49). This is due to alcohol's effect on the immune system that leads to HIV disease progression and failed virologic suppression.

This study found having a low baseline CD4 count (CD4<200 cell/uL) as an independent predictor of immunological and virological failure. Patients with a baseline CD4 count of less than 200 cells/ul had a greater than threefold and five fold increased risk of developing immunological and virological failure than those with a baseline CD4 count of 200 cells/ul or higher, respectively. A statistically significant association between low baseline CD4 count (CD4 count <200 cells/uL) and immunological failure is consistent with studies conducted in Asia (42), China (51), and Ethiopia (57,58). This could be because patients with low CD4 cell counts at baseline have weaker immunity, which could increase their risk of developing immunological failure. As opposed to this study, another study conducted in southern part of Ethiopia reported having a higher baseline CD4 cell count as a risk for immunological failure (59). This difference might be due to the difference in criteria used to define immunologic failure (they were used WHO 2010 criteria as follows fall of follow-up CD4 count to baseline (or below), or CD4 levels persisting below 100 cells/mm3, or 50% fall from on-treatment peak value) but, in this study WHO 2016 criteria were used. The other possible reason might be the difference in sample size (1321 Vs.224) and also the study included pediatric patients. The

significant association found between baseline CD4 count <200cells/uL and virological failure is confirmd by several studies conducted in Asia (42), South Africa (53), Ethiopia (58,66). It suggested that patients with a low CD4 count were in favor of virological non suppression. The reason might be because of a decrease in the patient's immunity, which is responsible for fighting against different opportunistic infections. So, the rate of viral replication increases compared to their immune-competent counterparts.

This study showed that in bivariate as well as multivariate logistic regression poor (low) adherence was highly associated with virological failure (p=0.001 and P=0.003 respectively). Patients having low levels of adherence were nearly six times more likely to develop virological failure as compared to those with high adherence. It is consistent to studies done at Uganda (82), Asia (42), and Ethiopia (63–66). Poor adherence to medication reduces viral suppression due to suboptimal drug concentration and subsequently increasing the viral load (75)

Baseline functional stuatus was one of the predictor factors of virological failure. Our finding observed that patients with a bedridden baseline functional status were nearly four times more likely to develop virological failure as compared to those with a working functional status. This is inline with studies done in Ethiopia; Debre-Markos (69), and Arba Minch (83). This could be due to the fact that those patients who work may have better incomes, which opens up opportunities for them to receive better assistance and care. This finding may also be explained by the possibility that patients became bedridden as a result of infectious diseases when their CD4 cell count gets low.

The other issue was regarding the use of cotrimoxazole prophylaxis. This study observed that patients who weren't using cotrimoxazole prophylaxis had more than two times more likely to develop virological failure as compared to those patients who were using cotrimoxazole prophylaxis. This is consistent with the study done in Uganda (84) which showed the beneficial effects of cotrimoxazole on CD4-cell count and viral load. This might be due to cotrimoxazoles effect on preventing opportunistic infections and stabilization of the immune system that inturn leads to a reduction in viral replication. As opposed to our study, a study conducted in China (85) showed that patients who used cotrimoxazole during ART were around two times more likely to have high-risk for virologic failure. This might be due to methodological difference; A study in China defined virological failure as two or more consecutive VL>400copies/ml after 6

months of ART treatment, whereas in our case VF was defined as two consecutive viral loads greater than 1000 copies/ml with 3 months enhanced adherence support. The other reason might be the difference in sample size included in the study (1860 versus 224 in our case).

Strength and Limitation of the study

One of the strength of the current study is the use of a nested case-control study which takes advantage of both cohort and case-control study. In addition, this study showed the factors associated with immunological and virological failure in the study area and tries to fill the gap. However, the study was not without limitations. First, due to the observational nature of the study, it was underpowered to detect difference in therapeutic outcomes due to inclusion of minimum number of observations in each of the non communicable diseases comorbidities. Second, there was lack of sufficient studies done on the impact of age-associated comorbidities on HIV treatment outcome to compare our result with other finding. Third, the baseline characterstics of the study participants were unmatched because of the small sample size. Forth, another problem of this study is the application of a non-probability sampling technique (purposive sampling technique) because of lack sampling frame for HIV infected patients comorbid with age –associated comorbidities. So, this study lacks generalizability.

7. CONCLUSION

Immunological failure was higher in patient's comorbid with chronic age associated comorbidities. However, there were no statistically significant association between the existence of age-associated chronic comorbidities and virological failure.

History of alcohol intake and having a baseline CD4+ count of <200cells/uL were found to be an independent predictor of both immunological and virological failure. Male gender, having NCD-comorbidity, and age ≥ 50 years were significantly associated with immunological failure and a low level of patients medication adherence, not using cotrimoxazole preventive therapy, being younger (age<50 years) and having a baseline bedridden functional status were found to be an independent predictor of virological failure among the study participants.

8. RECOMMENDATIONS

- **For FMoH**
  - Due to the double burden of HIV and non communicable diseases (NCDs), it is better if federal ministry of health develop a comphrensive HIV/NCD clinic.
- **For JMC, head office**
  - It is better for the hospital to give attention for malnutrition (low BMI) patients and better to do on availability of therapeutic foods.
- **For JMC health care providers**
  - Health care providers shall provide health education to their patients, which help them to identify risk factors for the development of chronic non communicable disease (NCD) and to focus on early prevention.
  - Special attention and care shall be given for older patients, patients with a lower baseline CD4 count, problems with adherence, bedridden functional status, and positive for behavioural measures.
  - They should clearly counsel NCDs impact on the overall treatment outcome.
  - Documentation at the ART clinics should include social determinants such as smoking and alcohol use at every visit of the patient.
- **For adherence counselors**
  - The adherence support should be intensified so as to improve the patients medication adherence as well as the overall treatment outcome
- **For researchers**
  - Using the results of this study as an input, further research in the other ART clinics should be conducted to appreciate the problem.
  - One or more studies with better study design such as prospective cohort and sufficient sample size should be done to elucidate the problem of chronic non communicable diseases in HIV.

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10. ANNEXES

1. Patient Information Sheet

Title: "The influence of age-associated comorbidities on responses to combination antiretroviral therapy among people living with HIV" at the ART clinic of JMC, South West Ethiopia.

Name of the principal investigator: Abebaw Abie Gedif

Name of the study area: Jimma Medical Center (JMC)

Research budget covered by: Jimma University

Research objective: To assess the influence of age-associated comorbidities on responses to combination antiretroviral therapy among people living with HIV" at the ART clinic of JMC.

Significance of the study: The study finding is used to assess the influence of age-associated comorbidities on responses to combination antiretroviral therapy among people living with HIV" at JMC and also it provided pertinent information regarding the impact of age-associated comorbidities on response to combination antiretroviral therapy (cART). Finally, the information generated from the study will help the responsible bodies to make various levels of decision making.

Study procedure: Data were collected by using a semi-structured questionnaire prepared from a review of related literature, and medical record reviews of patients. The tool had two parts, the patient interview part and the chart review part. It includes socio-demographic, adherence, behavioral, medication-related, and laboratory as well as clinical and diseases related character of the patient

Risks: No risks except the time that patient spends during the interview.

Participant right: Taking part in this study was completely voluntary. It was patient's choice wheather to participate or not. The patient had a right to stop the interview at any time, or to skip any question that he/she didn't want to answer.

Benefit: The study is beneficial for patients' quality service delivery for future encounters. It informs health care providers about the status of care. It also can be used as a source of information for the hospital and policy makers.

Incentives: Participants were not provided any specific incentive for taking part in the research other than acknowledgment.

Confidentialities: The study result was not included the patient's name and address and any information communicated were kept confidential.

Agreement: Patients are expected to be fully voluntary to participate in the study.

Whom to contact: If you have any kind of inconveniencies about the study, you can contact the following individual:

Abebaw Abie (Principal investigator)

Cell Phone: 0931859905 or

Email: abebawabie31@gmail.com.

2. **Patient Written Consent Form**

Dear Sir/madam; my name is Abebaw Abie Gedif. I am a Master's Degree student in clinical pharmacy at Jimma University. As part of my academic requirements, I am expected to conduct a research. This study is aimed to assess "the influence of age-associated comorbidities on responses to combination antiretroviral therapy among people living with HIV" at the ART clinic of JMC. The information obtained from this study will facilitate clinicians to improve the provision of care and policymakers in their planning activities. Your participation in this study is voluntary and all data provided will be treated as confidential and anonymous. You have a right not to participate in this study. Therefore; we politely request your cooperation to participate in this study. But your input has great value for the success of the objectives of the research.

So, do you agree?

1. Yes 2. No

Thank you for your cooperation!!!

Informed Consent

While putting my signature on this sheet, I am giving my consent to participate in this study. I have been informed that the purpose of this study is to assess "the influence of age-associated comorbidities on responses to combination antiretroviral therapy among people living with HIV" at the ART clinic of JMC and I have understood that participation in this study is entirely voluntarily. I have been told that my answers and other profiles to the questions will not be given to anyone else and no reports of this study ever identify me in any way. I have also been informed that my participation or non-participation or my refusal to participate in this study will not affect me. I understood that participation in this study does not involve risks.

Study participant	***Data collector***	***Supervisor***
Sign.....	Sign.....	Sign.....
Phone number: ……...	Phone number: ……...	Phone number: ……...

Patient Information Sheet: Amharic Version

የተሳታፊዎች መረጃ ቅጽ

ዋና ተመራማሪ፡ አበባዉ አቤ ገድፍ

ምርምሩ የሚካሄድበት ቦታ፡ ጅማ ህክምና ማዕከል

የጥናቱን ወጪ የሚሸፍነው ድርጅት፡ ጅማ ዩኒቨርስቲ

የጥናቱ ዓላማ: በተጠቀሰው የጤና ማዕከል ከእድሜ ጋር ተያያዥ የሆኑ ተጉዳኝ በሽታወች በኤች አይ ቪ መድሃኒት የህክምና ዉጤት ላይ የሚያሳድሩትን ተጥዕኖ በተመከተ ጥናት ማድረግ

የአሰራር ቅደም ተከተል፡ በዚህ ጥናት እንዲሳተፉ በአክብሮት አየጋበዝን ፍቃደኞች ከሆኑ የመግባቢያ ስምምነትዎን ተረድተው ይፈርማሉ። በመጀመሪያ ስነ-ህዝብ እና ማህበራዊ ጉዳዮችን የተመለከቱ

ጥያቄዎችን፣ በመቀጠልም ከህመሞ ጋር የተያያዙ ጥያቄዎችን እንጠይቅወታለን፡እንዲሁም የተለያዩ የላብራቶሪ ዉጤቶችን ከካርዶ እንዎስዳለን፡፡

በጥናቱ ምክንያት ሊደርስ የሚችል ጉዳት፡ በጥናቱ በመሳተፍዎ የሚደርስብዎት ጉዳት የለም፡፡ በጥናቱ ያለመሳተፍ ወይም ከገቡ በኋላ የመውጣት መብት፡ ጥናቱ በሙሉ ፍቃደኝነት ላይ የተመሰረተ ነው፡፡በጥናቱም የመሳተፍ ግዴታ የለብዎትም፡ ፡መመለስ ያልፈጉትን ጥያቄ ማለፍ ይችላሉ ። በተጨማሪ ባልመሳተፍዎ የሚያገኙት የጤና አገልግሎት ላይ ምንም አይነት ችግር አያስከትልብዎትም፡፡እንዲሁም በማንኛውም ሰዓት ከተሳታፊነት ማቋረጥ ይችላሉ፡፡

በጥናቱ መሳተፍ ያለው ጥቅም፡ በዚህ ጥናት ቢሳተፉ ለወደፊት የኤች አይ ቪ ህመም ህክምና ዉጤት ለማሻሻል ይረዳል፡፡

ጥቅማጥቅም፡ በጥናቱ ሊይ በመሳተፍዎ ከምስጋና በቀር የሚያገኙት የክፍያ ጥቅም አይኖርም፡፡

ሚስጥራዊነት፡በዚህ ምርምር የሚገኝ ማናቸውም መረጃ በሚስጢር ይጠበቃል፡፡ የተሳታፊው ስም ኣይፃፍም፡፡ ከተመራማሪውና የጤና ባለሙያው በስተቀር ሌላ ሰው አያየውም፡፡ከጥናቱ የምናገኛቸው መረጃዎች ሚስጢራዊነታቸው የተጠበቀ ነው፡፡

ስምምነት፡ በዚህ ጥናት ሊይ የሚሳተፉ ታካሚዎች ሙሉ ፍቃደኛ መሆን አለባቸው፡፡ በጥናቱ ዙሪያ የበለጠ መረጃ ቢያስፈልግዎ፡ ለሚመለከተው ግለሰብ ማነጋገር ይችላሉ፡፡

አበባዉ አቤ ገድፍ

ስልክ፡+251931859905 ወይም

የኢሜል አድራሻ፡- abebawabie31@gmail.com

Patient Informed consent Amharic Version

የስምምነት ሰነድ

ዉድ ተሳታፊዎች

ስሜ አበባዉ አቤ ገድፍ ይባላል የሁለተኛ ድግሪ የመመረቂያ ጥናቴን ጅማ የህክምና ማእከል ከእድሜ ጋር ተያያዝ የሆኑ ተጉዳኝ በሽታወች በኤች አይ ቪ መድሃኒት የህክምና ዉጤት ላይ በሚያሳድሩት ተጥዕኖ ላይ ያተኮረ ነው። የዚህ ጥናት አላማ ሊስተካከሉ የሚችሉ ሁኔታዎችን መለየት እና የበሽታውንም አጠቃላይ ሁኔታ ማሻሻል ነው።።።
በመሆኑም ከላይ የተጠቀሱትን አላማዎች ለማሳካት የእርሰዎ ትብብር እና ተሳትፎ በጣም አስፈላጊ ነዉ።።የሚሰጡት መረጃ ሚስጥራዊነቱ የተጠበቀ ነዉ። እንዲሁም በጥናቱ ያለመሳተፍ እና በፈለጉት ሰዓት ከጥናቱ የመዉጣት መብትዎ የተጠበቀ ነዉ።።ከዚህም ባሻገር መመለስ ያልፈልጉትን ጥያቄ መተዉ ይችላሉ። ይህን የጥናት አላማ ተረድተዉ ተሳታፊ ለመሆን ፍቃደኛ ስለሆኑ በቅድሚያ ምስጋናዬን አቀርባለሁ።።

በጥናቱ ላይ ለመሳተፍ መስማማቴን አረጋግጣለሁ።።

የተሳታፊው ፊርማ/ የጣት አሻራ ----------

ቀን----------ወር----------ዓ.ም.----------

የመረጃ ሰባሳቢው ስም እና ፊርማ----------

ቀን----------ወር----------ዓ.ም.----------

ስለ ትብብርዎ በድጋሜ አመሰግናለሁ።።

Patient Information Sheet: Afaan Oromo Version

Guca Odeffanno dhukkubsattotaa

Mata-duree: dhiibba dhibeewwan hin daddabarre umriidhaan wal-qabatee dhufu yaala qorichaa farra HIV irratti qabuu ilaaluuf

Maqaa qorataa: Abebaaw Abbe Geddif

Magaa iddo qoranno: giddu-gala yaala Jimma

Baasii qoran no kan danda'u: yuuniiversiitii Jimmaa

Kayyoo qorannoo: dhiibba dhibeewwan hin daddabarre umriidhaan wal-qabatee dhufu yaala qorichaa farra HIV irratti qabuu ilaaluuf.

Barbaachisumma qoranno: bu'aan qorannoo kanarra argamu odeeffanno barbaachisa ta'e dhukkubsatoota karaa garaan tajaajila yaala isaani foyyessuf gargaara. Akkasumas qaamolee dhimmi ilaaluuf murtii adda addaa murtessurratti isaan gargaaru danda'a.

Adeemsa qorannichaa: qorannoo kanarratti akka hirmaattan kabajaan isiin afferaa, heyyamamaa yoo tataan waliigaltee hirmaanna hubattani mallattesitu. Jalqabarratii odeffanoo waa'ee hawwasumma kessani illallatu isin gaafanna, itti ansuun waa'ee dhukkuba kessani gaffii tokko tokko isin gafanna. Dhumarratti bu'aa laaboraatorii kessani kardii kessan irra ni fudhanna.

Sababa qoranno kanarrati hirmaattanif dhiibba gahuu danda'u: qoranno kanarratti waan hirmaattaniif dhiibban sinirra gahu hin jiru.qoranno kanarratti hirmaachuu dhisuus erga jalqabdanii bodde addan kutus ni dandeessu. Qorannichi gutuumaa quututti heyyama keessan irratti kan hundaa'ee dha. Gaaffi deebisuu hin barbaanne irra darbuu ni dandeessu.hirmachuu dhiisuu kessanif tajaajila argattan irratti jijjiramni ta'uu hin jiru.

Qorannoo irratti hirmaachuun bu'aa qabuu. Hirmannan keessan tajaajila HIV irratti kennamu foyyessuf ni gargaara.

Kafaltii waan hirmattanif kennamu: qoranno kanarratti hirmaachu kessaniif galata irran kan hafee wanti isiinif kennamu hin jiru.

Iccciti eeguu: qorannoo kanarra oddeffannon argamu hundi iccitiidhaan egama.maqaan hirmaataa hin barra'u. qorataa fi hojjattotaa fayyan ala namni biraa hin fayyadamu.oddefannon qorannorra argannu iccitiin isaani kan eegame dha.

Waliigaltee:qoranno kanarratti kan hirmaatan gutumatti heyyama isaaniin ta'uu qaba.waa'ee qoranno kana odeeffanno dabalataa yoo barbaaddan bilbila armaan gadiin argachuu ni dandeessu.

Abebaaw Abbe Geddif

Lakk. Bilbilaa:+251931859905 yookin

E-mail: abebawabie31@gmail.com

Gucaa waliigaltee

Kabajamaa hirmaataa qorannaa kanaaan maqaan koo **Abebaaw Abbe Geddif** jedhama. yunivarsiitii Jimmaatti barataa kiliinikaal faarmaasii waggaa lammaffaa yoon ta'u, yeroo ammaa kana qorannoo waa"ee dhiibba dhibeewwan hin daddabarre umriidhaan wal-qabatee dhufu yaala qorichaa farra HIV irratti qabuu ilaaluuf yunivarsiitii jimmaa kutaa yaala HIV irratti gaggeesufan jira.Kanaafuu galma gahiinsa qorannoo kanaatif deebiin afanii isin waa'ee yaala keesssanii naaf kennitan fi odeeffannoon kaardi yaala keessanii irra jiru baay'ee barbaachisadha. Odeeffannoon isinirra argamu maqaas ta'ee mallatto eenyummaa keessani kan hin qabnee fi iccitiidhan kan qabamuudha.hirmaachuu yookin hirmaachuun dhiisuun kessan yaala fayya argatan irratti dhiibba hin qabu. Garuu furmata dhukuba HIV fi dhibee hin daddabarre waliin jiru irratti mul'ateen kennamu irra ni fayyadamtu. Akkasumas qulqullina yaala gara fulduraatti hospitaalichaan kennamu foyyesuuf ni fayyada. Kanaafuu yaada keessan iftoominaan akka naaf Laattan aferamtaniirtu. Dabalataanis hirmaannaan kun guutumaan guututti fedhiiiratti kan hundaa'eedha.Gaaffii deebisu hin barbaanne yoo jiraate irra darbuu yookiin gaafachuu ni dandeessu. Yoo hirmaachuuf eeyyamamaa taatan guca kanarratti mallatteesun mirkaneessaa.

Waliigaltee mallattessuf heyyamamaadha?

1/ eyyen 2/ lakki

Galatoomaa!

Qorannoo irratti hirmachuuf heyyamuu koof mallaoon mirkannessa

Mallattoo hirmaataa/mallattoo qubaa_____

Guyya_____ ji'a _____ bara_____

Maqaa fi mallattoo nama odeeffanno funaanuu_____

Guyyaa_____ji'a_____ bara_____

Waan na gargaartaniif sinan galateeffadha!

Annex I: Data abstraction format from patient interview

Part I: Patient's socio-demographic characteristics (Use an "X" mark in the boxes)

1. Card No_____
2. Age (year)_____
3. Gender: Male ☐ Female ☐

4. Marital status
   - Single ☐
   - Marriage ☐
   - Divorced ☐
   - Widowed ☐

5. Home Residence:
   - Rural ☐ Urban ☐

6. Educational status
   - Unable to read & write ☐
   - Primary school(1-8) ☐
   - Secondary school (9-12) ☐
   - College & above ☐

7. Occupation: Gov't employee ☐ NGO ☐
   - Farmer ☐ Daily laborer ☐ Retired ☐
   - Merchant ☐ Housewife ☐ unemployed ☐
   - Student ☐ If other (specify)_____

8. What is your monthly income? (ETB)_____

9. Living condition: Alone ☐ Living with family ☐ living with friends ☐
   Living with other relatives ☐ If other specify_____

10. Time of HIV diagnosis (months)_____
11. Stay after diagnosis to ART initiation _____
12. Duration on treatment (months) _____
13. Do you have chronic non communicable disease (NCD) comorbidities? Yes ☐ No ☐
14. If Yes for question No 13, what type of chronic NCD comorbidities do you have? _____
    Hypertension ☐ Diabetes mellitus ☐ Asthma ☐ CHF ☐
    Epilepsy ☐ Cancer ☐ Depression ☐
15. If you have comorbidities, please tell me your chronic follow up charts card number? MRN _____
16. Non communicable disease (NCD) diagnoses _____
17. Do you have a child? Yes ☐ No ☐
18. If your response for question no 18 is yes, how many children do you have?_____
19. Have you disclosed your serostatus to your family/ friends or any one you trust? Yes ☐ No ☐
20. Did you have family history of any NCDs Yes ☐ No ☐
21. If your response for question no 21 is yes, what are those comorbidities?

    _____ _____ _____ _____ _____

Part II: Patient Behavioral information

22. Do you currently drink any alcohol? Yes ☐ No ☐
23. If Yes to Q23, how long since you start drinking? _____in months

24. If no for Q23, have you **ever** consumed any alcohol such as beer, wine, spirits, tella, areki or *[add other local examples]*?

Yes ☐ No ☐

25. How often have you drink one standard alcohol? Daily ☐ Weekly ☐ Monthly ☐

26. Do you **currently** smoke any **tobacco** products, such as cigarettes, cigars or pipes?

Yes ☐ No ☐

27. If your answer to question 27 is yes, how long have you been smoking? _____

28. If yes to Q27, How often do you smoke? Daily ☐ Weekly ☐ Monthly ☐

29. If your answer is no for question no 27, in the past, did you **ever smoke** any tobacco products?

Yes ☐ No ☐

30. During the past 30 days, has anyone smoked **in your home**? Yes ☐ No ☐

31. During the past 30 days, has anyone smoke in closed areas **in your workplace** (in the building, in a work area or a specific office)? Yes ☐ No ☐

32. Do you chew chat? Yes ☐ No ☐

33. Do you drink coffee? Yes ☐ No ☐

34. If no to Q33, did you ever drink coffee? Yes ☐ No ☐

35. How do you get the medication (NCDs)? Out of pocket ☐ Free medication ☐ By insurance coumpany ☐

36. Did you use herbal /traditional medicine? Yes ☐ No ☐

37. Do you have self medication practice? Yes ☐ No ☐

38. Do you take the medication as prescribed? Yes ☐ No ☐

39. If you have ever used any other substance please specify _____ _____ _____

Questions on lifestyles

40. Do you perform physical exercise? Yes ☐ No ☐

41. If yes to Q41, in a typical week, for how many days do you perform? _____

42. Did you reduce salt in your diet? Yes ☐ No ☐

43. Did you reduce fat in your diet? Yes ☐ No ☐

44. Did you reduce sugary beverages in your diet? Yes ☐ No ☐

Part III: Questions to assess patient's medication adherence
The Adherence in Chronic Diseases Scale (ACDS)

Below is a set of 7 questions with answers. Please rate, which response best reflects your behaviour, your situation and your opinions.

Please provide honest answers by checking the appropriate one with X.

1. Do you always remember to take all your medications according to your doctor's instructions?
   A. Always B. Almost always C. Sometimes D. Hardly ever E. Never
2. Do you happen to change the dosing of your medications without prior consultation with your doctor?
   A. Never B. Only occasionally C. Sometimes D. Frequently E. I do not adhere to my doctor's recommendations at all
3. Do you adjust the dosing of your medications according to how you feel?
   A. No, I strictly follow the prescribed dosing, no matter how I feel
   B. Yes, I reduce the dosage of some medications when I feel good
   C. Yes, I skip doses of some medications when I feel good
   D. Yes, I temporarily discontinue some medications when I feel good
   E. Yes, I discontinue all medications when I feel good.
4. On the appearance of medication-related side effects (e.g. stomach pain, liver pain, rash, lack of appetite, oedema):
   A. I seek medical attention instantly
   B. I reduce the dosage of the medication and attempt to expedite the elective appointment with my doctor
   C. I discontinue the medication and attempt to expedite the elective appointment with my doctor
   D. I discontinue the medication and wait for the next elective appointment with my doctor
   E. I discontinue all my medications and wait for the next elective appointment with my doctor
5. Do you find all your medications necessary for your health?
   A. Yes, I do
   B. I find most of my medications to be beneficial for my health
   C. I find only some of my medications to be beneficial for my health
   D. I find some of my medications to be beneficial for my health, while the others to be harmful for me
   E. I find the majority of my long-term medications to be harmful for me
6. Does your doctor inquire about medication-related problems that you might possibly experience?

A. Yes, on every appointment
B. Yes, he/she usually does
C. Yes, but only sometimes
D. Yes, but only occasionally
E. No, never

7. Do you tell truth when asked by your doctor about medication-related problems?
   A. Yes, always
   B. Almost always
   C. I try to be honest, but sometimes it is hard to admit to non-compliance with doctor's recommendations
   D. Sometimes yes, another time no
   E. No, I don't. I find it my own private business

Annex II: Data abstraction format from medical chart

Part I. Patient's clinical and immunological characteristics

Card Number_____ Base Weight (kg) _____Height (m) _____BaseBMI _____

1. Duration HIV diagnosis (months)_____
2. ART initiation date ____/____/_____ (dd/mm/yyyy)
3. ART initiation:
   - Age at base line (years) _____
   - Baseline CD4+ count (cells/mm^3) _____
4. Duration of taking HAART in months _____
5. Current weight (kg) _____ current BMI_____
6. WHO baseline clinical stage Stage I ☐ Stage II ☐ Stage III ☐ Stage IV ☐
7. WHO recent clinical stage Stage I ☐ Stage II ☐ Stage III ☐ Stage IV ☐
8. Baseline functional status Ambulatory ☐ Working ☐ Bedridden ☐
9. Current functional status Ambulatory ☐ Working ☐ Bedridden ☐
10. Baseline TB screen Positive ☐ Negative ☐ Not tested ☐
11. Current ART drug regimens of the study participants

TDF + 3TC +DTG ☐	TDF + 3TC + ATV/r ☐
TDF + 3TC + EFV ☐	ABC + DDI + LPV/r ☐
AZT + 3TC + NVP ☐	ABC + DDI + EFV ☐
AZT + 3TC + EFV ☐	AZT + 3TC + ATV/r ☐
TDF + 3TC + NVP ☐	ABC + 3TC + ATV/r ☐

12. Baseline viral Load (copies/mL) _____
13. Current viral load (copies/mL)_____
14. Baseline CD4 + count (cells/mm^3) _____
15. Current CD4 count/ CD4 count during data collection (CD4 (cells/ mm^3) _____
16. Hepatitis B co-infection Negative ☐ Positive ☐ Not tested ☐
17. Hepatitis C co-infection Negative ☐ Positive ☐ Not tested ☐
18. Co-trimoxazole preventive therapy Yes ☐ No ☐
19. TB (INH) prophylaxis Yes ☐ No ☐
20. Current treatment for TB Yes ☐ No ☐
21. If Yes for Qn no 19, what type of TB? Pulmonary ☐ Disseminated ☐ Unknown ☐
22. TB treatment history Yes ☐ No ☐

23. If Yes for Qn no 20, what type of TB? Pulmonary ☐ Disseminated ☐ Unknown ☐

24. Fluconazole preventive therapy (FPT) prophylaxis Yes ☐ No ☐

25. Was there any opportunistic infections? Yes ☐ No ☐

26. If yes for question no 23, what was the type of opportunistic infections?

Tuberculosis ☐ Meningitis ☐ PCP ☐ Pneumonia ☐

Toxoplasmosis ☐ Oral candidiasis ☐ Others specify_____

27. Switching Yes ☐ No ☐

28. Switching to: 1st line regimen ☐ 2nd line regimen ☐

29. Second line regimen

AZT +3TC + NVP ☐ TDF + 3TC + EFV ☐

AZT + 3TC + EFV ☐ ABC + ddl + LPV/R ☐

TDF + 3TC + NVP ☐ TDF + ddl + LPV/R ☐

If others specify_____

30. What are the reasons of switching drug?

Toxicity ☐ Pregnancy ☐ TB ☐ Clinical failure ☐ Age ☐

31. ARV drug adherence at base line Good ☐ Fair ☐ Poor ☐

32. ARV drug adherence during data collection Good ☐ Fair ☐ Poor ☐

33. Hospitalization history

HIV-related diagnosis ☐ Non HIV-related diagnosis ☐

34. Was there any adverse drug reaction/side effect encountered? Yes ☐ No ☐

35. If your answer for question no 32 is yes, what types of adverse drug reactions/side effects occurred?_____

Nausea ☐ diarrhoea ☐ fatigue ☐ head ache ☐ rash ☐

Anemia ☐ abdominal pain ☐ jaundice ☐ Dizzy, anxiety, night mare ☐

If other specify_____ _____ _____

36. Does the patient has comorbidity Yes ☐ No ☐	If yes, type of comorbidity Hypertension ☐ Dyslipidimia ☐ Atrial fibrillation ☐ Diabetic mellitus ☐ CKD ☐ Cardiac(heart failure) ☐ Epilepsy ☐ Mental illness ☐	Asthma ☐ COPD ☐ Peripheral arterial disease ☐ Ischemic heart disease ☐ pulmonary hypertension ☐ If others (specify)_____

Part II: Medications taken by adult HIV positive patients.

Medication given		Yes	No			Yes	no
ACEIs	Enalapril			**Antidiabetics drugs**	Metformin		
					Glibenclamide		
					Glpizaide		
					Regularinsulin		
					NPH insulin		
	Captopril						
ARBs	Losartan						
	Telmisertan						
Beta blocker	Metoprolol succinate						
	Metoprolol tartarete			**Antiasthatic drugs**	Sabutamol puff		
	Atenolol				Salbutamol tab		
	Propranolol				Beclomethasone		
Direutics	Furosemide						
	HCT						
	Spiranolactone						
	Digoxin						
Anticoagulant or antiplatilate	Warfairin			**Anti-epileptic drugs (AEDs)**	Phenytoin		
	Aspirin				phenobarnitone		
	Clopidogrel				carbamazepine		
Statins	Atrovastatine				Valproic acid		
	Simvastatin				Ethacrinic acid		
Others							

Part III: Laboratory data record for the patient

Follow up		Base line	1st	2nd	3rd	4th	5th
Parameter	Date of visit						
Lipid profiles	LDL: mg/dl						
	TG: mg/dl						
	HDL: mg/dl						
	Total cholesterol						
CD4+ count	Date of visit						
Viral load tests							
LFT	Date						
	ALT						
	AST						
RFT	**Date**						
	BUN						
	Sr Cr						
	GFR						
Blood glucose	**Date**						
	FBS						
	RBS						
	HbA1C						
CBC	**Date**						
	WBC						
	Neutrophil						
	Lymphocyte						
	RBC						
	Hgb						
	Hct						
	PLT						
	INR						
Other Ix	Gene expert						
	-						

DATA COLLECTED BY: _____

CROSS CHECKED BY: _____

አባሪ I፡ ከታካሚ ቃለ መጠይቅ የውሂብ ማጠቃለያ ቅርጸት

ክፍል I፡ የታካሚው ማህበረሰባዊ-ስነ-ህዝብ ባህሪያት (በሳጥኖቹ ውስጥ የ (X)ምልክት) ተጠቀም)		
1. የሕክምና መዝገብ ቁጥር _____	2. ጸታ ወንድ ☐ ሴት☐	3. ዕድሜ (በዓመት)_____
4. የጋብቻ ሁኔታ ያላገባ/ች/ ☐ ያገባ/ች/ ☐ የተፋታ/የተፋታች ☐ ሚስቱ የሞተችበት/ባሏ የሞተባት/☐ 5. የመኖሪያ ቦታ፡ ገጠር ☐ ከተማ ☐	6. የትምህርት ደረጃ መፃፍና ማንበብ የማይችል/የማትችል/ ☐ አንደኛ ደረጃ(1-8ኛ) ☐ ሁለተኛ ደረጃ(9-12ኛ) ☐ ከሌጅ የተማረ/የተማረች/ ☐	7. የስራ ሁኔታ፡- የመንግሥት ሠራተኛ ☐ መንግሥታዊ ያልሆነ ድርጅ☐ ገበሬ☐ የቀን ሰራተኛ ☐ ጡረታ ወጥቷል/ለች ☐ ነጋዴ ☐ የቤት እመቤት ☐ ስራ አጥ ☐ ተማሪ ☐ ሌላ ከሆነ (ይግለጹ) _____ 8. ወርሃዊ ገቢዎ በኢትዮጵያ ብር ምን ያህል ነው?_____
9. የኑሮ ሁኔታ፡ ብቻዎን ☐ ከቤተሰብ ጋር ☐ ከጓደኞች ጋር አብሮ መኖር ☐ ከሌሎች ዘመዶች ጋር መኖር ☐		

10. የኤች አይ ቪ ምርመራ ጊዜ (በወር) _____

11. የኤች አይ ቪ ምርመራ ካደረጉ በኑላ መድሃኒት እስኪ ጀምሩ ለምን ያህል ጊዜ ቆይተዋል?_____

12. የኤች አይ ቪ መድሀኒቱን ለምን ያህል ጊዜ ወስደዋል (በወር) ? _____

13. ሥር የሰደደ የማይተላለፍ ተጓዳኝ በሽታዎች አለብዎት ? አዎ ☐ አይ ☐

14. ለጥያቄ ቁጥር 13 መልስዎ አዎ ከሆነ ምን አይነት ሥር የሰደደ የማይተላለፍ ተጓዳኝ በሽታዎች አለብዎት ? (ከአንድ በላይ ምርጫ መምረጥ ይችላሉ) _____

የደም ግፊት ☐ የስካር በሽታ ☐ አስም ☐ የልብ ድካም ☐

የሚጥል በሽታ ☐ ካንሰር ☐ ድብርት ☐ ሌላ _____

15. ከላይ የተጠቀሱት በሽታዎች ካሉብዎት፣ እባክዎን የክትትል ካርድ ቁጥርዎን ይንገሩኝ ?

የሕክምና መዝገብ ቁጥር _____

16. የማይተላለፍ በሽታ ምርመራ፣ _____

17. ተላላፊ ያልሆነ በሽታዉ እንዳለብዎት ካወቁ ምን ያህል ጊዜ ሆነዎት (በዓመት) _____

18. ልጆች አሉዎት? አዎ ☐ አይ ☐

19. ለጥያቄ ቁጥር 18 ምላሽዎት አወ ከሆነ ፡ ስንት ልጆች አሉዎት? _____

20. ኤች አይ ቪ በደምዎ ዉስጥ እንዳለ ለቤተሰብዎ ወይም ለጓደኛዎ አሳዉቀዋል ? አዎ ☐ አይ ☐

21. በቤተሰብዎ ዉስጥ ማንኛውም አይነት ተላላፊ ያልሆኑ በሽታዎች ያለበት ሰዉ አለ ? አዎ ☐ አይ ☐

22. ለጥያቄ ቁጥር 21 የሰጡት ምላሽ አዎ ከሆነ፣ እነዚህ ተጓዳኝ በሽታዎች ምንድን ናቸው? _____

_____ _____ _____ _____

ክፍል II፡ የታካሚ ባህሪ መረጃ

23. በአሁኑ ጊዜ ማንኛውንም አልኮል ይጠጣሉ? አዎ ☐ አይ ☐

24. ለጥያቄ ቁጥር 23 መልስዎ አዎ ከሆነ፣ መጠጣት ከጀመሩ ምን ያህል ጊዜ ሆነዎት? _____

25. ለጥያቄ ቁጥር 23 መልስዎ አይ ከሆነ፣ባለፉት ጊዚያት እንደ ቢራ፣ ወይን፣ ጠላ፣ አረቂ ያሉ ወይም ሌሎች ማንኛውንም አይነት የአልኮል መጠጦችን ጠጥተዉ ያውቃሉ? አዎ ☐ አይ ☐

26. የአልኮል መጠጦችን ምን ያህል ጊዜ ይጠጣሉ? በየቀኑ ☐ በሳምንት አንዲ ☐ በየወሩ ☐

27. በአሁኑ ጊዜ እንደ ሲጋራ ያሉ የትምባሆ ምርቶችን ያጨሳሉ? አዎ ☐ አይ ☐

28. ለጥያቄ ቁጥር 27 መልስዎ አዎ ከሆነ፣ ማጨስ ከጀመሩ ምን ያህል ጊዜ ሆነዎት? _____

29. ለምን ያህል ጊዜ ያጨሳሉ? በየቀኑ ☐ በሳምንት አንዲ ☐ በየወሩ ☐

30. ለጥያቄ ቁጥር 27 መልስዎ የለም ከሆነ፣ ከዚህ በፊት የትምባሆ ምርቶችን አጭሰዉ ያውቃሉ? አዎ ☐ አይ ☐

31. ባለፉት 30 ቀናት ውስጥ በቤትዎ ዉስጥ የሚያጨስ ሰው ነበር? አዎ ☐ አይ ☐

32. ባለፉት 30 ቀናት ውስጥ በስራ ቦታዎ (ህንፃ ውስጥ፣ የስራ ቦታ ወይም የተለየ ቢሮ) አቅራቢያ የሚያጨስ ሰዉ ነበር?

አዎ ☐ አይ ☐

33. ጫት ታኝካለህ? አዎ ☐ አይ ☐

34. ቡና ትጠጣለህ? አዎ ☐ አይ ☐

35. ለጥያቄ ቁጥር 34 መልስዎ አይ ከሆነ፣ ካሁን በፊት ቡና ጠጥተዉ ያዉቃሉ? አዎ ☐ አይ ☐

36. የተጓዳኝ በሽታወችን መድሃኒት እንዴት ያገኛሉ? በኪስ ገንዘብ☐ በኢንሹራንስ ☐ በሌላ ከሆነ (ይግለጹ)_____

37. በሀክመዎ ከታዘዘልዎት ዉጭ በራሰዎት መድሐኒት የመጠቀም ልምድ አለዉት? አዎ ☐ አይ ☐

38. ከዕፅዋት የተቀመሙ/የባህላዊ መድኃኒቶችን ተጠቅመዋል? አዎ ☐ አይ ☐

39. መድሃኒቱን በታዘዘው መሰረት ይወስዳሉ? አዎ ☐ አይ ☐

40. ከላይ ከተጠቀሱት ዉጭ ሌላ ማንኛውንም ንጥረ ነገር ተጠቅመው የሚያውቁ ከሆነ እባክዎን ይግለጹ _____

_____ _____

በአኗኗር ዘይቤ ላይ መሰረት ያደረጉ ጥያቄዎች፡

41. የአካል ብቃት እንቅስቃሴ ያደርጋሉ? አዎ ☐ አይ ☐

42. ለጥያቄ ቁጥር 40 መልስዎ አዎ ከሆነ በሳምንት፣ ለስንት ቀናት ነው የሚሰሩት? _____

43. በአመጋገብዎ ውስጥ ጨውን እየቀነሱ ይጠቀሙ ነበር? አዎ ☐ አይ ☐

44. በአመጋገብዎ ውስጥ ስብን ቀንሰዋል? አዎ ☐ አይ ☐

45. በአመጋገብዎ ውስጥ ጣፋጭ ምግቦችን እየቀነሱ ይጠቀሙ ነበር? አዎ ☐ አይ ☐

ክፍል III: የታካሚውን መድሃኒት ጥብቅነት መገምገም ጥያቄዎች

1. በዶክተርዎ መመሪያ መሰረት ሁሉንም መድሃኒቶችዎን ሁልጊዜ ለመዉሰድ ያስታዉሳሉ?

A. ሁልጊዜ

B. ሁልጊዜ ማለት ይቻላል

C. አንዳንድ ጊዜ

D. መቼም

E. በጭራሽ

2. ከሐኪምዎ ጋር አስቀድመው ሳያማክሩ የመድሃኒቶዎን ልክ መጠን ይቀይራሉ?

A. በጭራሽ

B. አልፎ አልፎ ብቻ

D. በተደጋጋሚ

C. አንዳንድ ጊዜ

E. የዶክተሬን ምክሮች በፍጹም አልከተልም

3. የመድሃኒቶቹን ልክ እንደ ስሜትዎ መጠን ያስተካክላሉ?

A. አይ፣ ምንም ቢሰማኝ የታዘዘውን የመድኃኒት መጠን በጥብቅ እከተላለሁ።

B. አዎ፣ ጥሩ ስሜት ሲሰማኝ የአንዳንድ መድሃኒቶችን መጠን እቀንሳለሁ።

C. አዎ፣ ጥሩ ስሜት ሲሰማኝ የአንዳንድ መድሃኒቶችን መጠን እዘላለዉ።

D. አዎ፣ ጥሩ ስሜት ሲሰማኝ አንዳንድ መድሃኒቶችን ለጊዜው አቋርጣለሁ።

E. አዎ፣ ጥሩ ስሜት ሲሰማኝ ሁሉንም መድሃኒቶች አቆማለሁ።

4. ከመድኃኒት ጋር የተዛመዱ የጎንዮሽ ጉዳቶች (ለምሳሌ የሆድ ህመም ፣ የጉበት ህመም ፣ ሽፍታ ፣ የምግብ ፍላጎት ማጣት ፣ እብጠት)

A. ወዲያውኑ የሕክምና ክትትል እፈልጋለሁ

B. የመድሃኒቶቹን መጠን በመቀነስ ከዶክተሬ ጋር ቀጠሮን ለማፋጠን እሞክራለሁ

C. መድሃኒቱን አቋርጬ ከሐኪሜ ጋር ቀጠሮን ለማፋጠን እሞክራለሁ።

D. መድሃኒቱን አቋርጬ ከዶክተሬ ጋር ለሚቀጥለው ቀጠሮ እጠብቃለሁ

E. ሁሉንም መድሃኒቶቼን አቋርጬ ከሐኪሜ ጋር ለሚቀጥለው ቀጠሮ እጠብቃለሁ

5. ሁሉንም መድሃኒቶችዎን ለጤንነትዎ አስፈላጊ ሆነው ያገኙታል?

A. አዎ

B. አብዛኛዎቹ መድሃኒቶቼ ለጤንነቴ ጠቃሚ ሆነው አግኝቻቸዋለሁ

C. አንዳንድ መድሃኒቶቼ ለጤንነቴ ጠቃሚ ሆነው አግኝቻቸዋለሁ

D. አንዳንድ መድሃኒቶቼ ለጤንነቴ ጠቃሚ ሲሆኑ ሌሎቹ ደግሞ ለእኔ ጎጂ ሆነው አግኝቻቸዋለሁ

E. ብዙዎቹ የረጅም ጊዜ መድሃኒቶቼ ለእኔ ጎጂ ሆነው አግኝቻቸዋለሁ

6. ሐኪምዎ ሊያጋጥሙዎት ስለሚችሉት ከመድኃኒት ጋር የተያያዙ ችግሮችን ይጠይቃል?

A. አዎ፣ በእያንዳንዱ ቀጠሮ

B. አዎ፣ አብዛኛውን ጊዜ

C. አዎ፣ ግን አንዳንድ ጊዜ ብቻ

D. አዎ፣ ግን አልፎ አልፎ

E. አይ ፣ በጭራሽ

7. ከመድሀኒት ጋር በተያያዙ ችግሮች በሀኪምዎ ሲጠየቁ እውነት ይናገራሉ?

A. አዎ፣ ሁልጊዜ

B. ሁልጊዜ ማለት ይቻላል

C. እውነቱን ለመናገር እሞክራለሁ፣ ነገር ግን አንዳንድ ጊዜ የዶክተሮችን ምክሮች አለማክበርን መቀበል ከባድ ነው።

D. አንዳንድ ጊዜ አዎ፣ ሌላ ጊዜ አይሆንም

E. አይ፣ አላደርግም። የራሴ የግል ጉዳይ ነዉ

Data collection tools in Afaan Oromo version

Waa'ee hirmaattota qoranno

Kutaa 1ffaa put an (X) mark		
1. lakk.galmee yaala _____	2. sala Dhiira ☐ dhala ☐	3. umurii(waggan)_____
4. Haala fuudha fi heerumaa Kan fuudhe ☐ kan hin fuudhin ☐ Kan wal-hiikan ☐ Abban manaa/haati manaa duu'e/tee ☐ 5. Iddoo jireenyaa : Baadiyyaa ☐ Magaalaa ☐	6. Sadarkaa barnootaa dubbisuf barressu kan hin dandeeny ☐ Sadarkaa 1ffa (1-8) ☐ sadarkaa 2faa(9-12) ☐ kollejjii fi isa ol ☐	7. Ogummaa hojjeta mootummaa ☐ hojjata dhabbata mit-mootummaa ☐ qotee bulaa ☐ dafqaan bulaa ☐ sooroma kan ba'e ☐ daldalaa ☐ Hadhaa manaa ☐ hojii kan hin qabnee ☐ barataa/ttu ☐ kan biro(ibsi)_____ 8. gallin ji'aa kessan meqaa(qarshii Itiiyoophiyaatiin)?_____

9. haala jireenyaa： qofaa ☐ maatii wajjin ☐ Hiriyootaa waliin ☐

Fira kan biraa waliin ☐ kan biro(ibsi)_____

10. Erga vaayirasiin dhiiga kee kessatti argame hangaam ta'e (ji'aan)_____

11. Vaayirasiin HIV erga dhiiga keessan kessat argame jalqabe hanga qoricha jalqabdanitti hagam turtan?_____

12. erga qorichaa fudhachuu jalqabdee hagam(ji'aan)`_____

13. dhukkuba hin daddabarre qabduu**?** eyyeen ☐ lakki ☐

14. gaffi 12ffaaf deebiin kessan eyyen yoo ta'e, dhukkuboota armaan gadii keessa kamiin qabamtan?

dhiibba dhiiga ☐ Dhukkuba onne ☐ Aasmii ☐

Dhukkuba sukkara ☐ Kaansarii ☐ Dhukkuba nama kuffisu ☐

15. dhukkuba hin daddabarren yoo qabamtan galmee ittin hordoftaan natti hima_____

16. dhukkuba hin daddabarre_____

17. erga dhukkuba hin daddabareen qabamtanii hagamii(waggan)_____

18. daa'ima qabduu? eyyen ☐ Lakki ☐

19. Gaffii 17ffaa armaan olii kanaaf deebiin kessan eyyen yoo ta'e daa'ima meeqa qabdu?____

20. vaayirasiin HIV akka dhiiga keessan kessa jiruu maatii yookiin hiriyootatti himtanii?

Eyyen ☐ Lakki ☐

21. maatii keessan kessatti namni dhukkuba hin daddabarre qabuu jira? Eyyen ☐ lakki ☐

22. Gaffii 20ffa armaan oliif deebiin kessan eyyeen yoo ta'ee kam fa'a akka ta'e ibsi

_____ _____ _____ _____

Kutaa 2ffaa: Odeffannoo amalaa hirmaataa

23. yeroo amma alkoolii ni dhugdaa? eyyen ☐ lakki ☐

24. gaffii 22faa armaan oliif eyyen yoo ta'ee,erga dhuguu jalqabd ee hagam?_____

25. kanaan duraa dhugaatii akka alkoolii biiraa wayiinii,farsoo, araqee dhugdee beektaa? eyyen ☐ lakki ☐

26. Alkoolii yeroo hagam hagamiin dhugdaa? Guyyaa guyyan ☐ torbeetti al tokko ☐ Ji'aan ☐

27. yeroo amma sigaara ni xuuxaa? Eyyen ☐ lakki ☐

28. gaaffi 26ffaa armaan olii kanaaf deebiin kee eyyen yoo ta'ee erga xuuxuu jalqabde hagam ta'e____

29. gaaffi 26ffaa armaan olii kanaaf deebiin kee eyyen yoo ta'ee, yeroo hagam hagamiin xuuxaa?

Guyyaa guyyan ☐ torbeetti al tokko ☐ Ji'aan ☐

30. Kanaan dura sigaara xuuxxee bektaa? eyyen ☐ Lakki ☐

31. ji'a tokko darbe kessatti namni mana kessan kessatti xuuxee jira? Eyyen ☐ Lakki ☐

32. ji'a tokko darbe kessatti namni naanno hojii kessanitti xuuxee jiraa? Eyyen ☐ Lakki ☐

33. jimaa ni qamataa? eyyen ☐ lakki ☐

34. buna ni dhugdaa? eyyen ☐ lakki ☐

35. gaaffi 33ffaa armaan olii kanaaf deebiin keessan lakki yoo ta'e kanaan dura buna dhugdanii beektuu?

Eyyen ☐ lakki ☐

36. qoricha keesssan haala akkamitiin argattu? Bittan ☐ bilisaan ☐ enshuraansiidhaan ☐

37. ofii kessaniif qorichaa bittanii fayyadamu bartee qabdu? eyyen ☐ lakki ☐

38. Qorichoota mala aadaan kennaman fayyadamtee beekta? eyyen ☐ lakki ☐

39. qorichaa keessan akka ogessi fayya siniif ajajetti ni fudhattu? eyyen ☐ lakki ☐

40. wantoota biraa ni fayyadamtu tanaan maloo ibsaa_____ _____ _____

Gaaffii haala jireenyaa

41. ispoortii/ sochii jabeenyaa qaama ni hojjattu? eyyen ☐ lakki ☐

42. Gaaffii 40faa armaan oliif deebiin keassan eyyen yoo ta'e, torbeetti yeroo meeqa hojjattu?_____

43. ashaboo nyaata soarata keessan irra ni hir'istuu? eyyen ☐ lakki ☐

44. nyaata cooma qaban ni hir'istuu? eyyen ☐ lakki ☐

45. dhugaatii sukkara of keessa qaban ni hir'istuu? eyyen ☐ lakki ☐

ASSURANCE OF PRINICIPAL INVESTIGATOR

The undersigned clinical pharmacy, MSc student acknowledge that this thesis is my original work. All information obtained from other sources are properly acknowledged and cited. I agree to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of school of Pharmacy; inistitute of health, Jimma University in effect at the time of grant is forwarded as the result of this application.

NAME OF THE STUDENT: _____

Date _____ Signature _____

APPROVAL OF THE FIRST ADVISOR

Name of the first Advisor: _____

Date _____Signature _____

APPROVAL OF THE EXAMINER(S)

Name of the examiner: _____

Date _____ Signature _____

APPROVAL OF SCHOOL OF HEAD

Name of school/department head: _____

Date _____ Signature _____