

## The Magnitude of Non-Communicable Diseases Risk Factors among People Living with HIV (PLHIV) in Ethiopia: WHO STEPwise approach

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### Abstract

**Background:** Anti-retroviral therapy in most parts of the world, including Ethiopia, has allowed HIV patients to live longer but with a corresponding rise in risk of developing non-communicable diseases (NCDs). Hence, this study aimed to describe the magnitude of behavioural, physical, and biochemical risk factors for NCDs among people living with human immunodeficiency virus (PLHIV) in Ethiopia.

**Methods:** A facility-based cross-sectional study was conducted in chronic HIV care clinics at five health facilities in Addis Ababa, Ethiopia. A total of 413 HIV patients were included in the study. A World Health Organization STEP survey tool was used to assess common risk factors for NCDs. Biochemical risk factors were assessed on half (207) of the study participants. Descriptive statistics was used to determine the magnitude of the behavioral, physical, and biochemical risk factors for NCDs.

**Results:** About 10.2% (42) of the PLHIV had a history of ever smoking tobacco, and 52.8% (218) of participants were lifetime alcohol consumers. About 86.4% (357) did not consume vegetables on a regular basis. Overall, 13.1% (54) had elevated total systolic blood pressure, 23.7% (98) had elevated diastolic blood pressure, and 11.8% of females and 3.8% of males had increased waist circumference. Of the total participants, 13.1% (53) were underweight, and 2.5% (10) were in the obese category. Among the samples collected, 34.7% (72) had elevated fasting blood sugar, and 21.3% (44) had elevated cholesterol levels.

**Conclusions:** The behavioral, physical, and biochemical risk factors of NCDs are common among PLWHIV. Incorporation of risk factors assessment to NCDs and timely advice by professionals will have far-reaching positive benefits on the well-being of PLWHIV. [*Ethiop. J. Health Dev.* 2023; 37(3) 000-000]

**Keywords:** Risk factors, Non-communicable diseases, People living with HIV, Ethiopia

### Background

Chronic Non-communicable diseases (NCDs) are major contributors to the burden of disease in developed countries and are rapidly increasing in developing countries. The annual death toll attributable to the four main types of NCDs, which include cardiovascular disease, cancers, diabetes, chronic respiratory diseases like chronic obstructive pulmonary disease (COPD), and asthma, accounts for 38 million people. Of the above deaths, close to three-quarters of the NCD deaths (28 million) occur in low and middle-income countries (1, 2).

Sub-Saharan Africa (SSA) suffers from both non-communicable and communicable diseases. Some authors use the term 'double burden' to describe the combined epidemic (2). Globally, there are compelling empirical evidence showing the causal links between the growing incidences of NCDs and increases in the consumption of unhealthy products such as alcohol and tobacco (3-5). The largest proportion of HIV infection occurred in Saharan Africa, which accounts for about two-thirds of the total number of People Living with HIV (PLWHIV) (6). In low-income countries like Ethiopia, the mortality associated with HIV/AIDS is decreasing after the introduction of ART. Though it is a great achievement in terms of healthcare service

delivery, the fact that HIV patients are living longer means they are at risk for chronic NCDs. The side effects of ART, which include impaired lipid and glucose metabolism and impairment of renal function with consequent alterations in blood pressure, may create a particular risk for cardiovascular diseases (7).

Despite its growing burden, statistical evidence on the magnitude of risk factors of NCDs is scarce in Sub-Saharan Africa (2). In Ethiopia's health facility setup, the prevalence and associated risk factors of NCDs among PLHIV have not been assessed so far, although knowledge of the number of PLHIV who have risk factors for NCDs could help in devising interventions at each level health system. Therefore, we aimed to determine the magnitude of physical, behavioral, and biochemical risk factors for NCDs among PLHIV in Ethiopia (Addis Ababa). This will help health care providers and policymakers about existing gaps in care provided to PLHIV to, understand the extent of the problem, and create a favorable environment, including screening programs for NCDs among PLHIV. The fact that these patients are enrolled in chronic HIV care makes them accessible for interventions that are mainly preventive.

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## Methods

### Study Setting and Period

The study was conducted in Addis Ababa, Ethiopia, from January to May 31, 2017. There are 155 health facilities in Addis Ababa that provide chronic HIV care. Of these, 86 health centers and 11 hospitals are run by the government. The rest are private clinics, private hospitals, and NGO-led clinics (8). In accordance with HIV treatment guidelines (9), all newly diagnosed patients are allowed to start on ART as soon as possible. According to the Addis Ababa Health Bureau report, the total number of HIV patients who are currently on ART is 85,116 as of November 2016.

### Study Design, Population, and Eligibility Criteria

A facility--based cross-sectional study was carried out among people living with HIV (PLHIV) who were enrolled in chronic HIV care services in five selected health facilities of Addis Ababa. Patients above 18 years of age were included in the study, while patients who had a mental illness, pregnant women, known hypertensive and Diabetic patients, and those who were unable to communicate were excluded from the study.

### Sample Size Determination and Sampling Technique

Since there were no comparable studies done to assess the prevalence of risk factors for NCD among PLHIV in our setup and with the assumption that PLHIV had the prevalence of NCD which is comparable to the general population, the study took proportion (P) values from a study by the Ethiopian Public Health Institute (EPHI) (10). Therefore, by using a proportion of 42.5 % of people who did not engage in vigorous physical activity, and taking a margin of error of 5% and after accounting for 10% of the non-response rate, the sample size was 413. Due to logistic reasons, analysis of biochemical risk factors was conducted from only 50% of the sample.

A total of three health centers and two hospitals providing chronic HIV care were selected randomly for the study, considering the number of patients on follow during the study period. A proportional number of PLHIV were chosen from each of the health facilities. The patients were selected using a simple random sampling method among PLHIV on chronic HIV care who came for follow-up during the study period from all involved health facilities.

### Data Collection Tools and Procedures

Data about behavioral risk factors were collected using a structured questionnaire and physical measurements, and blood samples were collected. The study used the instrument devised by the WHO STEPwise approach to chronic disease risk factor surveillance to determine the prevalence of risk factors for NCD disease. This tool has been tested in Ethiopia for similar studies that were done among the general population (10, 11). Data on socio-demographic and behavioral factors like smoking, alcohol consumption, dietary habits, and physical activity was collected in the first step. Physical measurements of blood pressure, height, weight, and circumference of the waist in Step 2

followed this. The Step 3 considered biochemical measurements of blood glucose and cholesterol levels (12). For those participants who had been fasting for the past 8 hours, fasting blood glucose (FBG) was done, while for those individuals who were not fasting, fasting blood glucose was measured the next day.

Data collectors were healthcare providers in the selected health facilities who were trained on the instruments of the study and on how to obtain consent prior to the commencement of data collection by the principal investigator. Lab technicians conducted the blood sampling and biochemical measurements.

Blood pressure was measured using a sphygmomanometer in millimeters of mercury (mmHg), and it was measured on the upper arm in a sitting position. The measurement was taken three times on each participant, and the average of the three readings was used. Criteria for the diagnosis of hypertension were those proposed by the World Health Organization (WHO)/International Society of Hypertension using the average systolic BP of 140mmHg or higher, or if the average diastolic BP was 90mmHg or higher, or if participants were on anti-hypertensive treatment. Participant's height and weight were measured once using a stadiometer and digital balance, respectively, without shoes and wearing only light clothing. The readings were recorded to the nearest 0.5 centimeter and 0.1 kg, respectively. Waist circumference was measured once using a tape meter and recorded to the nearest 0.1 cm.

### Data Quality Assurance

To assure the quality of data, standardized measuring instruments were used for physical and biochemical measurements, as well as standard laboratory equipments and procedures. The pretest was undertaken in a health center in Woreda 9 health centers at Addis Ketema on 5% of the study population, and correction adjustments were undertaken before the actual data collection. Health care providers at chronic HIV care clinic undertook the data collection. The principal investigator also made supervision of data collection and analysis of biochemical markers with technical support from statisticians.

### Data Analysis Procedures

Data was cleaned and entered into Epi Info 7.2 and analyzed using SPSS version 20. Descriptive statistics, mainly on the frequency and proportion of pre-defined risk factors, were calculated. PLHIV. Summary measures with mean and standard deviation were calculated.

### Definition of terms in the study

**Chronic HIV care:** Those health facilities that provide health services to PLHIV in an organized and separate way from other patients.

**Behavioral risk factors:** For this study, behavioral risk factors for NCDs include the use of tobacco products, consumption of alcoholic drinks, consumption of fruits and vegetables, salt consumption, and physical activity.

**Physical risk factors:** A systolic blood pressure  $\geq 140$  mmHg and a diastolic blood pressure  $\geq 90$  mmHg. Waist circumference greater than 80 centimeters for females and 94 centimeters for males, which is taken by taking the anterior superior iliac spines as a landmark and Body mass index (BMI) of  $\geq 25$  Kg/m<sup>2</sup> (13).

**Body Mass Index (BMI) category:** we categorized BMI as follows: Underweight  $< 18.5$  kg/m<sup>2</sup>, Normal birth weight  $\geq 18.5$  and  $< 25$  kg/m<sup>2</sup>, Overweight  $\geq 25$  and  $< 30$  kg/m<sup>2</sup>, Obese  $\geq 30$  kg/m<sup>2</sup> (14).

**Biochemical risk factors:** include a fasting blood glucose measured with capillary whole blood value  $\geq 100$  mg/dl and a total cholesterol level of  $\geq 190$  mg/d (14).

**Tobacco use:** Participants who smoked cigarettes at least 100 cigarettes in their lifetime and who, at the time of the survey, smoked either every day or some days were considered smokers. Participants who have smoked more than 100 cigarettes in their lifetime and have smoked in the last 28 days were considered current smokers, while those who smoked more than 100 cigarettes in their lifetime but have not smoked in the last 28 days were considered ex-smokers (4).

**Alcohol consumption:** refers to the act of ingesting, typically orally, a beverage containing ethanol. A participant who did not consume alcohol in the last 12 months but who did previously at any given point in time was considered a former drinker, while those who have consumed a drink containing alcohol in the last 12 months were considered a current drinker. Heavy episodic drinking of alcohol was defined also as those people who consumed more than 6 drinks on any occasion in the past 30 days (15).

**Serving of fruits and vegetables:** The values for risk factors were classified based on the WHO STEPS

manual recommendations. Accordingly, a low serving of fruits and vegetables was defined as less than five servings of fruits and vegetables per day (16).

**Physical activity:** physical activity is measured by subjective expression of participant's engagement in less than 150 minutes of exercise in a week. If the participants' work, sports, fitness, or recreational activities involve activity like carrying or lifting heavy loads for at least 10 minutes continuously was considered as a **vigorous-intensity physical activity**, while if the participants' activity work, sports, fitness, or recreational activities involve causes small-increases in breathing or heart rate such as brisk walking [carrying light loads] for at least 10 minutes continuously was considered as **moderate-intensity activity** (16).

Hypertension as systolic blood pressure 140mmHg or above and/or diastolic blood pressure 90mmHg or above; overweight as BMI 25 Kg/m<sup>2</sup> or higher; central obesity as Waist to Hip Ratio (WHR) greater than one for men and greater than 0.85 for women; high cholesterol as blood cholesterol level 5.22mmol/L or more; and raised triglyceride as blood triglyceride level 2.26mmol/L or more (17).

## Results

### *Socio-demographic and clinical characteristics*

A total of 413 PLHIV in chronic HIV care have participated in the study with a response rate of 100%. Among the study participants, 65.4% (270) were females. The mean age of the participants was 37 years, with a standard deviation (SD) of 9.18. The demographic finding shows that 13.6% (56) had no formal education, 44.1% (182) were married, and almost all 98.3% (406) were currently on HAART. The average duration of highly active antiretroviral therapy (HAART) was 5 years, and 56.1% (232) of PLWHIV had a recent CD4 count greater than 500 cells/ $\mu$ L (Table1).

**Table 1: Socio-demographic characteristics of people living with HIV/AIDS (PLHIV) in Addis Ababa, Ethiopia, 2017**

Variables	Frequency	Percent
Sex		
Male	143	34.6
Female	270	65.4
Age		
< 25	28	6.8
25-35	170	41.2
36-45	148	35.8
> 46	67	16.2
Mean age (SD)	37( $\pm$ 9.18)	
Level of education		
No formal education	56	13.6
Less than primary school	16	3.9
Primary school completed	111	27.0
Secondary school completed	152	37.0

College/University completed	71	17.3
Postgraduate degree	5	1.2
Marital status		
Married	182	44.1
Divorced	46	11.1
Widowed	71	17.2
Single	114	27.6
Start HAART?		
Yes	406	98.3
No	7	1.7
Duration of ART (n=406)		
≤ 5 years	223	54.0
> 5 years	190	46.0
Mean ±SD	5±3 years	
Recent CD4 count (cells/μl)		
<350	85	21.0
350-500	96	23.0
>500	232	56.0

### Behavioral characteristics

History of ever smoking tobacco was found to be 10.2% (42) among participants. The proportion of male smokers accounts for 85.7% (36). The study also found that 52.8% (218) of participants had consumed alcohol at some point in their lifetime and from this, 60.8% (133) were current consumers of alcohol. Of the current alcohol consumers, 24.8% engaged in heavy episodic drinking in the past month. One-third of participants, 24.2% (100), reported had chewed chat at some point in their lifetime. The current chat chewers were 15.1% (62). The dietary habits of participants revealed that the mean number of days fruits were

consumed per week was 2.5 days with an SD of 1.5. Mean number of servings of fruit consumed was 1.7 with a SD of 1. The mean number of days with vegetables consumed per week was 2.5 days, with an SD of 1.3. The mean number of servings of vegetables consumed per day was 1.6, with an SD of 0.8. The percentage of respondents who always consumed salty foods (subjective response) was 42.6% (176), and those who always consumed packed foods with high salt content were 25.2% (104). With respect to physical exercise, 77.7% (321) reported being involved in moderate-intensity physical activity (Table 2).

**Table 2. Behavioral characteristics of people living with HIV (PLHIV) in Addis Ababa, Ethiopia, 2017**

Characteristics	Frequency	Percentage
Consumed an alcoholic drink within the past 12 months		
Yes	176	42.6
No	237	57.4
Frequency of at least 1 drink in the past 12 months		
Daily	19	4.6
5-6 days per week	33	8.0
1-4 days per week	42	10.2
1-3 days per month	33	8.0
Less than once a month	30	7.3
Consume Alcoholic Drinks in the last 1 month.		
Yes	132	32.0
No	274	66.3
Past 30 days, consumed an average drink.		
Yes	129	31.2
No	284	68.8
Past 30 days, consumed above five drinks		
Yes	64	15.5
No	349	84.5
Have you ever chewed chat?		
Yes	100	24.2
No	313	75.8
Do you currently chew chat?		

Yes	62	15.1
No	351	84.9
Do you Eat vegetables per week?.		
Yes	56	13.6
No	357	86.4
Do you eat fruits per week?		
Yes	324	78.5
No	89	21.5
How frequently do you consume salty foods?		
Always	176	42.6
Often	98	23.7
Sometimes	77	18.6
Rarely	20	4.8
Never	30	7.3
Do not know	12	2.9
How much do you consume salty spices?		
Far too much	171	41.4
Just the right amount	64	15.5
Too little	25	6.1
Far too little	17	4.1
How is your consumption of packed foods		
Always	104	25.2
Often	81	19.6
Sometimes	115	27.8
Rarely	22	5.3
Never	75	18.2
Do not know	16	3.9
Does your work involve vigorous intensity?		
Yes	111	26.9
No	302	73.1
Does your work involve moderate intensity?		
Yes	321	77.7
No	92	22.3

### Physical Characteristics of PLHIV

Near one-third (59.6% (246)) of participants stated they had blood pressure measurements by health professionals on their visit. The mean systolic blood pressure was 119.4 mmHg, while the mean diastolic blood pressure was 76.9 mmHg among participants. The percentage of women whose waist circumferences

were greater than or equal to 80 cm was 11.8%. Males whose waist circumferences greater than or equal to 94 cm account were 3.8 % (5). The Body Mass Index (BMI) of participants revealed that 69.5% (281) of participants were within the normal weight range ,13.1% (53) were under the overweight, and 2.5% (10) were under the morbid obese category (Table 3).

**Table 3: Physical characteristics of PLHIV, Addis Ababa, Ethiopia, 2017**

Waist circumference		Frequency	Percent
Sex			
Males	<94cm	128	96.2
	≥94cm	5	3.8
Females	<80cm	29	88.2
	≥80cm	216	11.8
Weight category			
Underweight	BMI		
	<18.5kg/m <sup>2</sup>	53	13.10
Normal weight	≥18.5and < 25 kg/m <sup>2</sup>	281	69.50
Overweight	≥25 and < 30 kg/m <sup>2</sup>	60	14.90
Obesity	≥ 30kg/m <sup>2</sup>	10	2.50
Have you ever had your blood pressure measured			
	Yes	246	59.6
	No	167	40.4
Ever been told to have raised blood pressure			
	Yes	54	13.1
	No	359	86.9
Have you had a screening for			
	Yes	60	28.6

cervical cancer (n= 270)	No	210	71.4
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### Biochemical Characteristics of PLHIV

Among participants who gave a sample, the mean fasting blood glucose level was 93mg/dl. The percentage of participants who had impaired and elevated blood glucose levels 5.9% and 28.9 %, respectively. The mean total blood cholesterol level

was found to be 144.9 mg/dl. The percentage of participants whose total blood cholesterol level was greater than or equal to 190 mg/dl was 21.3% (Table 4).

Table 4: **Biochemical Measurements of PLHIV, Addis Ababa, Ethiopia, 2017**

Biochemical measurements	Frequency	Percent
Have you ever had your blood cholesterol measured?		
Yes	246	59.6
No	167	40.4
Ever been told that you have raised total cholesterol?		
Yes	35	8.5
No	378	91.5
Fasting blood glucose ( mg/dl)		
< 100mg/dl	135	65.2
100-110mg/dl	12	5.8
> 110mg/dl	60	28.9
Total cholesterol (mg/dl)		
< 190 mg/dl	163	78.7
≥190 mg/dl	44	21.3
Blood sugar measured		
Yes	43	10.4
No	370	89.6

### Discussion

The HIV management guideline adopted by Ethiopia's health care system recommends that all HIV patients should immediately start HAART(9). The finding of our study reveals that this condition has successfully been met. In our study, 10.2 % of the study subjects had a history of cigarette smoking. A similar percentage of tobacco users (9.4%) was seen in Jimma in southwest part of the country among the general adult population(11). In Nigeria and Malawi, the prevalence of smoking was found to be 13.3% and 14%, respectively, among PLHIV(18, 19).

A substantial share (52.8%) of the respondents drank alcohol at some stage in their life. About 13% of the respondents were engaged in heavy use of alcohol. This is a far higher proportion than the one reported in the NCDs risk factors epidemiological study at Jimma Gilgel Gibe, Ethiopia (11). This inconsistency could be due to differences in participant's residence since the majority of these study subjects were urban dwellers, which might have differing values and perceptions.

In our study, 15.1 % of the respondents currently chewed chat, which is almost similar to the general population reported by the Ethiopian Public Health Institute study as the percentage of people using chat

is 16% (10). The findings of the study revealed that individuals consuming less than five or more fruits and/or vegetables serving day accounted for 97% of the respondents. Adequate consumption of fruits and vegetables prevents obesity as a risk factor predisposing to a number of NCDs such as cardiovascular diseases, type-II diabetes, and cancer. According to the WHO, at least 400 grams of fruits and vegetables per day consumption is recommended to reduce the risks of such chronic NCDs (20). The findings of the present study reveal that the level of fruits and vegetable consumed is below the WHO recommended amount; however, the majority of the general population values is below the recommended amount and evidence to take appropriate public health intervention measures.

The proportion of those staying physically inactive was 30% in our study. Compared to the Gilgel Gibe study in Jimma, Ethiopia(11) and Malawi (19) NCDs epidemiological risk factors studies, physical inactivity in the present study has a three-fold higher proportion. However, evidence shows that vigorous and regular physical activity is vital to combat many of the NCDs, such as stroke, heart disease, type 2 diabetes, and many forms of cancer, and the morbidity and mortality associated with them(19). Moreover, alongside with healthy diet and avoiding tobacco use, regular physical

activity could help to reduce 80% of heart disease, stroke, Type 2 diabetes, and 40% of cancer (20).

The magnitude of elevated systolic and diastolic blood pressure was 18.3 % and 23.7%, respectively, while the proportion of elevated cholesterol was 21.3% and elevated fasting glucose was 28.9%. Similarly, one systematic review of the general population revealed that the prevalence of elevated blood pressure in low and middle-income countries ranges between 8.7% and 45.9% (21).

In our study, we found that overweight among participants is found to be 14.9 % and obesity of 2.5 %. The finding is low compared to a study conducted in Gondar city, which showed that 32.4% were overweight and 16.2% were obese in the general population (22). However, this finding still signifies that some of the HIV patients were at risk of obesity, which may expose them to other NCD problems. The difference in the target population could explain the possible difference in the finding as our study focused on HIV patients and highly vulnerable to various risk factors related to the disease and socioeconomic problems. Overall, the magnitude of risk factors for chronic non-communicable diseases is considerably high in our study population, which implies a need to design appropriate preventive measures to control these risk factors in PLHIV.

Our study has certain strengths and limitations: It is the first study in the country that tried to assess the prevalence of risk factors for NCDs among PLHIV and can be a stepping stone for further studies. While it is a health facility-based study, its small sample size and the fact that it was done on a specific subgroup of the population are limitations of the study.

### Conclusion

The findings of our study showed that a high proportion of PLHIV had NCD risk factors. This indicates that PLHIV patients are at a high junction of facing a double burden from NCDs unless public health interventions are in place to keep their vulnerability. Hence, healthcare professionals who are in front to help them in chronic HIV care centers should be vigilant towards NCDs and their risk factors. The programmers or policymakers should design healthy nutrition and fitness programs that suit PLHIV. Furthermore, addressing these health challenges will require community-based NCD prevention programs that educate and create awareness of the general public and PLHIV on the ways to be followed to minimize the NCDs risk factors and burden of NCDs in the country.

### Abbreviations/ acronyms

HAART:	Highly Active Anti-retroviral Treatment
NCD:	Non-Communicable Disease
PLWHIV:	People Living With HIV
SPSS:	Statistical package for social science
COPD:	Chronic obstructive pulmonary disease
SD:	Standard deviation

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### Competing interests

The author declares that there are no competing interests.

### Authors' contributions

KL, SG involved in the conceptualization and design. KL, SG, NF, AA were involved in proposal writing, project administration, analysis and visualization. KL and SG drafted the original manuscript. SG, AA, AT, NF, EK, and AJ were involved in the writing, analysis and final manuscript review. All authors read and approved the final version of the manuscript.

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